



United Nations
Economic Commission for Africa

Geospatial information for sustainable development in Africa

*African Action Plan on Global Geospatial
Information Management*

2016-2030





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Abbreviations

AAP-GGIM	African Action Plan on Global Geospatial Information Management
AARSE	African Association of Remote Sensing of the Environment
ACMAD	African Centre for Meteorological Applications for Development
AfDB	African Development Bank
AFREF	African Geodetic Reference Frame
AGRHYMET	Agriculture, Hydrology and Meteorology Research Centre
AOCRS	African Organization of Cartography and Remote Sensing
ARCSSTE	African Regional Centre for Space Science and Technology Education
ARMS	African Resources Management Satellite
ASSF	African Statistical Spatial Framework
ASTER	Advanced Space-borne Thermal Emission and Reflection Radiometer
AUC	African Union Commission
CODI	Committee on Development Information
CODIST	Committee on Development Information, Science and Technology
CODIST-Geo	CODIST Geoinformation Subcommittee
CORS	Continuously operating reference station
CRASTE	Centre Régional Africain des Sciences et Technologies de l'Espace
ECA	Economic Commission for Africa
ECOWAS	Economic Community of West African States
EIS	Environmental information system
FOSS	Free and open source software
GEO	Group on Earth Observations
GEONETCast	Global Network of Communication Satellite Based Data Dissemination Systems
GEOSS	Global Earth Observation System of Systems
GGIM	Global Geospatial Information Management
GI	Geospatial information
GIM	Geospatial information management
GIS	Geographic information system
GMES	Global Monitoring for Environment and Security
GNSS	Global Navigation Satellite System
GPS	Global positioning system
ICT	Information and communication technology
INSPIRE	Infrastructure for Spatial Information in the European Community
ISO	International Organization for Standardization

IT	Information technology
MAfA	Mapping Africa for Africa
NASA	National Aeronautics and Space Administration
NEPAD	New Partnership for Africa's Development
NICI	National Information and Communication Infrastructure
NMA	National Mapping Agency
NSDI	National Spatial Data Infrastructure
NSDS	National Strategy for the Development of Statistics
NSO	National Statistics Office
NSSF	National Statistical Spatial Framework
PPP	Public-private partnership
PUMA	Preparation for the Use of MeteoSat Second Generation in Africa
RCMRD	Regional Centre for Mapping of Resources for Development
REC	Regional economic community
RECTAS	Regional Centre for Training in Aerospace Surveys
SDI	Spatial data infrastructure
SERVIR-Africa	Regional Visualization and Monitoring System for Environmental Management and Disaster Response in Africa
SSF	Statistical spatial framework
UAS	Unmanned aerial system
UAV	Unmanned aerial vehicle
UNDG	United Nations Development Group
UNDP	United Nations Development Programme
UN EG-ISGI	United Nations Expert Group on the Integration of Statistical and Geospatial Information
UNEP	United Nations Environment Programme
UNGEGN	United Nations Group of Experts on Geographical Names
UNITAR	United Nations Institute for Training and Research
UN-SPIDER	United Nations Space-based Information for Disaster Management and Emergency Response
WMS	Web map services
WFS	Web feature services

Executive summary

The United Nations Secretariat launched the Global Geospatial Information Management (GGIM) initiative in 2011. It establishes a formal mechanism under United Nations auspices to discuss and coordinate GGIM activities and involves member States as the key players.

Two key programmes, namely the United Nations 2030 Agenda for Sustainable Development, adopted by the General Assembly in September 2015, and the African Union Agenda 2063, approved by the African Union in January 2015, further emphasize the need for a global coordination mechanism for geospatial information management (GIM).

The two Agendas have a lot in common and are mutually supportive and coherent, while Agenda 2063 is more specifically concerned with the needs of Africa. At its meeting in April 2016, the Conference of African Ministers of Finance, Planning and Economic Development highlighted the two Agendas as key to the next phase of Africa's development and noted their interrelationship.

Geospatial Information for Sustainable Development in Africa, which is embodied in the African Action Plan on Global Geospatial Information Management (AAP-GGIM), is the implementation tool of the United Nations initiative on Global Geospatial Information Management for Africa. It responds to the recommendation of the Africa preparatory meeting, GGIM: Africa, held in August 2011, urging member States, the Economic Commission for Africa (ECA) and the African Union Commission (AUC) to finalize and implement an African Action Plan on geospatial information management.

Geospatial Information for Sustainable Development in Africa focuses on four key areas, namely:

- Geospatial information policy and governance
- Common framework and tools
- Capacity building and knowledge transfer
- International coordination, collaboration and cooperation in meeting regional and global needs

It also contains a specific action area:

- Integration of geospatial information and statistics

The latter is very useful for providing decision makers with sound information products and services adapted to the attainment of the United Nations Sustainable Development Goals and the African Union Agenda 2063 objectives, based on a National Statistical Spatial Framework (NSSF).

Each focus area, including the integration of geospatial information and statistics, geospatial information is set out in detail in the chapters that follow with specific objectives, expected results, estimated budget figures and related activities.

Geospatial Information for Sustainable Development in Africa, the African Action Plan covering the period from 2016 to 2030, requires a total provisional budget of \$154,300,000.

1. Introduction

The world, in 2016, is at the dawn of a new era, a new step in the evolution of humanity, with hope, but also with many challenges for sustainable development, calling for a series of strategies, synergies of action and evaluation mechanisms. The world human family has just gone through the first phase of a global development vision, set up by the United Nations for the beginning of the third millennium, in the form of the Millennium Development Goals. Over the past 15 years, geospatial information has been used here and there to contribute to the implementation of the many initiatives taken around the world in an attempt to translate the Goals into reality.

Several organizations are working on issues related to geospatial information, but the growing number of global issues, including cross-border problems such as climate change, natural disasters, peace and security in the world, and the quality of the environment, which no nation or region can solve in isolation, calls for global coordination between member States and international organizations. Therefore, it became necessary to consider setting up a formal mechanism for involving all geospatial information stakeholders under the auspices of the United Nations.

It is against this background that the United Nations Secretariat launched the Global Geospatial Information Management initiative in 2011, which establishes a formal mechanism under United Nations auspices, to discuss and coordinate GGIM activities, involving member States as the key players.

The need for a global coordination mechanism for geospatial information management is further emphasized by two key programmes: the United Nations 2030 Agenda for Sustainable Development and the African Union Agenda 2063. In September 2015 the General Assembly adopted the 2030 Agenda for Sustainable Development under the banner Transforming our World. The 2030 Agenda consists of 17 Sustainable Development Goals, with 169 associated targets. At the continental level, the

African Union in January 2015 approved Agenda 2063 as a vision and action plan for “the future we want for Africa”. Agenda 2063 contains seven Aspirations for Africa. Due to its long time frame, Agenda 2063 has been divided up into shorter term objectives. The two Agendas have a lot in common and are mutually supportive and coherent, while Agenda 2063 is more specifically concerned with the needs of Africa. At its meeting in April 2016, the Conference of African Ministers of Finance, Planning and Economic Development highlighted the two Agendas as key to the next phase of Africa’s development and noted the supportive relationship between the two.

The 17 Sustainable Development Goals, with their 169 associated targets, are currently being further defined by measurable indicators. Likewise, the seven Aspirations for Africa will have indicators to provide a rational basis for the measurement of progress towards the achievement of the relevant targets. Once the indicators are approved, it may be necessary to review the Action Plan to provide it with greater focus and relevance. The baselines have been set on the basis of available information, which, in many cases, is scant and dubious in reliability. It will be necessary to record changes in such information to monitor the progress towards the achievement of the targets. As most development is location-based, the key information required is geospatial information. The use of geospatial information goes beyond monitoring indicators towards the attainment of the Sustainable Development Goals and Aspirations for Africa. Indeed, geospatial information is required before the monitoring stage for setting the scene of the prevailing situation through baseline surveys and representations. It is also important in the planning and implementation of the projects and programmes identified to generate the changes to be tracked by the various indicators, and for the evaluation of these same programmes and projects.

Many of the indicators are based on statistical information. Such statistical information must

then be linked to location, that is, geospatial information. This calls for a geospatial-statistical framework. The statistical and geospatial information communities must work more closely together to produce meaningful development information.

The Sustainable Development Goals and Aspirations for Africa both recognize the important

role of marine and inland water environments for sustainable development. These environments are often neglected by the geospatial information community. The geospatial information related to these environments must be given its rightful place alongside the other fundamental geospatial data sets.

2. Context

Since its establishment in 1958, the Economic Commission for Africa, in collaboration with national mapping agencies and other partner institutions from the international community, has been playing the key role of leader in assisting African Governments and their specialized institutions to turn cartography and mapping, remote sensing and geospatial information science into real opportunities for Africa's advancement in the socioeconomic domain, and thence in sustainable development. The organization of the former United Nations Regional Cartographic Conferences for Africa, followed by meetings of the Committee on Development Information (CODI) – replaced by the Committee on Development Information, Science and Technology (CODIST) – are a few examples of ECA efforts in this area in Africa. Therefore, it was no surprise, when the time came to consider global management of geospatial information under the aegis of the United Nations, to see ECA being instrumental in convening an Africa-wide preparatory meeting for the Global Geospatial Information Management initiative in August 2011.

As stated earlier, the initiative was launched by the United Nations Secretariat with the aim of setting up a formal mechanism, under United Nations auspices, to discuss and coordinate GGIM activities, with the involvement of member States as key players. The latter are expected to play the lead role in the development of a global policy to be brought to the attention of policymakers with a view to building synergies between decisions of the United Nations Regional Cartographic Conferences and CODIST meetings relevant to Africa and facilitating quick responses to concerns and emergencies. The Africa preparatory meeting issued the Addis Ababa Declaration on Geospatial Information Management which refers among other things to:

- the various recommendations and resolutions adopted on space issues by the African Ministerial Council on Science and Technology, and the African Union Consolidated Plan of Action on Science and Technology in Africa
- the role of ECA as the coordinating body for Africa's regional spatial data infrastructure through the CODIST geoinformation subcommittee (CODIST-Geo)
- the commendable efforts made towards the integration of geospatial information into national information and communication infrastructure (NICI) policies
- decades of efforts in building spatial data infrastructure in Africa including the Mapping Africa for Africa (MAfA) and African Geodetic Reference Frame (AFREF) initiatives
- national space programmes in Africa

The Declaration recommends to member States that the Economic Commission for Africa and African Union Commission finalize and implement the African Action Plan on GGIM.

The Action Plan, according to the Addis Ababa Declaration, should take into account the following key issues: policy and governance; common framework and tools; capacity-building and knowledge transfer; and international coordination and cooperation in meeting global needs. ECA has taken on the role of leading the initiative in Africa, ensuring that GGIM adequately reflects African issues and shaping its direction and dimension to reflect African interests.

3. Justification

The present document, Geospatial Information for Sustainable Development in Africa – the African Action Plan on Global Geospatial Information Management, is a first response to the recommendation of the Addis Ababa Declaration on Geospatial Information Management with regard to finalization of the Action Plan. Its implementation, the second part of the recommendation, will follow soon. The present document is therefore the first step towards, and a prerequisite for, the full implementation of the Addis Ababa Declaration.

Furthermore, the African Action Plan is essential to give content to the anticipated global action necessary for Africa’s sustainable development through the various channels of geospatial information applications and in full accord with the global agenda of the United Nations GGIM initiative. In this regard, it should be seen as a top layer for decision-making, necessary for translation of the targets of the United Nations Sustainable Development Goals and objectives of the African Union Agenda 2063 into reality for Africa over the coming decades, or more precisely in the 2016-2030 period. The African Action Plan sets out the planned action under the four focus areas defined by the Addis Ababa Declaration, namely policy and governance, common framework and tools, capacity-building and knowledge transfer, and international coordination and cooperation in meeting global needs, and the fifth focus area, integration of geospatial information and statistics, added after the first United Nations GGIM: Africa meeting held in Nairobi on 23 to 25 November 2015.

Lastly, the present document outlines the logical framework of identified priority actions (objectives, results and estimated costs) for United Nations GGIM in Africa. From this

framework will emerge at a later stage the specific implementation projects for achieving the objectives of the Action Plan over the period 2016-2030 and beyond.

3.1 Geospatial Information for sustainable development vision for Africa

The vision of Geospatial Information for Sustainable Development up to the 2030 horizon on the African continent is: Advancing Africa’s sustainable development agenda through sound geospatial information management. In this formulation, sound geospatial information management refers to the inclusive production and use of geospatial information, including its linkage to other strategies in development sectors such as information and communications technology (ICT) and statistics.

3.2 Geospatial Information for sustainable development mission statement for Africa

The mission statement of Geospatial Information for Sustainable Development in Africa is as follows: Africa produces and uses authoritative and evidence-based geospatial information for the attainment of its Sustainable Development Goals and Agenda 2063 objectives.

“Authoritative and evidence-based geospatial information” refers to rigorously controlled, best quality and “official” – consensus-based – geospatial information, which provides an objective, logically-led and uncertainty-free source of decision-making.

4. Focus areas of the African Action Plan on Global Geospatial Information Management

4.1 Governance and policy

(a) Introduction

Modern geospatial information techniques are becoming increasingly widely used in decision-making. In many countries around the world, and on every continent, geospatial information products and services are gradually being used in an increasing number of development sectors, thus contributing to an unprecedented growth in these products and services, and in the size of the geospatial information community worldwide. While this is good news for the decision-making process in general and for good governance, it is at the same time a challenge for corporate, governmental, subregional, continental and global-level institutions producing or making use of geospatial information on a regular basis.

The challenge lies not only in the availability of reliable sources of geospatial information, but also in access, quality, completeness, currency, availability of standardized metadata, the interoperability of geospatial information data sets, traceability of geospatial information products, rights of data producers, liability of geospatial information service providers, geospatial information products and services pricing, etc.

This multifaceted challenge calls for a series of organizational and managerial strategies, ranging from corporate-level geospatial information management rules to global scope mechanisms, to enable easy access to, and use of geospatial information products and services for those who need them. This multidimensional series of measures targeting the efficient management of corporate data assets, national geospatial information resource bases, and global coalition initiatives in the GIM sector, calls for some form of coordination to avoid inequities, conflicts and confusion when considering the inevitable reuse, exchange and integration of data sets

from different origins. It is the role of geospatial information policy and governance to handle this complex issue.

This section of the African Action Plan sets out an approach for addressing the geospatial information policy and governance issue in general, and more specifically in Africa. It is intended to guide the efforts of African member States in achieving better coordination of geospatial information management internally and at the continental and regional economic community levels.

(b) Rationale: Need for national geospatial information policy

(i) *Main drivers of geospatial information policy development in Africa*

The initiative to develop national geospatial information policy is driven by many considerations, among which the following seem to be the most important.

Economic drivers

It is well known that one of the key benefits of using geospatial information-based added-value information products and services is the removal, or the reduction, to a great extent of the level of uncertainty in the decision-making process. It allows, for example, a corporate entity to better target its customers by taking into account their spatial distribution (residence areas and/or workplaces) in its marketing strategy, thus refining the analyses leading to the design of products or services best suited for each category of customers' needs. Such a company can systematically include the use of geospatial information in their marketing strategy (customer sampling, product distribution, service delivery, feedback survey, etc.). Depending on the importance, size and variety of the company's influence area or targeted market, a decision will be taken either to outsource the spatial analyses related to its sector of activities, or to develop

internal capacity to perform the required spatial analyses and to make available, for that purpose, the necessary geospatial information resource base. This decision will typically be based on an accurate cost-benefit analysis including the cost of building and maintaining the required spatial database and human capacity development. If the internal capacity development is retained – meaning that this new development will have a satisfactory return on investment in terms of time frame and ratio – a corporate geospatial information policy will be developed to ensure a continued service of the new section (data security, quality, standardized processes, variety of information products, geospatial information services delivery to potential clients and sustainability of the services, investment in geospatial information staff and technology, etc.). In this case, the development of the corporate geospatial information policy will be influenced by the relative importance of the geospatial information-related activity in the company, but the driver is firstly profit, the financial benefit of investing in this area, and secondly the possible extension of the company's influence and visibility on the national, regional or global market.

To illustrate the sharpness of the competition in using geospatial information applications as a source of added-value production in today's business world, the article written by Quentin Hardy in the New York Times on 17 June 2012 under the title, *Apple Enters Mobile Map World, Stepping up Rivalry with Google*, is worth reading. It shows a real battle for the use of geospatial information in mobile communication. (Available from <http://www.nytimes.com/2012/06/18/technology/apples-goes-head-to-head-with-google-over-mobile-maps.html>).

If the issue is now analysed from a macro scale perspective, and from a government position, the motivation for developing a national geospatial information policy is different from the one explained above. Governments are always looking for ways of using efficiently their scarce budgetary resources. In this regard, the geospatial information policy will target the elimination of duplications in the use of public funds for data collection in the country. The reason here

is economy of scale and economic growth, not excluding the financial profit where this is possible. Thus, national mapping agencies have tried, before the advent of digital cartography, to follow up on all survey and mapping activities taking place in the country as a result of the private sector or international institutions' intervention in the frame of development projects.

Copies of the resulting maps and similar information products were requested to be deposited with the national mapping agency. This was done with a view to reusing these sources of geospatial information for the purpose of entire and gradual mapping of the country, and to avoid unnecessary surveying of areas recently covered by existing third party surveying and mapping initiatives. Although this principle applies in the current geographic information system (GIS) and remote sensing era, modern techniques have been developed to handle the issue, consisting of developing metadatabases of existing data sets and publishing them through a clearing house, while keeping control of access to the data sets themselves. Geospatial information needs to be open and shared, but there is an equal need for each organization to maintain control of its data, which calls for well-managed and executed data security protocols. However, these technological and institutional solutions cannot be fully operational without a strong geospatial information policy.

Social goal

From a government point of view, availability of geospatial information products for its own needs has always been an overarching goal. This explains why traditional maps were produced and stored for meeting "in case" governmental needs. This also explains why the same maps were marginally sold at a highly subsidized price. The geospatial information policy in this case is oriented towards the satisfaction of public interest objectives, hence the social dimension as a driver for the policy.

This driver is still valid today in Africa, as the base map at 1:50,000 is not yet nearly available for all countries. Even beyond the availability of this topographic map for all countries, the social goal will not disappear, as fundamental data sets

are still necessary in the spirit of meeting public interest needs.

The social goal is also implicit in the search for a globally better life on earth – including in Africa – as for example envisioned through the former Millennium Development Goals and the present Sustainable Development Goals, and the aspirations and related shorter term objectives of the African Union Agenda 2063. In this area, statistical data are critical to building projections based on past performances and evolution trends in key economic and social sectors, such as population, demographic pattern, trade, consumption, poverty, industry, services, etc. Combining geospatial information to statistical data enhances the resulting information product's impact on decision-making, by providing a clearer and easier to understand picture of the baseline situation and the projected targets, in project formulation for example.

National security

Most national mapping agencies have been created for military purposes in the first instance. This explains the barriers to access to some types of geospatial information data deemed highly sensitive and therefore classified in most countries. Geospatial information policies will always make provision for special management of such data and information products. In addition, nowadays, living within legally secured borders is a key objective of the African Union agenda, calling for the elimination of contradictory delimitation of boundaries between neighbouring countries in Africa. In this regard, peaceful national boundaries definition and demarcation involve the national mapping agencies in charge of the management of all national cartographic reference data, including border delineation reference pillars. The disclaimer mentioned on all maps regarding the recognition of international boundaries appearing on transboundary regions is an illustration of this driver's strength in geospatial information policy. This widespread disclaimer is indeed an essential provision in geospatial information policies and regulations worldwide.

Land management

Just as a State, through its Government, can only exert sovereignty over its legally secured territories, so can individuals, families, communities, legal entities or municipalities and local governments only over their recognized land assets. An important geospatial information application area is land management. Cadastral maps, both urban and rural, are an integral part of owners' property titles, therefore the demand for map products in succession, transfer, division, reconstitution, and transactions over land parcels is increasing with population growth and the intensity of economic activities. The governmental institutions in charge of these legal transactions can be overwhelmed with the load of work, therefore certified private companies collaborate in the delivery of the related geospatial information products and services. This calls strongly for a robust and consolidated management of the sector which seems to be the most demanding on policy, hence its status as a main driver.

Indeed, a closer look into this geospatial information application area reveals that, by extension, all land-related sectors can be categorized as contributing to the same driver of geospatial information policy:

- Physical planning: this is the planning of how a nation's land resource is used to meet development objectives.
- Environmental protection and management: terrestrial ecosystems being land-related, plans to manage adequately the natural resources in a sustainable way that preserves their productive capacity (sustainable agriculture, integrated water resources management, protected areas and biodiversity conservation, mining, coastal zone management, etc.) cannot be dissociated from some form of land management.
- Urban and regional planning and management: cities and their surroundings are in need of careful and well-planned use of the land supporting these areas of human activity concentration.

- **Transportation:** all transport types (terrestrial, aerial and river or sea) are related to land at some point, and geospatial information is useful in the management of the flow of people and goods, and the related infrastructure. Geospatial information policy cannot ignore this sector.
- **Agriculture and livestock:** sustainable land management, pastures, corridors for cattle movement, infrastructure for animal health care are all linked to planning land use.
- **Mining and forest management concessions** are also managed through specific rural cadastral techniques. In order to avoid conflicts due to overlapping concessions, or confusion in titles delivery, national land management regulations need to be very accurate on the location and physical limits of the concession, and the identity of valid concession title holders.

The above non-exhaustive list shows how important land management is as a driver for national geospatial information policy development.

Science and technology

Scientific progress and technological innovation are inseparable, and are another important driver for geospatial information policy development in Africa. Science and technology regularly shape the landscape of geospatial information applications, extending their scope and deepening their influence on development sectors. Recently, the use of ICT platforms as a medium for geospatial information applications development resulted in new areas such as web mapping, opening doors to the development of geospatial information-based solutions in the form of online collaborative workplaces and geospatial information resources sharing facilities. The emergence of virtual social groups on the Internet is also influencing the way geospatial information is produced. For example, providing opportunities for social groups or individual users to interact by inputting geospatial information data on a data set open to the public online, has seen the emergence of new areas, extending the benefits of the participatory geographic information system

concept. Volunteered geographic information is one of them. This evolution needs to be taken into account in geospatial information policy development, as it raises emergent issues such as the property rights on a participatory data set, or the liability linked to the use of such sources of geospatial information.

Another example is the development by a number of African countries of a space programme, and a new constellation of African remote sensing satellites is also under discussion (see section 4. (e)). Such progress opens up a new area calling for harmonized geospatial information policy at continental level.

(ii) Rationale for geospatial information policy development

National level

When a significant group of people decides to deal with a common issue, it becomes necessary to set some rules to guide the process towards a satisfactory result. The size and number of the groups involved directly influences the scope of the control mechanism put in place.

Similarly, with geospatial information management, as the number of institutions in a country applying geospatial information-related techniques increases, it becomes important to coordinate their efforts, so that the reuse of the geospatial information products and services they deliver becomes a development opportunity, rather than chaotic and uncontrolled anarchy. It is the role of Governments to plan, and therefore to monitor changes and innovation in order to organize the corresponding new sectors as they grow, as soon as a critical mass of knowledgeable actors becomes available. The challenge for Governments is to anticipate the development of a new sector and set rules beforehand. This is the first reason for every country in Africa to develop a national geospatial information policy in support of the spatial data infrastructure (SDI) development process.

In addition, there are a number of other considerations observed in most countries that justify the development of a national geospatial information policy:

- **Quality:** non-professional geospatial information producers may use inappropriate methods or tools to collect and integrate data, resulting in a certain level of risk linked to the use of the data set, even for the producers themselves.
- **Duplication of data collection:** at macro level, the same area of a country may be repeatedly subject to data collection activities by individual institutions working in isolation, whereas the data collected by the first actor could be used by other concerned institutions for their respective application needs.
- **Denial of access to data sets:** some governmental institutions, ignoring the principle of data custodianship, may deny access to their geospatial data sets by other public institutions working for the same national socioeconomic development, sustainable development, or poverty alleviation goals, with no valid reason for refusing to share the data sets.
- **Lack of documentation of existing data sets:** some data producers may not put the necessary effort into documenting their existing data sets using standardized metadata, thus preventing potential users from knowing about the availability of the data sets, or from making adequate use of them.
- **Violation of copyright:** some data users may develop added-value geospatial information products or services without due recognition and acknowledgement of the rights linked to the third party data sets used as input data.
- **Lack of clear status for some important data sets:** some critical data sets, usually produced within the framework of specific development projects, may not have a clear status, thus limiting their reuse for various other applications; others may be retained outside the country by partner institutions who claim ownership of them.
- **Cost of access:** the absence of a clear and transparent basis for costing geospatial

information products and services in a country does not ensure fairness in the required competitive environment of geospatial information applications for development. There is also the commonly used argument that the taxpayer has already paid for the products through their taxes and therefore should not have to pay again for them. Unaffordable products can also be a barrier to accessing such products.

This list is not exhaustive, and can be extended based on the experience of each individual country in Africa. It shows, however, that the efficient contribution of geospatial information to sustainable development in a country is subject to the development of a specific geospatial information policy addressing all these issues. Policy issues must be thoroughly taken into account so that difficulties that may arise are anticipated and action taken in advance.

As a result of the promotion of development of spatial data infrastructure in Africa, many African countries have realized the need to implement components of the infrastructure. They are also conscious of the need to adopt policies for promoting greater awareness of standard and coordinated geospatial data production, management and dissemination, and public access in all sectors, including the establishment of a geospatial data clearing house at local, state and federal levels with linkages to the private sector. To this end, various countries have put, or are putting in place modalities to draw up a national geospatial information policy, with South Africa being the first to have enacted a national spatial information act. An efficient, functioning national spatial data infrastructure and the associated national policy should therefore be regarded as vital requirements for effective and efficient geospatial information management in Africa.

Other levels

It is obvious that, if countries do not address the above mentioned issues at national level, this will affect geospatial information application at the subnational level and the quality of a country's contribution to higher level application (subregional, continental, global) as well. Indeed,

subregional initiatives – at the level of the regional economic communities in Africa, for example – need coherent national geospatial information policies to achieve the full contribution of geospatial information to the socioeconomic development of these subregional entities.

Geospatial information application at the subnational level will automatically comply with the national policy in place in a given country. It may be necessary to issue specific regulations at local government level, but these can only be the local application of national policy which cannot be superseded.

Although in theory national policies would be driven by national needs, it is important to note that a consensus-based subregional directive can have a positive impact on geospatial information policy development in countries not yet advanced in this field. The latter can speed up internally their national geospatial information policy development process in order to comply with the regional directive.

The same applies to the subregional groupings vis-à-vis the continent as a whole. Africa as a region can only succeed in developing a continent-wide, consensus-based geospatial information policy if the majority – or a reasonable number – of member States and their respective subregions are already aware, committed, and have in place such policies, or at least are in the process of developing them. However, initiating the development of a continental geospatial information policy for Africa can impact positively on those countries lagging behind.

Fortunately, even before the Global Geospatial Information Management initiative, the geospatial information policy issue had been identified and recommended by the CODIST geoinformation subcommittee as an important step in the spatial data infrastructure development process at national level, as well as at the higher levels in Africa.

In 2000, ECA convened an experts' group meeting on the "Future Orientation of Geoinformation in Africa". The meeting recommended that all geospatial information activities should be

oriented towards the development of spatial data infrastructure as the appropriate mechanism for the production, management, dissemination and use of spatial data and information products. The experts' report was received by the second meeting of the Committee on Development Information, held in 2001, and became the guiding principle for ECA in its advocacy work in the area of geospatial information management in Africa.

In conclusion, geospatial information policy is not an optional feature in the management of geospatial information for sustainable development. It is a mandatory milestone creating the required legal and coherent environment for achieving the most cost-effective and rewarding impact of geospatial information use in the implementation of development strategies at national and subregional levels in Africa. At the same time, it also goes beyond this to meet global needs such as those at the basis of the Global Geospatial Information Management initiative.

(iii) Geospatial information and good governance

Geospatial information-based decision-making has the advantage of being rational and evidence-based. As an example, the use of a geospatial database for planning the extension of education facilities in a country can be an indicator of good governance. A dedicated geospatial database can show the current population distribution including statistics for school-age children, existing educational facilities with their attributes such as number of classrooms, number of schoolboys and girls per classroom, the road network and natural obstacles on the routes to existing schools, and the status of each administrative entity with regard to the national target school attendance ratio set by development targets (Sustainable Development Goals). An algorithm can be built in to compute automatically the progress towards the Goals at local level. It can then be used to prioritize the local administrative entities on the basis of their needs, and in each entity show the geographic extent of the populated areas to be covered and simulate for each option of a new site how it will satisfy administrative needs (school attendance ratio and extent of geographic coverage, for

example). This type of tool for supporting decision-making could be part of the broad process of planning the extension of educational infrastructure, driven by the aim of achieving equity in access to education. Unfortunately, most of the time, it is the political and social influence of certain leaders that determines where a new school will be built.

The same example could be applied to the health sector, or the potable water and sanitation infrastructure development sector, or to road network development and maintenance, etc. Therefore, geospatial information applications should be not only encouraged, but imposed in areas where transparency is visibly not welcome for political or other reasons. Only a strong political will, geared to a solid geospatial information policy can result in good governance based on objective, fair and equity-driven decision-making.

A national geospatial information policy is the means by which a Government, looking for transparency in its governance actions, can promote easy access to geospatial information-based added-value information products and services. In some countries, maps and map products are seen as highly sensitive and classified information and sometimes controlled by the military. A national geospatial information policy will facilitate necessary access and make the information available to commercial organizations, civil society organizations and the public at large, allowing government agencies such as the national surveying and mapping agency to share fundamental data sets with other public and private sector organizations and industry. This will in turn enhance private sector opportunities to develop more innovative applications.

(c) Status of geospatial information policy development in Africa

As mentioned above, it was the role of the CODIST geoinformation subcommittee to promote the development of national geospatial information policies in Africa under the umbrella of the National Spatial Data Infrastructure (NSDI) initiative, coordinated by ECA. One key product of the initiative is the publication of an

online background document entitled “Spatial Data Infrastructure-Africa: an Implementation Guide” (available from <http://geoinfo.uneca.org/sdiafrica/default1.htm>). Chapter 4 of the guide is devoted to data policy, in the context of spatial data infrastructure development.

(i) National level

Despite this strategic effort, only a few countries have formally adopted a national geospatial information policy in the spirit of the National Spatial Data Infrastructure initiative. Sensitization events have been organized in this regard, with the support of ECA in some cases, to raise awareness of geospatial information policy as the legal tool and booster of geospatial information effectiveness and efficiency in socioeconomic development.

The following are examples of countries in Africa known to have adopted a national geospatial information policy or initiated the process:

- South Africa passed the Spatial Data Infrastructure Act in 2003. The Act establishes the South African Spatial Data Infrastructure, the Committee for Spatial Information, and an electronic metadata catalogue; it provides for the determination of standards and prescriptions to facilitate the sharing of spatial information, for the capture and publishing of metadata and the avoidance of duplication, and for other related matters. Additional legal instruments related to geospatial information policy include a custodianship policy and a policy on pricing for spatial information products and services.
- Kenya, in 2009, developed a draft Kenya National Spatial Data Infrastructure policy to address the issue of geospatial information management. The policy formulation was steered by Survey of Kenya, the national mapping agency, in collaboration with key stakeholders in the agriculture, culture and recreation, education, energy, environment, forestry, finance, county governments, security, tourism and transport, and communication sectors among others. The stakeholders constituted a secretariat that will be housed by Survey of Kenya at the

Kenya National Geospatial Data Centre. The policy aims at addressing legal and institutional frameworks for geospatial information management, gives guidelines for dealing with copyright issues, data pricing, data standards, metadata, and data security, and facilitates training and capacity development. Kenya has already developed digitization of spatial data infrastructure and data capture manual standards that are in line with international standards. Currently the 2009 draft policy is undergoing the process of aligning it with the 2010 Constitution of Kenya before its approval.

- In Ethiopia, the Ethiopian National Spatial Data Infrastructure was initiated by Proclamation No. 808/2013, Article 13, under the mandate of the Information Network Security Agency to integrate spatial datasets and make them available through a clearing house network. This collaborative geospatial data-sharing entity serves to develop sound geospatial data policy and legislation, prepare and impose standards, and assure the quality and compatibility of geospatial data.
- Nigeria issued a national geoinformation policy in September 2003 under the leadership of the Federal Ministry of Science and Technology. Part A provides general background and defines the philosophy of the policy; Part B deals with policy issues and gives details of the components of the national geospatial data infrastructure; while Part C of the policy is devoted to policy implementation. The draft policy was revised in January 2010 but is still in the process of being approved.
- Burkina Faso, with the support of ECA, initiated the development of a national geospatial information policy in 2003. The draft was adopted at a national forum in June 2006. It contains chapters on the aim and objectives of the National Geospatial information Policy; the means for the attainment of the policy objectives; the scope of the policy and basic definitions; the coordination authority; specialized working groups; the network of partner institutions; meeting external needs;

financing and maintenance of fundamental datasets; monitoring and evaluation of the policy implementation; and amendments, disputes and enforcement of the policy. The policy is still in the process of being approved as a law.

- Namibia initiated a draft spatial data sharing policy in September 2003 within the framework of the national spatial data infrastructure. It covers Namibia's spatial data infrastructure, spatial datasets, data standards and metadata, pricing strategies, and legal issues.

Other countries are known to have begun the formulation of national geospatial information policies:

- Benin has adopted an information charter within the framework of the SISEI project, the Environmental Information Circulation and Monitoring System on the Internet in Africa, to define the rights and obligations of data providers and users of the SISEI network.
- Ghana has streamlined its geospatial information policy into its broader ICT policy through the national information and communication infrastructure strategy. The experience has enabled Ghana to take full advantage of ICTs and geospatial information technologies. The Ghanaian Government also recognized that partnering with the private sector would facilitate the provision of the requisite investments needed to promote ICT growth in the light of other competing sectors of the economy. Geospatial information is recognized as a priority area, along with broadband access, cyber security, and the role of ICT technology in climate change and general environmental policy. The result is an ICT and geospatial information policy that promotes economic development, but through a people-centred, inclusive framework. This policy framework is a new approach, and a promising model for how to integrate geospatial information in governance. In addition, incorporating geospatial information policy into broader ICT strategy, which is often well funded, could

provide the necessary financial foundation to the national spatial data infrastructure process with high priority in the Government agenda, and a firm and broad-base commitment to its implementation.

(ii) Subregional level

East Africa

The former East African Africover project led by the Food and Agriculture Organization of the United Nations resulted in an intergovernmental data policy called Guidelines for Custodianship. Data distribution and management are based on these guidelines, while specific data access policies were developed in agreement with the national focal point institutions for the different types of data sets.

West Africa

The Economic Community of West African States (ECOWAS), under the leadership of its Early Warning Directorate, has produced the ECOWAS Geospatial Data Infrastructure Policy and ECOWAS Cartographic Strategy. The need for the policy and strategy arose from the realization that early warning and disaster mitigation and management cannot be tackled efficiently without ready access to fit-for-purpose geospatial information. The policy was validated in March 2013 by the heads of national mapping agencies of ECOWAS member States.

(iii) Regional level

In 2000, ECA launched the African Regional Spatial Data Infrastructure, a cooperative geospatial information management process for Africa, with the following vision: to ensure that spatial data permeate every aspect of society and that they are available to people who need them, and in a form that they can use to make decisions with minimal pre-processing. The African geospatial information management process is concerned with the need for complex information, unlocking the hidden potential in the data, producing once, using many times, and making information available to decision makers when they need it.

The following initiatives are all features of the African Regional Spatial Data Infrastructure:

- Mapping Africa for Africa
- Definition of fundamental geospatial data sets for Africa
- Creation of regional databases
- Development of interoperability and standards, resulting in the ISO 19115 compliant African metadata profile; the common geodetic reference, known as the African Geodetic Reference Frame; and the harmonized administrative boundaries project, known as the second administrative level boundaries outcome in its Africa component.

(d) Basis of geospatial information policy and governance in Africa

The previous section set out the need for geospatial information policy and the status of such policy development in Africa. The present chapter attempts to propose a strategy for the development of a continent-wide geospatial information policy as a contribution to the global initiative on geospatial information management.

(i) Geospatial information management and geospatial information governance

Definitions

To explain the subtle difference between geospatial information management and geospatial information governance, it is necessary to define the two terms, management and governance. Management is defined by the Business Dictionary (www.businessdictionary.com/definition/management.html) as “The organization and coordination of the activities of an enterprise in accordance with certain policies, and in achievement of defined objectives”. Governance is defined by the same Business Dictionary as the “Establishment of policies, and continuous monitoring of their proper implementation, by the members of the governing body of an organization”. Governance, therefore, is only meaningful when policies have been formulated, adopted and enforced.

Strategy for geospatial information policy development and governance

The application of these two definitions to geospatial information sheds some light on the real issue. Africa needs efficient organization and coordination of geospatial information activities to achieve sustainable development, and specific policies constantly monitored to ensure their proper implementation.

The following goal can be set for United Nations Global Geospatial Information Management in Africa with regard to geospatial information governance and policy: "A specific geospatial information policy, continuously monitored for the best of spatial data infrastructure processes and for the Sustainable Development Goals and Agenda 2063 targets attainment, in force in every member State in Africa, every regional economic community and at the continental level".

The establishment of such policies and continuous monitoring of their implementation requires a carefully designed strategy that is approved by consensus. Such a strategy is justified by the expanding scope of geospatial information management in Africa, with a number of nations stepping into the era of space programme development. The strategy proposed here is based on the way the United States of America, Canada, Spain, and other industrialized nations developed or are developing national geospatial information policies. It also builds on, and takes account of efforts already invested in new developments in the earth observation domain in Africa and abroad, such as the African Union African Space Policy and Strategy, and the African earth observation initiatives under AfriGEOSS within the framework of the Global Earth Observation System of Systems (GEOSS).

For example, the spatial data infrastructure feature of public access to geospatial information, the driver of the fundamental data sets concept, further expressed in the Group on Earth Observations (GEO) data sharing principles – which call for open access to publicly funded data at, preferably, no cost, or the cost of reproduction – is at the heart of this strategy.

(ii) Geospatial information policy development strategy at national level

Geospatial information as a critical development enabler

The development of a geospatial information policy can only be effective and justified if geospatial information is understood, considered and accepted as a critical development enabler, underpinned by solid institutional arrangements. It is why this basic objective must be targeted at the national level and reflected in national development strategies in Africa. The wave of ongoing national spatial data infrastructure initiatives is the best framework for achieving this objective in a coherent and coordinated way.

The adoption on 26 February 2015 of Resolution 69/266 on the Global Geodetic Reference Frame for sustainable development by the General Assembly contributes to leveraging geospatial information in political agendas as a critical enabler of development in general, and particularly for Africa.

National and regional space policies

It is gratifying to note that an African space policy has been developed to ensure consistent and coordinated implementation of regional space science and technology programmes in Africa. Various United Nations agencies such as ECA, United Nations Environment Programme (UNEP), United Nations Office for Outer Space Affairs, and also international and regional organizations and development partners such as the European Union, Group on Earth Observations, National Aeronautics and Space Administration (NASA), and Japan International Cooperation Agency, are implementing space technology-related projects in Africa such as SERVIR-Africa, the African Monitoring of the Environment for Sustainable Development project, and the "TIGER" initiative to promote the use of Earth Observation (EO) for improved Integrated Water Resources Management (IWRM) in Africa. The European Union-African Union meeting of 7 December 2007 on Global Monitoring for Environment and Security (GMES) in Africa also emphasized the need to utilize data from earth observation satellites for global monitoring for the environment and security. The ongoing and future regional space

science and technology-related activities require a regional policy framework for sustainable implementation. The development of regional space programmes such as the African Resource Management Satellite (ARMS) Constellation and AfricaGeoSat should be included in the policy, as well as the identification and development of other regional space science and technology programmes. African countries that are aspiring to launch earth observation and communication satellites should also be encouraged to develop national space policies as a first step.

The regional space programmes and policy would be better realized if a coordinating agency in the form of an African space agency can be put in place. The joint United Nations Educational, Scientific and Cultural Organization, UNESCO, and African Union high-level scientific workshop on the critical role of satellite remote sensing applications for Africa's sustainable development, held on 30 May to 1 June 2007, recommended the establishment of an African space agency to coordinate regional space programmes in Africa. The declaration of the workshop was unanimously adopted by the African Commissioners to UNESCO for integration into African Union science and technology programmes. The declaration also featured prominently as a key element of Africa's position at the fourth plenary meeting of the Group on Earth Observations held in Cape Town, South Africa, from 28 to 30 November 2007, and in the declarations of the seventh and eighth biennial conferences of the African Association of Remote Sensing of the Environment (AARSE) in 2008 and 2010 respectively. The agency would be an effective platform for the sustainable implementation of regional African satellite programmes, as well as the coordination of all regional space science and technology programmes, including stimulation of private sector participation in the space industry.

In addition to having national geospatial information policies, it is also necessary to put in place national mapping policies to address in detail the activities of national topographic mapping, provision of a geodetic framework, and cadastral mapping, including the funding modalities for them. These cannot be treated in depth within a national geospatial information

policy and their absence can deter production of these vital fundamental data sets.

Strategy for national geospatial information policy development

The development of national geospatial information policies should be based on the following steps derived from, but not limited to, the experience of the United States Federal Geographic Data Committee:

- Where we stand now – a survey and classification of all existing legal and policy documents oriented towards or related to geospatial information in the country.
- Gaps in existing policy framework – a review of all documents gathered above and identification of policy gaps.
- Going forward – setting a goal for the national policy (see the goal proposed above in 4.(i) for United Nations Global Geospatial Information Management in Africa), developing the policy in a participatory way with the contribution of thematic groups guided by the demands of the national Sustainable Development Goals and African Union Agenda 2063 targets, and its formal adoption by the Government and/or parliament.
- Setting national geospatial information policy development within a national spatial data infrastructure development plan, linked to the national ICT policy, the national information and communication infrastructure process, e-strategies, and the national strategy for the development of statistics – a national geospatial information policy is part of national spatial data infrastructure development and as such its development has to be set in the wider framework of the national spatial data infrastructure development process. In addition, as recommended by ECA and CODIST, the national spatial data infrastructure development plan in turn must be linked, at the higher level, to the national information and communication infrastructure process in the country, or the e-strategies and other strategies such as national land policies, with

a component on integration of geospatial information and statistical information for sustainable development. This ensures coherency and the mutual nurture of these processes, especially for the attainment of the Sustainable Development Goals and Agenda 2063 objectives.

- Advocacy action directed to policy makers, partner institutions and development initiatives, and donors – buy-in is key to a successful strategy for the development of a transformative geospatial information policy at national level. This calls for strong advocacy action directed towards all stakeholders.

(iii) Coherent geospatial information policy development at subregional level

While national geospatial information policies are necessary for national spatial data infrastructure development processes (linked to other strategies as suggested above), it is essential that they do not contradict each other from country to country within the same subregion. Similarly to other sector policies (such as environment, transportation, agriculture, industry, land, etc.) for which the development of sectoral strategies and policies is carried out at the level of regional economic communities for coherency and convergence, so national geospatial information policies should benefit from the same approach.

Key orientations should be defined in subregional consultations and should be captured in subregional geospatial information policy directives for use by the member States involved. The directives should prioritize the targets of the Sustainable Development Goals and the African Union Agenda 2063 for the relevant subregions.

In this way, the resulting regional economic community level geospatial information policies will be demand-driven and their contents will accommodate, in their broad principles, national concerns. At the same time, they will ensure coherency by influencing national policies to comply with the guiding principles of geospatial information management accepted and applied internationally.

(iv) Public access to geospatial information for development in Africa

The subregional directives mentioned above should not only reflect the individual socioeconomic and political agenda options in the relevant regional economic communities (in particular those supporting the Sustainable Development Goals and African Union Agenda 2063 implementation), but also be guided by strategic objectives set at the higher level of the continent, taking into account the technological and geospatial information policy evolutionary trends in the world on the one hand, and Africa-specific needs on the other. Among the Africa-specific needs, the area of land management, including the neglected marine and inland water environments – as highlighted by the Sustainable Development Goals – deserves full attention in terms of policy content definition.

Specific continent-wide efforts – along the lines of the Aarhus Convention on public access to geospatial information for Europe – should be put into generating the required conditions for more widespread use and reuse of geospatial data and the information products and services derived from them for development in Africa.

Given the key issues related to geospatial information management in Africa, such a continent-wide effort should target the following two main objectives:

- Geospatial information management as a critical development enabler in Africa
- Easy access to geospatial information by civil society at large in Africa

The first objective will positively influence member States and motivate them to give full attention and political support to the geospatial information sector and to allocate the required resources to relevant institutions, in order to give impetus to the spatial data infrastructure development process waiting to be speeded up in many countries. As mentioned earlier, General Assembly Resolution 69/266 should be an incentive for African Governments to leverage geospatial information management in their respective political agendas. However, adoption

of the resolution must be followed by advocacy action to popularize understanding of it both in policymaking circles and among sustainable development actors throughout the continent.

The second objective will open doors for the effective use of geospatial information by the public in Africa, where unfortunately geospatial information is often inaccessible most of the time to those who need it. The United Nations Global Geospatial Information Management initiative in Africa should be the appropriate framework to focus efforts and promote geospatial information acceptance and support by the appropriate policy organs. This objective, which is the overarching goal of spatial data infrastructure development, will also greatly contribute to sustainable development on the continent.

Finally, the outcome of the African Action Plan on Global Geospatial Information Management, once implemented, should impact positively on the spatial data infrastructure development agenda in Africa and give it an irreversible momentum.

(v) Policy orientation for geospatial and statistical information integration in Africa

To optimize the outcomes of the African Action Plan, there is a need to set up and monitor a policy-level mechanism that will promote the harmonious integration of geospatial and statistical information into sustainable development in Africa. To this end, there must be a clear orientation towards the development of spatial data infrastructure and a statistical spatial framework (SSF) at the national level (through the National Spatial Data Infrastructure and National Statistical Spatial Framework respectively) and at the subregional level (the Regional Spatial Data Infrastructure and Regional Statistical Spatial Framework respectively), with a coordination function at the Africa regional level (the Africa Regional Spatial Data Infrastructure and Africa Regional Statistical Spatial Framework).

In practical terms, the formulation of the policy orientation will be based on a needs and gaps analysis to be conducted at the national and then the subregional level. The analysis will

lead to a definition of requirements for the delivery of information products designed to support the implementation of the Sustainable Development Goals and African Union Agenda 2063 objectives in Africa. To prioritize statistical spatial framework-related application needs in this context, the following key questions must be answered:

- What elements need to be provided through the spatial data infrastructure development process for successful application of the statistical spatial framework at all levels?
- What elements are readily available and which need to be produced?
- What is required from the spatial data infrastructure development side to provide the missing elements for timely inputting into the statistical spatial framework implementation process?

A clear picture of the technical, organizational and financial implications of these new requirements will shape the content of the combined spatial data infrastructure and statistical spatial framework effort at the required levels.

(e) Summary of goal, objectives and results for geospatial information governance and policy

The following goal, strategic objectives (SOs) and results (Rs) will guide the development of Africa's geospatial information management policy and governance:

Goal

To enforce a specific geospatial information policy, continuously monitored for the best spatial data infrastructure processes and for attainment of the Sustainable Development Goals and Agenda 2063 targets, in every member State and every regional economic community in Africa, and for the continent as a whole.

Strategic objectives and key expected results

SO 1.1 Geospatial information management is adopted as a critical development enabler by member States in Africa;

R 1.1.1 Publication of a position paper on how geospatial information can boost the attainment of the 17 Sustainable Development Goals in Africa, and the seven aspirations and 15 objectives of the African Union Agenda 2063;

R 1.1.2 Strong advocacy action is taken throughout Africa using the position paper to achieve policy level engagement of African Governments in adopting geospatial information as a critical enabler for the sustainable development of the continent;

SO 1.2 A specific geospatial information policy is in force in every member State and every regional economic community in Africa, under the special data infrastructure agenda for sustainable development;

R 1.2.1 A comprehensive study on the state of national geospatial information policy development and regional economic community level geospatial information policy availability serves as the baseline for policy action planning in Africa;

R 1.2.2 Needy member States and regional economic communities are assisted in the development of their respective geospatial information policies;

R 1.2.3 The development of national space programmes in Africa is guided by and harmonized with the African Space Policy and Strategy;

R 1.2.4 geospatial information policy directives are disseminated in order to mainstream the attainment of the Sustainable Development Goals and Agenda 2063 targets and statistical geospatial information integration processes into the geospatial information policies of member States and regional economic communities.

SO 1.3 Africa member States take policy action to ensure integration of geospatial and statistical information;

R 1.3.1 Policy guidance is issued to engage Africa member States and regional economic communities in a policy dialogue involving the geospatial information and the statistics communities;

R1.3.2 A policy approach is adopted by regional economic communities and Africa member States to jointly develop the information products and services needed for the attainment of the Sustainable Development Goals and Agenda 2063 targets.

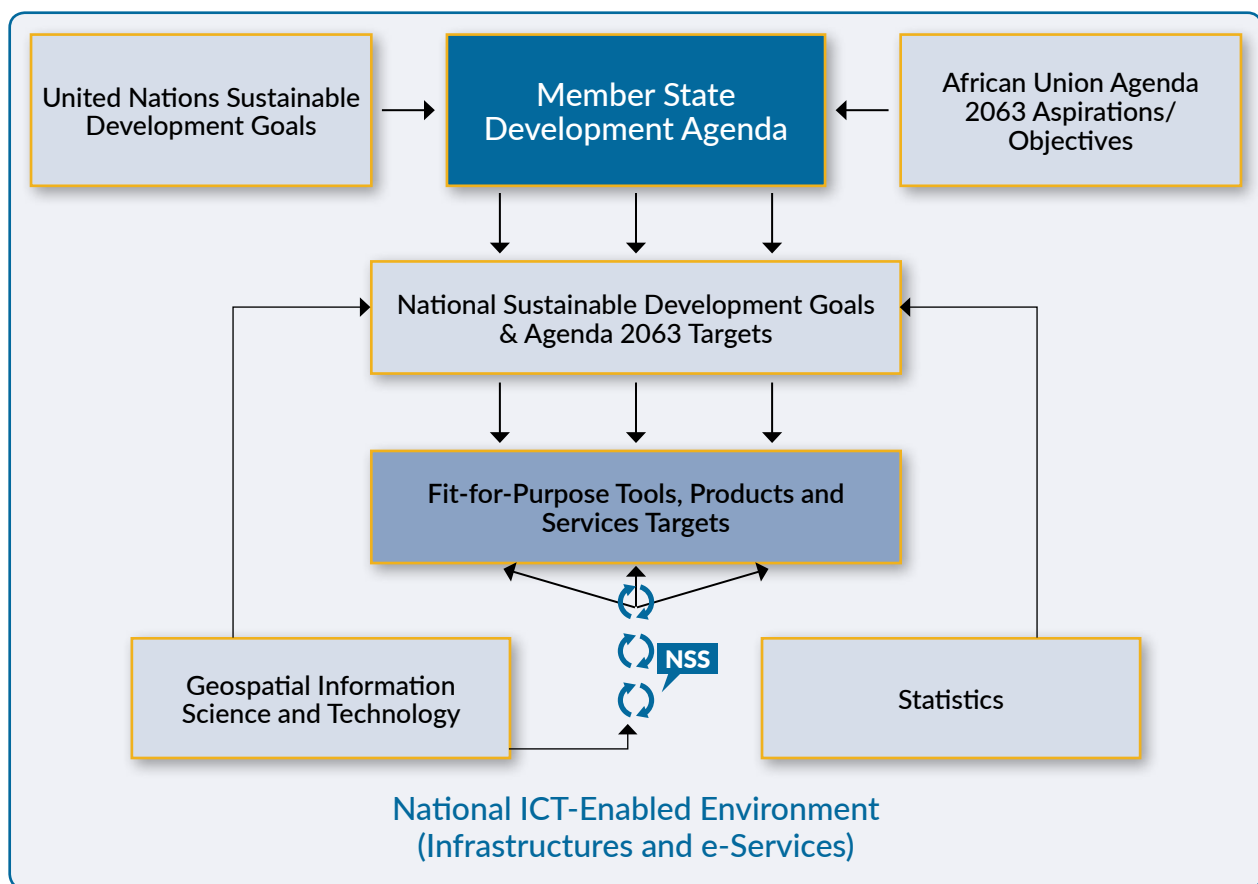
Details are provided in the consolidated logical framework (see section 4.6)

4.2 Common framework and tools

(a) Introduction

Good governance and sound policies in geospatial information management are necessary to achieve the Sustainable Development Goals and Agenda 2063 targets at the national, subregional and regional levels in Africa, as shown in the previous section. They will guide the way African countries, regional economic communities and the African Union reap the benefits of geospatial information management and make their valuable contribution to the achievement of the Goals and Agenda 2063 aspirations on the continent. It will be necessary to use appropriate technological and scientific tools, in an enabling environment and within a common conceptual framework to deliver the expected results. Figure 1 illustrates the way to proceed, from the Sustainable Development Goals and Agenda 2063, to the delivery of fit-for-purpose added-value information products and services over the first period, 2016-2030, of the African Action Plan. The Sustainable Development Goals and Agenda 2063 targets are to be derived for the national, subregional and Africa regional levels.

Figure 1: Conceptual framework of the African Action Plan on Global Geospatial Information Management at the national level



This conceptual framework of the “Common Framework and Tools” section was developed for the national level, but it can easily be adapted for the subregional (REC) and continental levels, provided that some aggregation process is carried out regarding the SATs and related information products and services between the national level and the REC, and between the RECs and the continental level:

The UN SDGs and AU Agenda 2063 aspirations and shorter term objectives are meant to complement existing national political and sustainable development agendas. However, they have to be translated into achievable targets (SDGs and Agenda 2063 Targets or SATs) for which fit-for-purpose tools, information products and services are required. Geospatial information is needed, as well as statistical information, to set these SATs as shown on the schema. Once the SATs set, the tools, products and services can be jointly identified and developed using an integrated process, combining Statistical and Geospatial Information, with the support of the

national ICT enabled environment – in particular Internet access, IT platforms, e-services, etc.). This schema sketches the framework that will be used to provide decision support inputs to the sustainable development efforts during the validity period of the Action Plan.

This section discusses the current status of geospatial information management in Africa, some of the challenges facing efficient uptake of geospatial information on the continent, existing opportunities, and some essential issues to be considered with regard to the development of a common framework and tools for geospatial information management in Africa. The aim is to ensure that geospatial information permeates every aspect of society and the data are made available to people who need them, when they need them, and in a useable form for decision-making with minimal pre-processing.

(b) Rationale: Need for a common framework and tools

To be successful in the complex task of providing the best input into, and achieving the greatest benefits from geospatial information application to the sustainable development agenda of the continent, it is useful to know where we are coming from, where we stand and where we would like to be after implementation of the African Action Plan.

A common framework will help to foster efforts at all levels and to optimize their impact on the expected results, while providing a clear view of the direction we are heading in. Nowadays a plethora of tools is available thanks to the opportunities offered by science and technology and it is therefore wise to choose the most suitable for our purposes in advance. Hence the need to define, based on the targets, the geospatial information-based tools to select and the geospatial information products and services to deliver and use.

(c) Overview of geospatial information status in Africa

An assessment of the current status of geospatial information in Africa is a necessary precursor to the development of meaningful and sustainable common frames and tools for geospatial information management on the continent. Unfortunately, a comprehensive study and documentation of the status of geospatial information on the continent is lacking at the moment and perhaps should be one of the priority areas to be addressed in the Global Geospatial Information Management initiative. However, it is worth noting the commendable efforts made or being made by various international, regional and national organizations such as ECA, United Nations Office for Outer Space Affairs, UNEP, United Nations Development Programme (UNDP), and the African Association of Remote Sensing of the Environment, to facilitate the uptake of earth observation and geospatial information technology in Africa through the promotion of, among others, spatial data infrastructure and space science and technology. To make geospatial data sets available, discoverable, better accessible, shareable, interoperable and re-usable, ECA and

the Committee on Development Information, Science and Technology have paid much attention to the development of spatial data infrastructure in Africa, as mentioned earlier (see section 4.1).

Within the spatial data infrastructure initiative, and through the efforts of the CODIST geoinformation subcommittee working group on fundamental data sets as part of the Mapping Africa for Africa initiative, the following projects have already been completed: definition and determination of fundamental geospatial data sets for Africa; catalogue of available fundamental geospatial data sets for Africa and gap analysis for all countries; while the project on guidelines for best practices for the acquisition, storage, maintenance and dissemination of fundamental geospatial data sets is in progress, with the outline of the document and document specification completed.

At the regional level, ten themes of fundamental data sets have been defined but the data sets are either not available at all in many countries, or they are largely unavailable in the form and currency required to contribute to the fundamental data sets of the national or regional spatial data infrastructure. For example, in many countries, 1:50,000 topographic maps that serve as base maps are out of date and in analogue form; cadastral maps or databases are mostly unavailable; coherent and standardized geographic names are not available yet; and in most cases geodetic controls are not yet unified and adjusted and are not in sufficient density. The situation is similar with respect to the other fundamental data sets.

Further, with regard to the spatial data infrastructure initiative, a metadata profile for Africa has been developed but this is yet to be implemented in a case study to guide adaptation at the national level.

Notable progress has also been made on the implementation of the African Geodetic Reference Frame with about 65 International GNSS Service-approved continuously operating global navigation satellite system reference stations operational regionally within the AFREF project as at 2015, while many member States

have also established a number of such stations on their territories; for example, the Office of the Surveyor General of Nigeria has, between 2008 and May 2013, established 15 zero-order GNSS continuously operating reference stations in the Nigerian permanent GNSS network.

Many countries have also contributed to the second administrative level boundaries database, which is an important data set for planning and implementation of development projects at the national and regional levels.

Another key geographic data set is national street address, a very important data set for all location-based services. A national coverage of this vital data set is not available in most African countries.

Data accessibility is also improving with the increasing development of geospatial web portals in Africa such as SERVIR-Africa and the African Geo Information Research Network, and the accessibility of geospatial information through the Internet. However, according to World Bank figures published in 2008, only 2 per cent of the population of Africa has Internet access, thus efforts have to be made to increase this number by huge investments in communication satellites, or by improving the undersea cable infrastructure. Other initiatives such as the GEONETCast and PUMA African Monitoring of the Environment for Sustainable Development project focusing on connectivity for the transfer of geospatial data sets to users are also noteworthy.

The use of earth observation satellite data to generate development information is rapidly improving in Africa as attested to by the 2008 United States Geological Survey on remote sensing in Africa. This is especially so, following the launching of earth observation satellites by African countries – Algeria (AlSat-1 and AlSat-2), Nigeria (NigeriaSat-1, NigeriaSat-2 and NigeriaSat-X), Egypt (EgyptSat-1) and South Africa (SumbadilaSat-1) – within the last fifteen years, which led to increased awareness among decision makers and civil society of earth satellite and geographic information system applications. The availability of free archived Landsat data and Shuttle Radar Topography Mission digital

elevation models, and cheap alternatives such as ASTER Data Systems data are also making satellite data more affordable. All these are expected to improve the production of fundamental data sets in Africa.

Nigeria's latest earth observation satellites, NigeriaSat-2 and NigeriaSat-X were launched on 17 August 2011. The NigeriaSat-X was built entirely by Nigerian engineers who were trained at Surrey Satellite Technology Ltd. The satellite carries two payloads: one 32 m resolution sensor (as carried by NigeriaSat-1) and another 22 m resolution sensor. NigeriaSat-2 is a highly advanced 300 kg earth observation satellite with four multispectral channels with 2.5 m spatial resolution in panchromatic mode and 5 m in multispectral mode. Furthermore, it has capability for stereo imaging. It will therefore significantly boost African capabilities for geospatial information production for developmental activities such as natural resource management, as well as aid disaster relief through the Disaster Monitoring Constellation for International Imaging.

The African Resource Management Satellite Constellation programme has also been officially endorsed by the Governments of Algeria, Kenya, Nigeria and South Africa, and is open to other African countries that may be interested in joining the venture in the future. The new NigeriaSat-2 satellite is expected to be Nigeria's contribution to the programme, signalling its practical implementation with the expected improved availability of satellite images for geospatial information production in Africa. The goals of the African Resource Management Satellite Constellation initiative include:

- Building on indigenous knowledge to develop and transfer satellite technology
- Developing African human resources by means of joint participation and knowledge sharing
- Providing Africa with rapid, unrestricted and affordable access to satellite data thereby ensuring effective indigenous resources management in Africa by Africa

Furthermore, three African countries have operational communication satellites, namely Egypt, Morocco and Nigeria, which have the potential to improve ICT infrastructure for geospatial information production, management and use in Africa.

In the area of geospatial information capacity development, specialized regional centres of excellence and organizations exist, including:

- Regional Centre for Training in Aerospace Surveys, RECTAS (a bilingual English-French centre offering education and training programmes at technical and postgraduate levels); Regional Centre for Mapping of Resources for Development, RCMRD (short courses and project training); African Organization of Cartography and Remote Sensing, AOCRS (networking); African Centre for Meteorological Applications for Development, ACMAD (weather-related courses and projects); African Regional Centre for Space Science and Technology Education, ARCSSTE (postgraduate courses in English); Centre Régional Africain des Sciences et Technologies de l'Espace, CRASTE (postgraduate courses in French); Agriculture, Hydrology and Meteorology Research Centre, AGRHYMET (short courses and project training in French)
- National specialized institutions offering regular and short-term training programmes in geospatial information, such as Centre Royal de Télédétection Spatiale, (Morocco); Centre de Suivi Ecologique, (Senegal); Centre for Remote Sensing and Geographic Information Services, (Ghana) and Ghana School of Surveying and Mapping; Federal School of Surveying (Nigeria)
- Universities and polytechnics offering courses at diploma, first degree and postgraduate levels
- Organizations and professional networks that regularly organize conferences and workshops, such as the African Association of Remote Sensing of the Environment, Environment Information Systems-Africa (EIS-

Africa) and African Leadership Conference on Space Science and Technology.

In the area of geospatial information funding, the common trend is lack of proper funding of geospatial information activities on the continent. For example, the 2008 United States Geological Survey on remote sensing in Africa indicated that on average, less than \$200,000 was budgeted for geospatial information technology by the respondent organizations in Africa. However, for countries that painstakingly funded geospatial information, evidence now exists of positive returns on investment apart from the intangible benefits. For example, Nigeria's Abuja Geographic Information Systems generated a total revenue of over 22 billion naira (approximately \$145 million) and foreign currency up to \$2.2 million from September 2004 to November 2008.

(d) Challenges facing geospatial information management in Africa

As notable as the above overview of current status is, there are key challenges that must be addressed to enable sustainable development of geospatial information in Africa. Some of these challenges are:

- **Barriers to adequate access to earth observation satellite data** – obtaining archived and current images still poses a challenge due to selective coverage by producers; persistent cloud in the equatorial region; absence of permanent receiving stations in the region for commercial high- and medium-resolution sensors, except for African-owned satellites, and high cost of images. Even images from regionally-owned satellites are difficult to access for other African countries.
- **Inadequate geodetic infrastructure** – elevation data are not adequate in many African countries. As mentioned above, there is a preponderance of inadequate national geodetic controls in Africa to the extent that survey plans required for the registration of land titles are still being tied to a previously established, so-called local origin determined by solar or stellar observations. Apart from the fact that the planimetric controls may be based on different coordinate systems,

they are usually not unified with the vertical control points, while many applications such as urban and land management in cities with multi-level buildings require 3D geospatial data.

- **Obsolete and non-digital information archives** – much of the geospatial information archives in Africa are still paper-based and this limits their accessibility; in many cases, the data are so obsolete that new mapping is required.
- **Insufficient capacity utilization and knowledge transfer** – many geospatial information professionals, technologists and technicians in various organizations were trained in the obsolete methods of map production, and the equipment base is also obsolete. To compound the problem, technology changes so rapidly that hitherto trained personnel would already require retraining within a period of five years. Moreover, in many cases, personnel that were trained abroad are often assigned to unrelated tasks and are not able to utilize or transfer the knowledge gained to others. There is also a lack of participation in relevant international events and organizations due to financial constraints.
- **Weak link or communication gap between policy level and geospatial information expertise** due to inappropriate strategy for generating awareness of the benefits to be derived from geospatial information science and technology application, resulting in a low level of political will, inadequate funding and poorly executed development projects.
- **Fast evolution of technology** – geospatial and information and communication technologies offer tremendous opportunities but changes are often so rapid that organizations and personnel are unable to keep up with them, usually due to financial constraints to purchasing updates or retraining staff.
- **Uncoordinated planning, design and implementation of development projects** due to donor preferences, closed focus areas or sectors, and coordination gaps between the national and regional levels, resulting in duplication of efforts and resources and avoidable increased cost.
- **Inadequate infrastructure support** – it is axiomatic to state that successful uptake of geospatial information technology in Africa is largely constrained by non-availability of efficient national infrastructures, from information and communication to power, or lack of access to such infrastructure, particularly in rural areas. In 2004 it was estimated that Africa would need \$15 billion a year in infrastructure financing to achieve 7 per cent economic growth and to halve extreme poverty by 2015 and reach the Millennium Development Goals. Despite the appreciable growth recorded in ICT infrastructure, a 2008 World Bank report indicated that only 2 per cent of the population in Africa had Internet access in 2008; this figure increased to 26.8 per cent in 2013, according to WorldStats (<http://www.internetworldstats.com/stats1.htm>), and the situation has only improved marginally as at 2015. Even then, the bandwidth is often too low to support image and geospatial information transfer. One of the factors responsible for the low bandwidth is cost, as the Internet service providers within the countries require huge amounts of foreign exchange to pay for the Internet backbones located outside Africa. The power sector is particularly worrying in many countries. Inefficient electricity supply affects utilization of available ICT and increases the cost of other infrastructures and projects due to the need for back-up electricity. For example, the telecommunication operators in Nigeria are reported to be spending an average of 6.7 billion naira (approximately \$43m) monthly to power their base stations.
- **Inadequate funding** – many Governments have failed to yield to the consistent call on African Governments to properly fund survey and mapping activities in their various countries. Not less than 2.5 per cent of the national budget each year has been generally advocated but the amount allocated is often typically a far cry from this percentage. Beyond this, some of the

national mapping organizations do generate some income which is by law paid directly into the Government treasury but which the organization has no access to and in fact is not permitted to expend even for its operations except through the budgetary provision of the following year. Unfortunately such budgetary provision often does not take into consideration the amount generated by the agency; a high income generating agency may still attract inadequate budgetary provision.

- **Institutional and legal challenges** – access to geospatial information in Africa is often limited due to institutional barriers. National security is sometimes used and abused as an argument to restrict access to some geospatial data. In addition, some form of monopoly on geospatial information production and use still exists here and there, thus hindering the contribution of the private sector and other types of players to the expansion of the sector. Similar challenges come from the restriction or ban on the use of unmanned aerial vehicles for geospatial information production in many countries.

(e) Opportunities for geospatial information management in Africa

Despite the aforementioned challenges, there are notable opportunities that can facilitate sustainable management of geospatial information in Africa. Some of these opportunities can be inferred from the current status overview above and further highlighted as follows:

- Availability of African national earth observation and communication satellites, which are essential data infrastructure components that, if properly coordinated, can contribute immensely to this process.
- Ongoing global and regional initiatives such as GMES, UN-SPIDER, GEOSS, African Monitoring of the Environment

for Sustainable Development and various internationally supported national land reform programmes, through which fundamental data sets are being made available and capacity is being built, as well as support from international geospatial organizations for regional development programmes such as the International Cartographic Association's working group on Mapping Africa for Africa, International Society of Photogrammetry and Remote Sensing, International Association of Geodesy and Fédération Internationale des Géomètres.

- Availability of adaptable best practices e.g. Global Spatial Data Infrastructure (GSDI) and Infrastructure for Spatial Information in the European Community, INSPIRE.
- Availability of regional capacity-building structures and networks such as the African Association of Remote Sensing of the Environment and EIS-Africa, and centres of excellence such as RECTAS, RCMRD, ARCSSTE, CRASTE, ACMAD and AGRHYMET, as well as high-quality national capacity-building institutions.
- Availability of open source software and global data.

Current advances in space and Geo-ICT technologies offer great opportunities for the effectiveness of the United Nations initiative on Global Geospatial Information Management in Africa, in particular the following:

- Use of global data sets on Africa, including, but not limited to the second administrative level boundaries data sets, Google Earth and Google Maps, free GlobeLand30¹, free earth observation archive data, the digital elevation model, future African Resource Management Satellite Constellation data, the African Monitoring of the Environment for Sustainable Development, Monitoring

¹ GlobeLand30, promoted during the Fourth High-level Forum on Global Geospatial Information Management, held in Addis Ababa in April 2016, is the first 30m resolution land cover data over the whole globe freely available online. It is an initiative of the Republic of China, and the data set was donated to the United Nations on 22 September 2014. The two-date coverage (2000 and 2010) allows land cover changes to be mapped for 10 classes: cultivated land, forest, grassland, shrub land, wetland, water bodies, tundra, artificial surfaces, bare land and permanent snow and ice. Among the many possible applications these data sets can be used for, two land cover data sets (2000 and 2010) are readily available for Africa. These can be used to derive an Africa-specific land cover data set – one of the fundamental data sets (with a consensus-based number of land cover classes) in combination with other data sources if needed.

for Environment and Security in Africa and GMES-Africa data sets, etc. to build and share fundamental data sets at cheaper rates.

- Cloud computing especially for the storage of high volume geospatial data sets.
- Unmanned aerial vehicles and systems technology emerging as a new exploration means, and pictures taken from unmanned aerial vehicles, is a new application area with a high potential for covering limited sectors or cloudy areas for calibration, validation or ground-truth purposes.
- Volunteered geographic information, community mapping, and the participatory geographic information system offer possibilities for continuous updating of some data sets such as roads network, built-up areas, addressing extension, etc.
- Use of free and open-source software, especially for metadata catalogue and clearing house implementation.
- In the earth observation domain, nanosatellite technology, developed from the CubeSat idea, is a low-cost solution in research for quickly acquiring practical knowledge and experience in earth observation satellite design, building and launch.

(f) Basis for the development of common frameworks and tools for geospatial information management in Africa

The following proposals are formulated keeping in mind that, during the period 2016-2030, geospatial information management in Africa has to be demand-driven, in other words, guided by the satisfaction of national, subregional and continental level needs for the implementation of the Sustainable Development Goals and Agenda 2063 aspirations and shorter term objectives.

(i) National and regional geodetic infrastructure development

To facilitate adequate and fit-for-use geospatial data for various applications, it is necessary to intensify the implementation of the African Geodetic Reference Frame as well as other

national geodetic control points. As indicated earlier, many countries have established continuously operating reference stations apart from those established under the AFREF project; therefore, an immediate inventory of the already established stations in every country is required to confirm the current status. This can then serve as input for the design of a regional continuously operating geodetic network. The regional design is necessary to optimize the design of national networks. Similarly, the national network design should guide the second administrative levels (states, regions, districts, provinces, etc.) in locating continuously operating reference stations in their jurisdictions. International and national development programmes that include the establishment of continuously operating reference stations (such as the national land reform programmes being undertaken in various countries) should implement this part of the project in close collaboration with the AFREF secretariat. The development of AFREF and national continuously operating reference stations should be compliant with General Assembly Resolution 69/266 of February 2015 on the global geodetic reference frame for sustainable development. This includes improving and maintaining appropriate national geodetic infrastructure and sharing geodetic data openly.

Other GNSS-based techniques should be promoted; for example, African very long baseline interferometry stations could be used for geodesy purposes as well.

(ii) Production of fundamental datasets

Even though an inventory of existing fundamental data sets was carried out some years ago as reported above, some countries must have undertaken (or are currently undertaking) mapping activities internally since then. Thus an update of the inventory is essential. The updated inventory should include the current status of all ten fundamental data sets and the street address catalogue at the minimum. It should also include the status of the national fundamental data sets in countries where these have been defined. While accepting that new mapping will be required in many cases, it is still essential to also address the issue of converting the existing analogue

data for time-lapse information for development projects, for example, a post-disaster operation will normally require information on the spatial situation before the incidence of the disaster.

The collection, updating and management of the fundamental geospatial data sets should be informed by the needs expressed by users. However, the neglect in geospatial information of marine and inland waters, highlighted by the Sustainable Development Goals, calls for careful insight into this issue when reviewing the fundamental data sets for member States, regional economic communities and the continent as a whole. The information required for the indicators of the Goals and Agenda 2063 should be a key driver for geospatial information management in Africa (see 4.(ii) above). Reliable and relevant fundamental data sets should be regarded by Governments as part of Africa's national and regional sustainable development infrastructure, with geospatial information management considered and adopted as a full socioeconomic development enabler in Africa.

Early completion of the "Guidelines of Best Practice for the Acquisition, Storage, Maintenance and Dissemination of Fundamental Geospatial Data Sets", started by the (former) CODIST geoinformation subcommittee working group on fundamental data sets for the Mapping Africa for Africa initiative will contribute significantly to the production of fundamental data sets as it will be a document for African countries to use as a practical hands-on toolkit.

The use of satellite images from the continent's spacefaring nations (Algeria, Egypt, Nigeria and South Africa) should be encouraged for the production of the fundamental data sets where appropriate. This will help to boost the national economies of these countries and promote the use of their satellite assets. To facilitate this, a special regional data price will be necessary, perhaps spearheaded by a joint African Union Commission-ECA space science and technology programme in consultation with the African Resource Management Satellite partners and Egypt, pending the development of an African regional space policy (see next section). It is heart-warming to know that Nigeria is ready to

share data from her earth observation satellites with other African countries as promised by the Director General of the National Space Research and Development Agency on 25 March 2012. One (or a combination) of the regionally-owned satellites can then be used to produce a seamless, uniform, orthorectified, 2.5m natural colour, continental coverage (similar to SPOTMaps) as base data to generate other geospatial data sets at appropriate scales and resolutions.

Beside the space borne imagery, airborne imagery should not be neglected as part of Africa's fundamental data sets series. This platform is particularly useful and is the best solution, for example in the permanently cloudy regions of Africa, as flying below the cloud cover allows nowadays the generation of good quality airborne imagery.

The collection and management of geospatial information on the neglected marine and inland waters must be included with other fundamental data sets.

(iii) Development of metadata, geospatial standards and geoportals

Availability of multi-scale geospatial standards is a sine-qua-non condition for efficient geospatial information management in Africa. Consequently, Global Geospatial Information Management in Africa has a working group dealing with geospatial standards, and likewise at the national level in various countries as part of the spatial data infrastructure process. The geospatial standards working group of CODIST has produced a generic metadata profile for the Africa region, but an implementation guide for it needs to be produced as early as possible to encourage adaptation and implementation at the national level. The working group, in collaboration with regional and international partners, also needs to prepare profiles for all the fundamental data sets and components of geospatial standards, namely:

- **Specialized hardware** (with configuration issues, particularly in logical data modelling)

- **System administration standards** (file and directory naming standards, system access and security)
 - **Data format standards** (Geospatial data format, data content and data dictionary standards, data coding and classification standards, data exchange format, metadata standards)
 - **Product presentation standards** (map symbology standards, map design and layout standards, other product output standards)
 - **System access and data and product distribution standards** (policies, catalogue and fee schedule for products and services, procedures for responding to and tracking requests)
 - **Software and application standards** (geographic information system software packages, GIS-related software packages, relational database management system standards, application development software standards, application design and documentation standards)
- Development of best practice guidelines and advice on application of the standards

Also, the development of standardized geographical names in collaboration with the United Nations Group of Experts on Geographical Names and ECA, and the establishment of geographical names authorities in African countries should be encouraged as recommended by CODIST.

In order to facilitate access to available data sets, it is necessary to develop and strengthen a regional geoportal at ECA-GISS to host country spaces (national metadata catalogue), regional metadata, as well as the seamless continental orthorectified images database with web map and web feature services capability, using free and open source software. Country spaces should consist of a mirror content of national geospatial platforms set up in member States to disseminate and share national fundamental data sets and their metadata.

In this regard, African countries should be assisted by the United Nations initiative on Global Geospatial Information Management for Africa to develop such national geospatial platforms, and regional economic communities should be assisted to set up and operate subregional geospatial platforms especially designed to deliver regional economic community-level information products, to be used in the application of geospatial information to Sustainable Development Goals and Agenda 2063 implementation at that level.

(iv) Funding of geospatial information activities

An effective funding model is necessary for sustainable and successful geospatial information management in Africa, and should include a strategy for public-private partnership for the production of key geospatial data sets. The funding challenge can be substantially reduced by granting autonomy to the national mapping agencies. In the absence of full autonomy, a better arrangement could be found by allowing the agencies to spend a certain percentage of their internally-generated income on mapping activities. The percentage could be determined by

In producing the geospatial standards profiles at the regional and national levels, the activities to be carried out will include, among others:

- Inventory, review and evaluation of existing national standards
- Review of existing related international standards
- Development of draft national standards in conformity with generic International Organization for Standardization (ISO) standards
- Registration of national standards with national standards organizations and ISO
- Development or adoption of standard terminologies
- Publication of supported standards for use by the geospatial information community

evaluating the cost of production in the previous five years, for example, and comparing this with the yearly allocation in the national budget. This will allow the agencies to be properly funded and thus in a position to implement new innovation systems in their production strategies.

Opportunities such as funding facilities offered by African institutions like the African Development Bank and New Partnership for Africa's Development (NEPAD), and multilateral and bilateral donor or development agencies such as the United Nations organizations (UNDP, UNEP, etc.), the World Bank, European Union, United States Agency for International Development (USAID), China, France, Germany, Japan, etc., have to be explored and funding secured for the African Action Plan. Financial support should be provided either as a direct contribution to the core budget of the United Nations initiative on Global Geospatial Information Management for Africa, or through funding specific programmes and projects identified in the Action Plan.

Ongoing initiatives and imminent major projects in Africa should be approached to explore and assess the possibility of using part of their financial resources to implement, in partnership, some of their activities through the United Nations GGIM initiative in Africa.

However, a long-term solution to geospatial information funding in Africa could be drawn from the experience of the ICT community, with their Universal Access and Universal Service² concept, built into ICT policies in recent years, and funded under the Universal Access and Service Fund (UASF) principle.

(v) Capacity-building and technology transfer

In geospatial information production and management, advances in space and information technologies have had a positive impact on human capacity globally through availability

of geospatial information technology tools. To be fully utilized however, the acquisition of this technology must be fully complemented by readily available skilled manpower and an enabling infrastructure. Because of its central role in sustainable geospatial information management, the aspect of capacity-building is treated separately in more detail in section 4.3 of this document.

(vi) Infrastructure support

The effectiveness of the United Nations initiative on Global Geospatial Information Management for Africa requires efficient infrastructure support, especially electrical power and ICT.

As noted, a number of African countries, including Egypt, Nigeria and Morocco, have communication satellites. The services of these satellites should be maximized as much as possible to promote regional development in Africa through a special pan-African price regime that will contribute to an appreciable increase in the density and the bandwidth of Internet services. Efforts should also be made to improve the undersea cable infrastructure. The GEONETCast facility with its relatively low cost also promises to be a key player in image data transfer and distance learning and its use is highly recommended.

In order to enhance the uptake of earth observation in Africa, developments in the ICT sector need to take into consideration the special requirements of the geo-community for high speed and high bandwidth Internet connection, to facilitate efficient data transfer and especially the realization of the high data volume of satellite images.

In the area of electricity infrastructure, alternative energy sources, especially solar energy solutions should be widely deployed.

² Universal Service (US) means that every household in a country has the opportunity for telephone service. Universal Access (UA) means that everyone in a community can gain access to a publicly available telephone, although not necessarily in their homes. ... Since many countries have reached universal access for telephony and now strive to achieve universal service, they are now focusing on reaching universal access for broadband. Therefore, the generic term UAS (or UA/S) is becoming more common as policies target for both UA and US. ... But some form of funding has to be found to finance gaps which still exist between the market's commercial boundaries and the targets UAS policymakers may wish to reach. ... The model of a mainly industry-financed Universal Access and Service Fund using the principles of Output Based Aid (OBA) to finance investments targeted under UAS policy has become a well-known financial instrument for developing countries (From ICT Regulation Toolkit: www.ictregulationtoolkit.org).

(vii) Private sector stimulation

Globally, the private sector has driven technological innovation and the growth of the knowledge economy. It is therefore necessary to ensure effective indigenous private sector involvement in the production and management of geospatial data, through job outsourcing and public-private partnerships. The model of the Canada Centre for Mapping and Earth Observation is of particular interest as they contract certified private companies to deliver earth observation-based cartographic products, compliant with their national standards, on the basis of accurate production protocols. This type of public-private partnership stimulates the emergence of geospatial information service providers and consolidates the role of the private sector as an active player in geospatial information management in the country.

(g) Summary of goal, objectives and results for a common framework and tools

Goal

Adoption of a common framework for the delivery of fit-for-purpose tools, products and services, generated from the integration of statistical and geospatial information and geospatial information-based tools and applied to the United Nations initiative on Global Geospatial Information Management for Africa.

Strategic objectives and key expected results

SO 2.1 Africa member States take action to use geospatial information for the attainment of the Sustainable Development Goals and Agenda 2063 targets;

R 2.1.1 National Goals and targets are used to design related, geospatial information-based added-value information products and services;

R 2.1.2 National sets of Goals and targets-related added-value information products and services are aggregated into subregional sets for the regional economic communities, and the latter aggregated into sets for Africa as a region.

SO 2.2 A high-quality ground-level infrastructure is strengthened for sound geospatial information production in Africa;

R 2.2.1 National and regional geodetic infrastructure is further developed with continuously operating reference station networks and other global navigation satellite system-based techniques, in compliance with General Assembly Resolution 69/266 on the Global Geodetic Reference Frame;

R 2.2.2 Support is provided to ground-level infrastructure.

SO 2.3 Fundamental data sets, metadata and geospatial standards are developed and geoportals set up for geospatial information management in Africa;

R 2.3.1 Fundamental data sets are produced for Africa with the support of United Nations GGIM: Africa Working Group 2 on fundamental data sets and standards;

R 2.3.2 Metadata and geospatial standards in Africa are disseminated on geoportals.

SO 2.4 The private sector is involved in the agenda of the United Nations initiative on Global Geospatial Information Management for Africa and funding mobilized;

R 2.4.1 Public-private partnership is enabled for geospatial information management in Africa;

R 2.4.2 New scientific and technological opportunities are used for better geospatial information management in Africa.

4.3 Capacity development and knowledge transfer

(a) Introduction

The full potential of geospatial information management as a driver of economic growth and development can only be realized if data are available in formats that are recognizable to the user base, with derived information made accessible to public decision makers and leaders in civil society and the private sector.

A handful of countries have implemented comprehensive geospatial information management platforms which have demonstrated the great potential for geospatial data to support planning, natural resource management, transparency in government, and economic development in general. Examples include the Lake Victoria Region Water and Sanitation Initiative, Kenya Open Data Portal, and South Africa's National Spatial Information Framework. Despite the huge potential for catalysing progress in development, however, examples of comprehensive geospatial information management platforms on the African continent are scarce. This is not due to lack of interest or effort, but rather is a factor of the large investment needed to launch geospatial information management initiatives and the substantial coordination problems that such efforts must overcome.

This section discusses the subject of capacity development using the United Nations Development Group (UNDG) capacity development methodology overlaid with the African Union-NEPAD Capacity Development Strategic Framework.³ It emphasizes a shift from stopgap, supply-driven measures to "build" capacity, to a more comprehensive, holistic, vision-driven, long-term transformative development process that has internal energy to sustain itself over time.

(b) Rationale: Need for a new capacity development approach

Efforts to build capacity in geospatial information management must adopt an integrated approach, one which meaningfully addresses issues related to data, communications, partnerships, standards, technology, and most importantly users. Efforts to build capacity in geospatial information management in Africa over the past 20 years have been supply driven, and have typically reflected the mandates of mostly external actors. Local, national and regional applications of geospatial information management have continued to expand in scope and relevance, but without a strong demand-driven agenda for building capacity, the outcomes of such efforts will continue to fall short of their true potential. In particular, efforts to develop capacity in geospatial information management in Africa have been largely piecemeal, short-term and context-dependent.

This is why the development of capacity is necessary – to support the operative requirements of geospatial information management initiatives. Additionally, capacity-building must break free of traditional models that focus solely on training of technical specialists, and must build institutional capacity and an enabling environment.

(c) Status and review of geospatial information management capacity-building efforts in Africa

Efforts to build capacities for managing geospatial information in Africa span over more than three decades. Traditionally, much of the "capacity-building" had been by way of training a few professionals, mainly from the surveyor-general departments, and equipping these organizations in map-making and related activities. In the mid-1970s there was an impetus and proliferation in geospatial information production and management activities in the wake of the earth resource satellite programmes. While a few of these initiatives were very successful in terms of their objectives, most of them remained project-focused and did not address long-term

³ The Capacity Development Strategic Framework serves as a common reference for capacity development, ensuring continuity and synergy between regional and national level activities. It also offers both a transformative and integrative approach to capacity development, and attempts to address the problem of fragmentation by forging a common approach, with needs as defined by Africans. It was endorsed by the African Union Assembly of Heads of State and Government in February 2010.

integrated development information needs. A legacy of these programmes includes regional training centres (such as RECTAS and RCMRD) which still run training and service programmes to support member Governments.

The environment movement in the 1980s put considerable pressure on Governments to take steps for the effective management of the environment. The shift in thinking regarding the environment and sustainable development triggered a huge demand for environmental information. The United Nations system, led by the United Nations Institute for Training and Research (UNITAR) and the United Nations Environment Programme, responded to this need to expand the capacity base in “geographic information” development and application to the management of the environment. Training programmes were established both at the global and regional levels.

While these programmes created a new cadre of personnel in the environment and natural resource management sectors, they did not generate the critical mass of capacity needed to address the challenge of the time – improving the availability of land-related information across Africa. In 1990, the World Bank proposed a broad-based multi-donor approach to addressing the challenge, which was supported by a broad coalition of stakeholders. It led to the launch of the Programme on Environment Information Systems in Sub-Saharan Africa (the EIS Programme), the first Africa-wide initiative to facilitate capacity-building in spatial information management at a scale sufficient to have a long-lasting impact.

The Africa Geographic Information System and African Association of Remote Sensing of the Environment conference and exhibition series were launched as part of the knowledge exchange and learning process associated with the EIS Programme. The programme also spawned several subregional initiatives aimed at strengthening capacity, including the Southern African Development Community EIS Programme launched in 1993; the Regional Environment Information Management Programme for Central Africa in 1998; and the Regional Integrated

Information System of the Intergovernmental Authority on Development in 1999.

The EIS initiative spun off many new agency- and mandate-related capacity-building initiatives in the 1990s. Notable among these were:

- The UNEP Environment and Natural Resources Information Network programme, which enabled developing countries and countries with economies in transition to improve their capacity for the effective use of environmental information, and hence improve policy development.
- The AFRICOVER land cover classification and mapping initiative launched by the Food and Agriculture Organization of the United Nations in 1994 to build capacity to establish and maintain, for the whole of Africa (at the subnational, national and regional levels), a digital georeferenced database on land cover and a geographic referential base including: geodesy, toponymy, roads and hydrography.
- The implementation by UNITAR of the Environmental Information System on the Internet initiative, a capacity-building programme on integrated management of data and information to implement multilateral environmental instruments.

These were the days before the emergence and use of the term “spatial data infrastructure”. However, by its very nature EIS was a “native spatial data infrastructure”. The EIS concept had emerged from various initiatives to promote the more efficient use of data, statistics, and other documents that enabled managers to identify and quantify specific environmental resource categories, and to determine their optimum utilization. Emphasis was placed on a demand-driven approach which required that the production of information had to correspond to priority needs of users at various levels. As the early pioneers worked their way around difficulties and challenges, networks (or information communities) of data producers and users evolved; the need for data producers to construct a data infrastructure became paramount, and so was the importance of describing existing data

or metadata. Community members also learnt it was important to establish a common data architecture which would ensure that data could be used “off-the-shelf”. Eventually the formalized concept of national spatial data infrastructures brought much needed order to a chaotic world of competing geographic information systems, and many African countries went on to establish national spatial data infrastructures.

These initiatives did yield significant capacity outcomes. Among these, a cadre of geographic information system and environmental information system professionals emerged across Africa from a wide variety of backgrounds and application areas. Existing institutions were strengthened and new ones were created for the purpose of training and providing geospatial information services. In some countries policy frameworks to support the development, exchange and application of geospatial data were put in place, along with institutional arrangements to facilitate the production and exchange of harmonized geospatial datasets. An active, pan-African network or community of geospatial information practitioners emerged.

In this landscape, ECA, among other development actors, played a key role in capacity-building in the geospatial information domain. It should be recalled that the present pillars of endogenous capacity in geospatial information training in Africa, in particular RECTAS and RCMRD, were created under the aegis of ECA back in the 1970s. The position paper on “The Future Orientation of Geoinformation Activities in Africa”, published by ECA in 2001, was a very important milestone. It formally marked the transition in Africa from the environmental information system as an institutional and technical response to the need to improve the role and benefits of information in environmental management, to spatial data infrastructure as it is widely understood and used today. The paper provided guiding principles for advocacy and recommendations for the development of spatial data infrastructure as the appropriate mechanism for making reliable information easily available for policy, investment, planning, management, and monitoring and evaluation purposes at the regional and subregional levels.

(d) Basis and elements of geospatial information management capacity development in Africa

The use of the term “capacity development” is deliberate, and in this context the term is not synonymous and interchangeable with “capacity-building” which commonly refers to a process that supports only the initial stages of building or creating capacities and alludes to an assumption that there are no existing capacities to start from. The development of capacity that becomes institutionalized and brings about improvements in performance, stability, and adaptable institutions and institutional frameworks requires a fundamental shift from a supply-driven, stopgap paradigm to a demand-driven, transformative process that facilitates multi-stakeholder engagement; facilitates access to knowledge; promotes participatory policy dialogue and advocacy; reflects and integrates with the broader development context; and creates space for learning by doing.

Details of basic principles in the capacity development approach are provided as an appendix to this Action Plan.

(i) Definition of capacity development

Capacity development, in contrast with project-oriented capacity-building often implemented through technical assistance, is not a one-off activity, but an ongoing process of transformation and enhancement of abilities. Several definitions of “capacity” and “capacity development” exist; this paper adopts definitions used for the development of the “Tanzanian Capacity Profile”. (Strategy for Capacity Development in Tanzania: A Concept Paper GoT/DP Capacity Development Working Group, March 2006.)

Capacity is defined as the ability of people, communities, organizations, and societies to perform functions, solve problems and set and achieve targets within an institutional setting or enabling environment. In more concrete terms it is the ability of an entity to do the following:

- a) Scan and analyse its environment;
- b) Identify complex problems, issues, needs and opportunities;

- c) Formulate strategic and operational strategies to deal with these problems, issues, needs and to seize opportunities;
 - d) Design plans and programmes of action;
 - e) Develop effective communication and information-sharing in society;
 - f) Assemble and effectively and sustainably use resources to implement, monitor and evaluate the plans and use the feedback to learn lessons acquired through the process.
- Establishment or strengthening and maintenance of geospatial information management service centres to provide support and expert advisory services
 - Skills to collect, build appropriate data sets, manage, and interpret data, including building the capacity of consumers to make appropriate use of analytical tools and data sets
 - Technology, including hardware and software systems and processes for storing, accessing, analysing, transforming, and sharing or exchanging information, supported by the appropriate infrastructure in the context of current as well as evolving computing environment
 - User-oriented products, tools and services to facilitate the flow of information between custodians and users of data, to assist the interpretation of data according
 - to user requirements, and to support decision-making in the national development context
 - Credibility, including protocols for security, intellectual property and management of documentation of knowledge and supporting processes; geospatial information management service centres should have credibility in their business practices, with protocols for marketing, distribution of funds (with appropriate return of royalties and licensing fees), etc.

Capacity development is [therefore] essentially a process of enhancing the institutional, human and organizational abilities to perform core functions, solve problems and seize opportunities, organize communication and information sharing, define and achieve objectives in a sustainable manner. The implication of this broad definition is that one may need to distinguish between capacity development for organizations, for institutions and for state building to the extent that these different levels may require different approaches involving different actors. It is important to realize that capacity development is not an end in itself; it is a means to achieve objectives and goals set by society at its respective levels (groups, communities, sectors or whole societies).

(ii) Need for a holistic strategy for geospatial information management capacity development in Africa

In the context of geospatial information management, the foregoing implies substantial investments in: (a) establishment and maintenance of the full range of spatial data infrastructure-related elements, and (b) meaningful engagement with a diverse group of stakeholders to ensure a broad user group and access to people and organizations that can implement policies and initiatives. There should be a holistic strategy to address the following key elements⁴:

- Data availability and accessibility (including mechanisms for discovery) in the form(s) that users require

Financing plan and partnership

The strategy should have a clear financing plan, with defined roles for the various stakeholders and mechanisms to deal with the obstacles and difficulties imposed by the need to foster cooperation among stakeholders. In addition to engagement with a broader group of stakeholders that have been involved in previous capacity-building initiatives, strategies must explicitly seek to build partnerships with

⁴ Based on Feeney, M-E.F., I.P. Williamson, and I.D. Bishop (2002). The role of institutional mechanisms in spatial data infrastructure development that supports decision-making. *Cartography*, 31(2), 21-37 (<http://repository.unimelb.edu.au/10187/1455>).

individuals and organizations from fields that have not formally been aligned with geospatial information management in the past. This might include census agencies and custodians of national statistics data. Other partners may include representatives of the open source community who have developed comprehensive data sets in many regions, sophisticated infrastructure platforms for disseminating data, and extensive networks for engaging researchers and policymakers.

The ICT community is a particularly attractive partner for practitioners of geospatial information management capacity development. ICT initiatives have been well integrated into public, private, and civil society organizations, and have quickly gained the institutional support necessary for long-term support and development. ICT initiatives would benefit significantly through greater integration with geospatial information management and spatial data infrastructure, and vice versa.

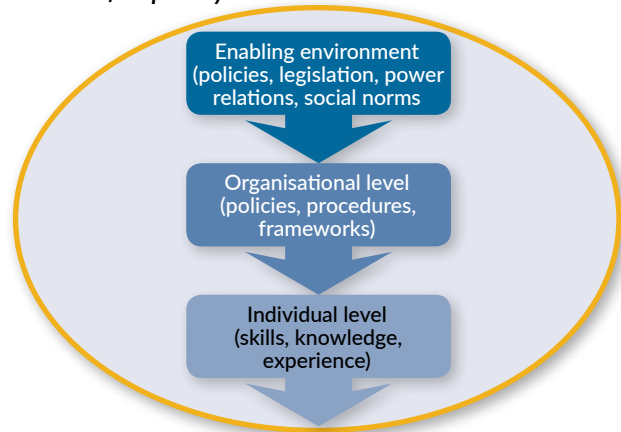
Public-private partnership

A capacity development strategy for geospatial information management activities should have a strong partnership component. The private sector has been the primary driver in the uptake and near-ubiquity of geospatial information applications as we know them today, and national strategies should build public-private partnerships in order to benefit from the expertise and resources of such partnerships. They should be driven by the goal of improving the availability and accessibility to high-quality geospatial information.

Incentives for being a partner should be clearly articulated, including a common vision which creates or adds value for partners who should commit themselves to supporting the development and use of geospatial information for development. With the right incentives and opportunities private-sector partners would be encouraged to support and facilitate capacity development, including demand-side capacity, through more awareness creation, learning by doing, coaching, formal training and education, and sharing best practices and lessons learned.

Partners should commit themselves to facilitating access, working at the local, national, regional, and global levels to reduce the barriers that constrain the flow of geospatial information. They should work to strengthen networking among experts, policymakers, civil society and the public, and to strengthen linkages between local, national, regional and global institutions, systems and efforts.

Levels of capacity



As indicated above, capacity exists at different levels – within individuals, as well as at the level of organizations and within the enabling environment; these form an integrated system. Attention must be paid to this interrelatedness, implying that any strategy and intervention to assess or develop capacity necessarily for geospatial information activities needs to take into account capacity at each level; otherwise it becomes skewed or ineffective.

Capacity development process

Transformative capacity development keeps the focus on development results and institutions, fosters broad national ownership, and ensures alignment with national development priorities, strategies, processes and systems. It addresses technical and functional capacities; defines stakeholders and beneficiaries; and includes response and support strategies for investments in long-term education and learning, strengthened public systems, mechanisms for engagement and accountability between citizen and state, and necessary institutional reforms that ensure responsive public and private sectors that manage and deliver services to those who need them most.

An assessment of capacity is therefore an essential first step in the capacity development process. In previous capacity-building efforts the focus of assessments tended to be on (data) user needs; the capacity of the data provider, usually a Government agency, was defined and limited to training and equipment. In the more comprehensive approach being proposed, a broad range of issues have to be determined and an analysis of desired capacities compared with existing capacities needs to be undertaken. A capacity assessment therefore offers a systematic way to collect information and knowledge regarding assets and gaps in capacity. The information and knowledge generated would then be used to formulate capacity development responses that will allow the strengthening of capacities in areas that are necessary or the optimization of use of existing capacities.

User-driven approaches will better identify needs and related capacity issues. Not only will user-driven approaches increase the likelihood that initiatives will be successful through wider engagement with end users, but will also provide a critical feedback mechanism that will help geospatial information management leaders identify the most productive uses of geospatial information (ranging from which data to disseminate to the structures of spatial data infrastructure).

Interventions must also focus on strengthening linkages between education and training organizations and research and implementing organizations. This will not only counter brain drain, but will also increase the immediate impact of human capacity-building on the realization of development objectives, as well engender innovation.

Regional network organizations, such as EIS-Africa and the African Association of Remote Sensing of the Environment, have played, and are still playing, key roles in capacity development in geospatial information, by facilitating the transfer of knowledge and resources among individuals and organizations. In turn, to further increase the effectiveness of these efforts, a comprehensive capacity development strategy must not neglect

network organizations, but rather integrate and complement their efforts.

Change and change readiness

Introducing information systems often requires, and causes changes. Societies that have understood, developed, and adapted policies, legislation, systems, and business processes to this reality, have, and continue to, benefit from the challenges and opportunities from ICT. The domain of ICT is constantly changing, and the ICT movement has become highly adaptive and capable of responding and contributing to advances in technology in ways that create wealth and improve decision-making.

Geospatial technologies have also advanced rapidly and have become fully integrated and institutionalized throughout the principal sectors of many countries through geospatial information management and spatial data infrastructure. While African countries have fully embraced ICT, the case cannot be made for geospatial technologies. Rather, instances of geospatial information development have been piecemeal, ad hoc, and largely uncoordinated with a few important exceptions (for example NEPAD, the Kenya Open Data Portal, among others). The experience in North America and numerous European countries demonstrates the potential for geospatial information and spatial data infrastructure to drive economic development.

Capacity development itself also entails change – a change from one state to another that is more desirable, and should therefore be managed as such. In order for Africa to benefit fully from the opportunities provided by geospatial information, it is necessary to develop and strengthen capacities to embrace change, innovation, and adaptation in the realm of the constantly changing ICT environment. ICT is a logical partner for geospatial information, and greater integration of both types of initiatives would prove mutually beneficial.

However, this requires a fundamental rethinking of capacity development. It requires capacity development that is much more than supporting training programmes and the use of national expertise. Training will provide skills, but there

are many examples of highly trained skilled individuals who are unable to function at their full potential because the organizational and enabling environments are not conducive to productivity.

Thus it is the combination of the skilled personnel with an enduring and credible vision, a comprehension of the application context, existence of appropriate infrastructure, availability of IT technology and adherence to IT policies and procedures, and open-minded and positive attitudes in using the related technology that gives information and knowledge its strategic importance and brings about innovation and adaptation, without which capacity is transient and unsustainable.

In addition, “business processes” need to be changed. For the present discussion this implies that “location” and geospatial information should become part of the way individuals, groups and society are structured and work; this is already happening, driven by “external” interests and forces, including the private sector. Without appropriate national ICT policies that create space for responsive procedures and associated processes to be designed and implemented to facilitate, encourage and even force such changes in behaviour, potential benefits to economies from geospatial information would remain a pipe dream.

Whole society capacitation

This implies that society as a whole needs to be capacitated in order to bring about change. It requires that the capacity development strategy for geospatial information should not only address technicians and policymakers, but people across and at all levels of society – thought leaders, knowledge workers, as well as all categories of implementers (doers) alike. A broad base of stakeholders should be exposed to and be part of the capacity development process which creates space, infrastructure, engaging process and capacity for change to become an information society that is spatially enabled.

(iii) Capacity development suggestions for the 2016-2030 period of the Action Plan

The holistic approach applied to Geospatial Information for Sustainable Development over the 2016-2030 period could consist of the following actions, to be refined based on the deep review of geospatial information capacity in Africa:

Geospatial information governance and policy

At geospatial information policy level, needy countries should be assisted, not only to develop their national geospatial information policies, but also to undertake measures aimed at creating the institutional capacities necessary to generate the full potential of geospatial information management as a driver of economic growth and development. At the geospatial information governance level, this entails institutional reforms to better reflect the basic principle of separation of powers, whereby the geospatial information policy development and monitoring role is separated from that of geospatial information production, and private sector stimulation through public-private partnerships is effective. At the continental level, coordination of policy efforts for a better utilization of present and future space programmes compliant with the African Space Policy and Strategy is essential for capacity development at policy level.

The United Nations GGIM: Africa Working Group on Institutional Arrangements and Legal Frameworks (WG3) should be assisted to play a key role in ensuring quality geospatial information governance at all levels in Africa.

Common framework and tools

The outcome of the baseline study on fundamental data sets and standards will shape the capacity development action in this domain. However, there is evidence of the need to empower the geospatial information and statistics communities to work together in order to develop jointly added-value information products and services for the attainment of the Sustainable Development Goals and Agenda 2063 targets. Therefore, capacity development efforts should target:

- Human individual capacities to design and contribute to fit-for-purpose added-value information products and services at the national, subregional and continental levels
- Institutional capacities to produce, deliver and disseminate these added-value information products and services for member States and regional economic communities (including technological platforms and their operational requirements, deployment of continuously operating reference stations and other GNSS-based techniques, promotion of new technological opportunities including unmanned aerial vehicles and volunteered geographic information)
- Enabling environment in terms of regulations and institutional arrangements profitable to this collaborative work involving geospatial information and statistics experts for Africa's sustainable development.

Capacity development

The capacity development infrastructure, human resources and the contents of curricula will be assessed by the baseline study necessary to project capacity action in this domain over the period of validity of the Action Plan. However, the need is there to support the Pan-African University initiative of the African Union in order to reflect the real needs of the continent in human capacity at all levels, including the domain of geospatial information management. The capacity of ECA to monitor new development trends and innovation in support of the continent's future, through briefs, training workshops and specialized forum initiatives needs to be strengthened.

The various integration areas should be explored more deeply in order to formalize, where necessary, the required arrangements between disciplines (ICT, geospatial information, statistics). In particular, the National Statistical Spatial Framework should be given full attention as an implementation tool for the implementation of the Sustainable Development Goals and Agenda 2063.

Specific research should be initiated in critical areas such as adequate funding for geospatial information management in Africa, taking into account the way this issue was solved in other sectors such as ICT, cities management, etc. Full attention should be given to research in the neglected marine and inland waters coverage by geospatial information, with a view to developing accurate mapping solutions for below water surfaces and their natural resources.

(e) Summary of goal, objectives and results for capacity development and knowledge transfer in the period 2016-2030

Goal

To meet key individual, institutional and enabling environment requirements in capacity for the sustainable development of Africa.

Strategic objectives and key expected results

SO 3.1 Institutional capacity in geospatial information management is developed in Africa;

R 3.1.1 Accurate and comprehensive knowledge of the state of Africa's geospatial information management capacity for Sustainable Development Goals and Agenda 2063 production is available to support the demand-driven capacity development planning for the African Action Plan;

R 3.1.2 Targeted actions are taken to enable Sustainable Development Goals and Agenda 2063-oriented capacity development at institutional levels in member States in Africa;

R 3.1.3 Targeted actions are taken to strengthen earth observation capacity in Africa and consolidate the technological capacity of ECA;

R 3.1.4 Targeted actions are taken to improve university and high school curricula.

SO 3.2 Infrastructural capacity in geospatial information management is built in Africa;

R 3.2.1 A series of national-level comprehensive studies are carried out on key components of the spatial data infrastructure.

SO 3.3 Individual capacity in geospatial information management is built in Africa;

R 3.3.1 Actions are taken to build African indigenous capacity and retain skills.

Details are provided in the consolidated logical framework (see section 4.6).

4.4 International coordination, collaboration and cooperation in meeting regional and global needs

(a) Introduction

There have been many efforts to promote the benefits of geospatial information globally. Africa in particular benefited from initiatives taken by the international community in favour of member States and subregional and regional entities. Geospatial information management, like any other science-and-technology-triggered development tool, was brought to the continent thanks to the international cooperation effort. As already mentioned in previous sections, ECA was very active in spreading the good news of the great potential for geospatial information to support planning, natural resource management, transparency in government, and economic development in general.

Besides other similar initiatives, ECA used a smart strategy to influence both the policy level and African expertise, through diverse forms of communication. This capacity to converge and concentrate efforts so as to create exposure to innovative concepts and processes, influence their adoption by the targeted policy, professional and civil society organizations, and facilitate their use and application in the various fields of sustainable development, is the answer

to the successful agenda of ECA on geospatial information management in Africa.

However, member States in Africa are in partnership with other institutions from inside the continent, and also from abroad, and their choice to respond to ECA assistance is only effective if the approach is inclusive, flexible, transformative, and preserves freedom.

This section discusses international coordination, cooperation and collaboration in general in the area of geospatial information management, highlights several of the most prominent options, describes their actions, and considers some strategy options of interest to the African Action Plan.

(b) Rationale: Need for sound international coordination, cooperation and collaboration in the Global Geospatial Information Management development effort in Africa

Past experience in various domains has proven that, unless development projects and programmes are designed, implemented and monitored in a coherent environment, resources put in – financial, human and material – can be wasted and development objectives missed.

As far as the United Nations GGIM initiative is concerned, its design and early development process so far has been characterized by openness and synergy building. Indeed, a broad and long consultation process has taken place since 2010, in an inclusive spirit, bringing together all stakeholders. In Africa, it can be said that there has been good continuity with past achievements, so that only the financial resources need to be found to propel the initiative towards its highly promising objectives.

However, the same open-minded, inclusive and participatory spirit must prevail for the rest of the journey, which is why it is of utmost importance that the critical issue of coordination, cooperation and collaboration in development efforts is proactively addressed in the Action Plan.

(c) Basis for international coordination, cooperation and collaboration in the development effort

(i) Definition of terms

In order to be accurate with the use of the terms coordination, cooperation and collaboration, it is useful to agree on their meaning in the context of the present Geospatial Information for Sustainable Development document.

Coordination

According to the Business Dictionary (Web-Finance Inc. www.businessdictionary.com/definition/coordination.html), coordination is “the synchronization and integration of activities, responsibilities and command and control structures to ensure that the resources of an organization are used most efficiently in pursuit of the specified objectives. Along with organizing, monitoring, and controlling, coordinating is one of the key functions of management”.

Coordination in the present context, describes the consensus-based function assigned to the individual or institution responsible for consulting, planning, distributing tasks, allocating related resources, following up on activities and reporting back to the group of stakeholders.

Cooperation

This term expresses a “voluntarily arrangement in which two or more entities engage in a mutually beneficial exchange instead of competing. Cooperation can happen where resources adequate for both parties exist or are created by their interaction” (from the Business Dictionary).

This term implies that there is a voluntary agreement between United Nations GGIM: Africa and its stakeholders as the latter consider that it is in their interests to work together toward the overarching goal of geospatial information management in Africa.

Collaboration

There are three aspects to this term, as defined by the Business Dictionary:

1) General: “A cooperative arrangement in which two or more parties (which may or may not

have any previous relationship) work jointly towards a common goal”.

2) Knowledge Management : “Effective method of transferring ‘know-how’ among individuals, therefore critical to creating and sustaining a competitive advantage. Collaboration is a key tenet of knowledge management”.

3) Negotiations: “Conflict resolution strategy that uses both assertiveness and cooperation to seek solutions advantageous to all parties. It succeeds usually where the participants’ goals are compatible, and the interaction among them is important in attaining those goals”.

This term is more generic than the two first and may, in the general sense, be close in meaning to cooperation. However, in the present context the term is used for occasional interaction with United Nations GGIM: Africa for a limited period of time. Thus, United Nations GGIM: Africa will collaborate with specific partners for specific action for specific periods of time. It is very explicit in the knowledge management context.

(ii) Suggestions for United Nations global geospatial information management coordination

Two levels of coordination should be distinguished: (1) the global level coordination performed by the United Nations GGIM secretariat based in New York; and (2) the regional level coordination for Africa, assumed by ECA in its capacity as United Nations GGIM: Africa secretariat, following the decision taken by the same body during its first meeting in November 2015 in Nairobi.

For practical reasons, ECA may be allowed to delegate some of its coordination activities to the regional economic communities, for example for the harmonization of geospatial information policies at subregional levels, if this is not against the governance rules at the global level. In any case, such delegation of “coordination powers” does not lift the institutional responsibility and accountability of ECA as a regional coordination body for Africa. ECA remains accountable for its overall performance, including that of its power-delegated entities (if any).

(iii) Suggestions for cooperation within United Nations Global Geospatial Information Management in Africa

On the basis of the definitions above, cooperation will prevail among all the stakeholders of United Nations GGIM: Africa. To give an idea of one dimension of this cooperation, United Nations GGIM: Africa should offer a full cooperation relationship with the following ongoing initiatives. It should be kept in mind that cooperation is voluntary, and therefore a potential cooperative institution may choose to stay at the collaboration level. United Nations GGIM: Africa should develop the capacity to handle and be prepared to face such potential reactions.

Mapping Africa for Africa

The Mapping Africa for Africa initiative was launched by ECA, the Government of South Africa, and the International Cartographic Association, and functions to spur the development of geospatial information resources in support of the previous Millennium Development Goals and now the Sustainable Development Goals, Agenda 2063, and the goals of NEPAD. The Catalogue of Fundamental Geospatial Data Sets was produced under the auspices of the MAfA initiative. That study has been recognized as a key step towards the comprehensive mapping of the entire continent, which is the overarching goal of MAfA.

The MAfA initiative attracted significant attention to the value of spatial data infrastructure among African Governments. Much of the attention has focused on efforts to capture or consolidate geospatial information identified in the Catalogue of Fundamental Geospatial Data Sets.

Cooperation with this initiative will, for example, ensure smooth continuity of actions taken under the MAfA project, while allowing United Nations GGIM: Africa to capitalize on the achievements, and learn from the experience acquired in areas such as fundamental data sets development, ISO standards and metadata profile development.

Standards and interoperability

Standards are absolutely necessary for establishing effective geospatial information management initiatives. In particular, the adoption

of standards enables a much broader base of users to apply geospatial information to a wide range of activities. By promoting interoperability, standards catalyse the integration of data from diverse sources, which can multiply the value of the data.

The ISO/TC 211 is a system of standards for digital geospatial information. The system was created to increase the understanding and usage of geographic information; increase the availability, access, integration and sharing of geographic information; promote the efficient, effective and economic use of digital geographic information and associated hardware and software systems; and contribute to a unified approach to addressing global ecological and humanitarian problems.

The Open Geospatial Consortium defines the set of standards for software products and web-based services that use geographic data. As software and web-based mapping applications are increasingly prevalent in Africa, the Consortium certification has become more and more valuable.

Knowing that the foundation of accurate geospatial information starts with a uniform coordinate reference system, ECA is pursuing in partnership with the African Union Commission its efforts to develop the African Geodetic Reference Frame project, which aims at setting up a unified geodetic reference frame for Africa, so that maps and other geospatial information products can be represented on the same datum. AFREF is based on current satellite positioning technologies, and forms the geodetic infrastructure for multinational projects requiring precise georeferencing (for example, three-dimensional and time-dependent positioning, geodynamics, precise navigation, and geospatial information). Like other continental geodetic reference frames, it will be part of the global geodetic infrastructure. In the first instance, it is intended that there should be at least one International GNSS Service station in every country. When completed, it is envisaged that users will not be more than 1,000 km from one such point at any place in Africa, to be eventually densified to reduce that distance

to 500 km or less. When fully implemented, AFREF will be important for various societal benefit areas, namely: climate change, peace and security (border issues), transboundary resources management, economics, etc.

United Nations GGIM: Africa will work in cooperation with the AFREF project. The first working group set up under the initiative is on AFREF. General Assembly Resolution 69/266 of February 2015 reinforces this action and gives it full legitimacy for the whole continent.

Group on Earth Observations, Global Earth Observation System of Systems and AfriGEOSS

The Group on Earth Observations is a voluntary partnership of international institutions, designed to facilitate efforts to use earth observations for decision-making, particularly around issues of environmental quality and human welfare. GEO was created in 2002 following the World Summit on Sustainable Development, held in Johannesburg, South Africa. In 2005, GEO launched a 10-year initiative to create the Global Earth Observation System of Systems, to focus on nine “societal benefit areas”, namely disasters, health, energy, climate, water, weather, ecosystems, agriculture and biodiversity. The GEO 2016-2025 strategic plan further outlines eight societal benefit areas, which are the areas in which earth observations and geospatial information are translated into support for decision-making: biodiversity and ecosystem sustainability; disaster resilience; energy and mineral resources management; food security and sustainable agriculture; infrastructure and transportation management; public health surveillance; sustainable urban development; and water resources management.

In Africa, 27 member States and seven Africa-based participating organizations participate to some degree in GEO and GEOSS activities. Engagement is typically with national ministries of science and technology, rather than with national mapping agencies. The GEO Africa Caucus has recognized in the implementation of GEOSS, the opportunity to consolidate GEO objectives and programmes for Africa’s benefit through the AfriGEOSS initiative. The concept of the AfriGEOSS initiative was fully endorsed by the

ninth plenary meeting of GEO in November 2012, with several GEO members and participating organizations expressing their willingness to provide contributions. The initiative was then officially launched on 5 November 2013 during the joint Africa Geographic Information System 2013 and Global Spatial Data Infrastructure 2014 Global Geospatial Conference in Addis Ababa, Ethiopia. Its implementation plan was adopted by the Africa Caucus in November 2014.

AfriGEOSS is supporting member States to establish GEO national coordination mechanisms, such as has already been put in place in South Africa. These national coordination mechanisms provide an opportunity to explore how engagement at national level can be undertaken to influence the development of national Sustainable Development Goals indicators, with a focus on environmental indicators that take into consideration access to geospatial and earth observations data and information. Indicators based on environmental parameters have been lost in the globally defined Sustainable Development Goals indicators. The use of earth observations and geospatial information in achieving the Goals should also be stressed, and not just monitoring the indicators.

Another advantage of the national coordination mechanism is the sharing of information on existing and planned mapping activities and thereby providing a platform to engage in reducing duplication of effort and proliferation of similar geospatial data and information.

It should also be recognized that the national mapping agencies are not the sole custodians of geospatial data and hence are expected (by United Nations GGIM) to coordinate at national level the use of geospatial data and to engage with the national statistical agencies in support of the Sustainable Development Goals. The GEO national coordination mechanism, strengthens this aspect of the work, as all national relevant entities are represented.

GEOSS has addressed the needs identified in section 4.3 above, through its capacity-building working group, and through efforts to raise the

stature of spatial data infrastructure initiatives within members' Governments.

As highlighted in the sections on geospatial information policy and governance and the common framework and tools, the space sector is key to Africa's future in terms of availability and access to earth observation data. Cooperation with GEO and AfriGEOSS can only boost the achievements in this field, especially through synergy of action between their societal benefit areas and the Sustainable Development Goals and Agenda 2063 driving the present document. The GEO work programme includes an initiative on earth observations in service of the 2030 Agenda for Sustainable Development (available from <http://www.earthobservations.org/activity.php?id=52>). The United Nations GGIM is part of the task team leading the initiative. Pilot countries are being sought to showcase the use of earth observations and geospatial information in achieving the Sustainable Development Goals and also pilot the integration of this information with the statistical data.

Global Spatial Data Infrastructure Association

The Association is a global umbrella organization composed of institutions, agencies, corporations and individuals working to promote the development of spatial data infrastructure. In particular, Global Spatial Data Infrastructure works to promote improved coordination, collaboration, education and scientific decision-making through spatial data infrastructure.

The Association has been a consistent supporter of spatial data infrastructure initiatives on the African continent. Examples include the monthly Spatial Data Infrastructure-Africa Newsletter, the Global Spatial Data Infrastructure Small Grants Programme, and a series of training courses offered in partnership with local organizations (for example, in Swaziland and Lesotho). These activities have directly addressed some of the needs identified under 4.3 above, in particular by providing funding for spatial data infrastructure-related initiatives such as the small grants programme, and by strengthening human capacity.

Cooperation with the Association is key to United Nations-GGIM: Africa as it has been an active player in spatial data infrastructure development on the continent, particularly in networking, related information dissemination, and incentives for spatial data infrastructure components advancement through the small grants programme. Funding agreements may emerge from a well negotiated cooperation profile between the two entities.

In addition, Global Spatial Data Infrastructure is part of the Joint Board of Geospatial Information Societies, which would be an opportunity for United Nations-GGIM: Africa to broaden its partnership horizon and increase win-win cooperation opportunities.

Global Monitoring for Environment and Security in Africa

GMES in Africa is a pan-African initiative and a partnership between the African Union Commission and the European Union. Started in 2015, the GMES initiative in Africa addresses the need for improved environmental monitoring towards sustainable management of natural resources, water resources, and coastal and marine resources in the five subregions of Africa.

The initiative was designed on the basis of the experience gained from previous programmes such as African Monitoring of Environment for Sustainable Development and Monitoring for Environment and Security in Africa, with the objective of providing all African nations with the resources they need to manage their environment more effectively and ensure long-term sustainable development in the region. Most importantly, it aims to improve the lives and prospects of millions of disadvantaged people in Africa currently enduring poverty and hardship and whose livelihoods depend heavily on their environment, thereby contributing to poverty alleviation in this part of the world.

The purpose of the GMES programme is to increase the information management capacity of African regional and national institutions in support of decision makers at different levels and to facilitate sustainable access to Africa-wide

environmental information derived from earth observation technologies.

GMES in Africa extends the operational use of earth observation technologies and meteorological data to environmental and climate monitoring applications. The initiative will enable all African national and regional institutions focusing on the environment and natural resources, as well as the continent's National Meteorological and Hydrological Services, to catch up technologically with their counterparts in Europe, America and Asia, which have benefited from the use of operational space technologies in environmental monitoring for some time. GMES in Africa will generate added-value products and services, based on earth observation data, and put in place regional networks for the dissemination and use of these services at the national level.

Cooperation with GMES in Africa is essential from many viewpoints: it promotes the concept of Global Monitoring for Environment and Security, based on free access to earth observation data for the environment and weather-related security. Also interesting is the notion of readily useable services for particular user groups in the context of geospatial information production and dissemination. These trends and new developments are important to consider from the United Nations GGIM: Africa side, in order to harmonize the policy options the continent is exposed to.

United Nations Platform for Space-based Information for Disaster Management and Emergency Response, UN-SPIDER

The United Nations Office for Outer Space Affairs, as one of its objectives in assisting developing countries in using space technology for development, has been working in awareness-raising and capacity-building in Africa. General Assembly Resolution 61/110 of 14 December 2006, established the United Nations Platform for Space-based Information for Disaster Management and Emergency Response, UN-SPIDER, as a new United Nations programme, with the following mission statement: "Ensure that all countries and international and regional organizations have access to and

develop the capacity to use all types of space-based information to support the full disaster management cycle". Since then UN-SPIDER has been active in disaster risk management.

UN-SPIDER aims to provide universal access to all types of space-based information and services relevant to disaster management by providing a gateway to space information for disaster management support; serving as a bridge to connect the disaster management and space communities; and being a facilitator of capacity-building and institutional strengthening.

The programme provides training opportunities to facilitate the development of knowledge and skills of individuals in the use of space-based data and information for disaster and risk management, and capacity-building for institutions aimed at providing policy-relevant advice to achieve disaster risk reduction by promoting the use of space-based information and applications. UN-SPIDER technical advisory missions are a core element in this context.

In addition to capacity-building, UN-SPIDER conducts awareness and outreach activities at the international and regional levels based on awareness campaigns, outreach workshops and other related activities. and offers technical advisory support at the national level. It also has regional support offices in countries in Africa.

Cooperation with United Nations GGIM: Africa can be seen as an opportunity for the latter to broaden its scope by providing earth observation-based and ground-level geospatial information data for the disaster risk reduction field in Africa, and possibly benefit from some facilities such as the training opportunities to improve the development of knowledge and skills of individuals. Areas of cooperation with mutual benefits to both parties are obvious, not to mention the possibility of tapping into some funding resources for joint activities.

Regional Visualization and Monitoring System, SERVIR-Africa

The Regional Visualization and Monitoring System for environmental management and disaster response was developed in 2005 at the

behest of eight countries of Central America. The SERVIR mission is to “enable the use of earth observations and predictive models for timely decision-making to benefit society”. This mission is accomplished through improved access to satellite data, models, online maps, visualization and decision support tools, as well as training and strategic partnerships. As a result, SERVIR enables scientists, educators, project managers and policy implementers to better respond to a range of issues including disaster management, agricultural development, biodiversity conservation and climate change.

In 2008, NASA and CATHALAC, the Water Centre for the Humid Tropics of Latin America and the Caribbean – another regional operational facility of SERVIR – partnered with the Regional Centre for Mapping of Resources for Development in Kenya to set up an East African office of SERVIR, building upon the existing strengths of RCMD, and augmenting its data management and training capability. The SERVIR-Africa facility will initially focus on establishing a geospatial portal to provide searchable and viewable earth observation data, and improved products to address flood forecasting and Rift Valley fever using unique NASA space-based assets.

On 14 July 2016, USAID and NASA launched a West African branch of SERVIR at the Agriculture, Hydrology and Meteorology Research Centre in Niamey, the Niger. Cooperation in this initiative will be beneficial to both United Nations GGIM: Africa and SERVIR, as their objectives converge and earth observation is their common means of operation. In addition, with two offices now on the continent, this initiative has already accumulated some practical experience of operating in Africa that United Nations GGIM: Africa can tap into.

The list is not exhaustive and other initiatives may have been overlooked or may be imminent, or launched in the coming years. United Nations GGIM: Africa should monitor the development cooperation field continuously, to be able to identify and take advantage of new cooperation opportunities. Needless to say, other stakeholders or subsidiary bodies of United Nations GGIM including global working groups and geospatial information professional

organizations operational in Africa such as EIS-Africa and African Association of Remote Sensing of the Environment, are also potential cooperation partners of the United Nations GGIM: Africa implementation process.

(iv) Suggestions for collaboration

Collaboration, being object-specific and time-bound, should be used on an opportunistic basis by United Nations GGIM: Africa. It is necessary to know beforehand what potential of collaboration exists in terms of institutions and expertise, but in any case baseline studies identified for many sectors of intervention will provide up-to-date information on who to collaborate with, possibly at the national level, but also at subregional and continental levels.

(d) Opportunities and intervention points

The above examples of geospatial information management-related achievements or initiatives show that African countries have acknowledged the importance of geospatial information for sustainable development. They also show that inter-institutional cooperation and synergy of action are key to the real contribution of geospatial information management to sustainable development. In this regard, the African Action Plan opts for building on past achievements and strengthening international cooperation and collaboration around geospatial information management in Africa. A contemporary best practice is to focus on geospatial information management in applications and the importance of “quick wins”. The following are strategy options of interest to the Action Plan:

(i) Use of geospatial information in strategic planning and governance

The South African experience points to the potential for geospatial information to support strategic planning and government decision-making at all levels. Not only does this approach elevate and recognize the crucial role of geospatial information in formulating and implementing policy, but it also provides tools to monitor and evaluate service delivery throughout government.

The major rallying point for national spatial guidelines was that many policies and actions of

Government needed to be better coordinated, and a spatial perspective offered a clear frame of reference. Thus, setting the frame of reference became the fundamental task of national spatial guidelines. Spatial frameworks established a mechanism and principled approach to coordinate and guide policy implementation across government and to provide a common reference point for interpreting spatial realities and the implications for government intervention and private sector activity.

(ii) Mainstreaming geospatial information into broader infrastructures

As an emerging field that has quickly become a valuable asset for planning initiatives, ICT shares a common role and history with geospatial information technology. More importantly, the integration of the two rapidly developing fields can help Governments to improve their services and businesses to increase their competitiveness. Such is the case in Ghana, which mainstreamed its geospatial information policy into its broader ICT policy through the national information and communication infrastructure strategy. The experience has enabled Ghana to take full advantage of ICT and geospatial information technologies. The Ghanaian Government also recognized that partnering with the private sector would facilitate the provision of the requisite investments needed to promote ICT growth in the light of other competing sectors of the economy.

Geospatial information is recognized as a priority area, along with broadband access, cyber security, and the role of ICT technology in climate change and general environmental policy. The result has been ICT and geospatial information policy that promotes economic development, but through a people-centred, inclusive framework, focusing for example on:

- human capacity-building
- improving access to technical training in education
- promoting electronic government and governance

- adoption of ICT and geospatial information technologies in the agricultural sector
- application of these technologies in health programmes

This policy framework is a new approach, and a promising model for the integration of geospatial information in governance. Additionally, incorporating geospatial information policy into broader ICT, which is often well funded, could provide the necessary funding to see national spatial data infrastructure have a firm financial foundation and receive prioritization from Government.

(iii) Application of geospatial information for monitoring development goals

In many countries, spatial data infrastructure projects help in developing a framework for broader and more effective use of spatial data and geographic information systems to monitor progress in achieving development goals. Building a national spatial data infrastructure is seen as important as it will help establish standards for collecting, maintaining and sharing geographic information, which in turn would increase efficiencies in government processes and promote innovation to support economic growth and sustainable development.

(iv) Synergy of action

Geospatial information management is by nature a multi-stakeholder responsibility, as described in section 4.b above. As a multi-stakeholder endeavour, geospatial information management can only succeed with close cooperation between the actors, in order to get the most efficient form of contribution from each partner. In this regard, it is not only essential that the technical capacity or scientific expertise of partner institutions is used as a resource base, and the funding potential of donor institutions and beneficiary member States is utilized, but it is also highly advisable that their respective inputs be coordinated, following a commonly agreed form of strategy and organization.

Besides the organizational structure of United Nations GGIM as an entity and the legal instruments guiding the operations of its Africa

initiative, in all the focus areas set out in this African Action Plan, synergy of action should be applied as a rule of thumb. To achieve this, openness and constant communication among the stakeholders through their respective representatives in the coordination meetings is critical during the action planning phase (in order to avoid duplication of efforts and resources, or redundancy and gaps coexisting in the same planned action), during implementation (to monitor performance and readjust short-term activities where necessary), and at the evaluation stage (to learn from the experience and evaluate the accuracy and realism of the defined targets and associated indicators).

Opportunity should be given to all partners to share their views and opinions, so that the resulting decisions are consensus-based. Therefore, planned actions, ongoing projects, and programmes directly or indirectly related to the objectives of Geospatial Information for Sustainable Development should be made known and their potential impact taken into account in fixing the targets and developing the strategies. In particular, donor preferences should be softened – ideally removed – through non-ear-marked contributions to the global budget of the African Action Plan. Finally, the needs of beneficiary member States should guide decision-making where low motivation may exist due to discrepancies between donor orientation and United Nations GGIM: Africa priority options and strategies.

(e) Summary of goal, objectives and results for international coordination, cooperation and collaboration in meeting regional and global needs in the period 2016-2030

Goal

To apply the most efficient management rules in terms of international coordination, cooperation and collaboration for the operation of United Nations GGIM: Africa.

Strategic objective and key expected result

SO 4.1 United Nations GGIM: Africa operations are based on United Nations project and programme management rules;

R 4.1.1 United Nations GGIM: Africa stakeholders understand and comply with the rules of its management;

R 4.1.2 The United Nations monitoring and evaluation mechanism is built into the United Nations GGIM: Africa management process.

4.5 Integration of geospatial information and statistics

(a) Introduction

This section of the African Action Plan sets out a specific area of action in line with the coordination, collaboration and cooperation initiatives introduced in section 4.4 above. It deals with a new activity identified as critical for Geospatial Information for Sustainable Development in Africa, and it is therefore a more developed formulation, well suited to the overarching goal of sustainable development and the attainment of the Sustainable Development Goals and Agenda 2063 targets, through integrated statistical and geospatial information data and the development of geospatial information-based decision support tools offering fit-for-purpose information products and services.

Over the years, there has been an exponential growth in the availability of detailed geospatial data and, more recently, in the interest and ability of Governments, businesses and the public to make practical use of the data upsurge. This had led to a focus on spatial data infrastructure, underpinned by data and metadata standards, at the national and transnational levels. Statistical agencies at the national and international levels are increasingly interested in opportunities to define and promote interoperability between statistical and spatial data infrastructure. It is noticeable that over the years the key element in promoting interoperability has become the promotion of better understanding, documentation and application of the relationships between relevant frameworks and standards related to statistical and spatial information (data and metadata).

With regard to openness and cross-sector interaction and cooperation, ECA was a pioneer and visionary in Africa. This can be illustrated

by the decision to convene every two years an international conference in Africa for Africa, bringing together experts, decision makers and policy-level actors from the ICT domain, the geospatial information sphere and the statistics sector, under the Committee on Development Information⁵ (CODI) initiative. Since the first meeting of the Committee in 1999, policy issues and strategies pertaining to the economic development of member States in Africa have been discussed, based on an intelligent coordination of efforts in these three sectors, and resolutions have been adopted for action to be taken on the various issues identified and their solutions. In 2005, a study was undertaken by ECA on the integration of the spatial data infrastructure development process into national information and communication infrastructure policies. The integration of geospatial information and statistics was the missing link in the development information chain. Efforts to ensure the integration of these two areas can only optimize the impact of the United Nations GGIM: Africa initiative on the sustainable development of the continent. However, this global picture should not overshadow initiatives under way in the field in Africa, in particular Rwanda's best practice policy (use of geospatial technology for the country 4th Population and Housing Census that was conducted in August 2012) and the ongoing project launched by United Nations GGIM: Africa in Kenya and Namibia to generate spatially enabled population census data.

(b) Rationale: Need for integrating statistical and geospatial information

The integration of statistical and geospatial information in the implementation of the Action Plan will benefit member States through the provision of services for the attainment of internationally and nationally agreed developmental goals. Geospatial information is a useful tool in many different areas of statistics, including population census, social and demographic statistics (health, justice, education, and labour), economic statistics (business surveys, trade, transport, tourism, agriculture, etc.) and environmental statistics.

Geospatial information is relevant in all the different phases of statistical production and is useful in cross-sectoral and inter-agency projects as well. The value of geospatial data in statistics is not surprising, because most data types (variables) studied by statisticians have a spatial component, and statisticians are uniquely aware of how boundary conditions can affect sampling and therefore their results.

At the national, local, subregional and continental levels of governance, statistical data are very important as sources of evidence-based decision-making. However, geospatial information has the ability to enhance and expand this, and to transform the richness of a flat statistical table into visually expressive – and often impressive – fit-for-purpose information for development.

From the geospatial information perspective, statistical techniques are very important as a means to solve issues or provide solutions to methodological problems, as in digital image processing and interpretation of classification results using stochastic rules. In the design of geospatial information solutions, sampling techniques allow geospatial information experts to classify, for example, member States, states within a federation, regions and communities, road networks, protected areas, etc. according to criteria prone to statistical reasoning.

Fuzzy logic applied to accuracy representation allows visualization of the quality of data used to map a specific theme, and therefore shows areas where decisions can be taken with full certainty, and others where the level of error due to the relative accuracy of the entry data has to be taken into account. These few examples show the natural interaction between geospatial information and statistics, and the need to strive for concerted action to deliver information products and services bearing advantages and benefits from both sides.

The emergence of inexpensive computing power, expanding network bandwidth and sophisticated component-based software can potentially

⁵ After the fourth meeting of CODI, held in April 2005 in Addis-Ababa, the name of the Committee was changed to CODIST to include Science and Technology. Three meetings were organized under the new acronym, in 2009, 2011 and 2013, before the advent of Global Geospatial Information Management.

offer statisticians and geospatial information practitioners extraordinary opportunities for collecting, analysing, and presenting statistical data from a spatial perspective, thus increasing the use of statistical data in geospatial information-based tools, and delivering added-value products and services.

And yet, in the past, there has been a limited number of statistical applications that integrate geospatial components and equally, geospatial information applications use little or no statistical applications. These limitations have led to:

- lack of discoverable and available data
- different processing approaches
- different standards, formats and data dictionaries
- different quality levels
- lack of a common geospatial referencing framework
- lack of consistent metadata and data quality and heritage information

Within the two communities there has been diversity in data policy and its interpretation, in data specification, in pricing and access rules, and in private-public sector relationships. This has also inhibited wider use of spatial data, and limited the use of statistical data in spatial analyses.

Nowadays, the common benefits of integrating geospatial information and statistical information for smarter solutions in sustainable development justify the initiative to engage the two communities in collaborative work towards the production of standardized spatially-enabled statistical data sets.

(c) Status of geospatial and statistical information integration in Africa

Globally, the use of frameworks has been restricted to national spatial data infrastructures and a limited number of country-specific statistical spatial frameworks. Enumeration geography has

been the main method used to geocode statistical unit record data (i.e. data relating to individual persons, households, dwellings, businesses or buildings); however, this method is a very traditional method and can limit the usefulness of the data release by merging enumeration and dissemination geographies together. National registers are the next most popular method of geocoding, followed by related address coding. These methods provide highly accurate and flexible geocodes by producing location coordinates and small area geographic codes. Direct capture using GPS, or similar technologies, is being increasingly used in the field, especially in Africa, which seems to be leapfrogging older techniques. The majority of countries use regional government administrative boundaries as the primary geography to disseminate and disaggregate statistics. These meet key client needs but are subject to change, which can affect time series comparisons. Other geography types being used alongside these administrative geographies include: enumeration geographies – linked to the geocoding approach mentioned above; function-based statistical geographies – to define urban, rural and remote areas; postal geographies; and grid-based geographies – growing in popularity in Europe as a means of providing small area geography.

In Africa, initiatives such as the LandScan global population project (showing population distribution by daytime and night-time) influenced the grid approach to population distribution representation. However, the most common application of statistical information with the spatial dimension remains the use of the early basic principle explained in 4. (ii) below. Poverty mapping at the beginning of the new millennium also had an impact on the introduction or use of geospatial information in statistical data production by a number of national statistics offices in Africa. In 2005, a study carried out by ECA revealed that, of the total number of 28 African countries taking part in the survey, 18 member States, representing 67 per cent of the participating countries, used the geographic information system in their national statistics office. Eight others (29 per cent) were planning, at that time, to introduce the geographic information system into their activities, on

average within a two-year time period. The national registers approach was promoted recently by the publication, in 2014, by the African Development Bank (AfDB) of guidelines for building statistical business registers. This is an indication of a widespread need for this approach in Africa, but the guidelines did not consider associating the spatial dimension with the process.

The 2011 population census in Namibia was used to develop an atlas designed to complement and enrich the figures and statistics using the geographic information system. Rwanda won the Geospatial World Excellence Award 2014 for its successful fourth population and housing census, conducted in August 2012 using geospatial information-based tools. The United Nations GGIM: Africa Working Group 5 on Integration of Geospatial and Statistical Information for Sectoral Applications also recently launched a project related to population census in Kenya and Namibia.

The examples are not exhaustive but they show the existence of an integration momentum, still predominantly at the stage of post-production linkage between geospatial and statistical information in Africa. It is therefore time to turn this momentum into a formal and systematic process for the best of sustainable development on the continent.

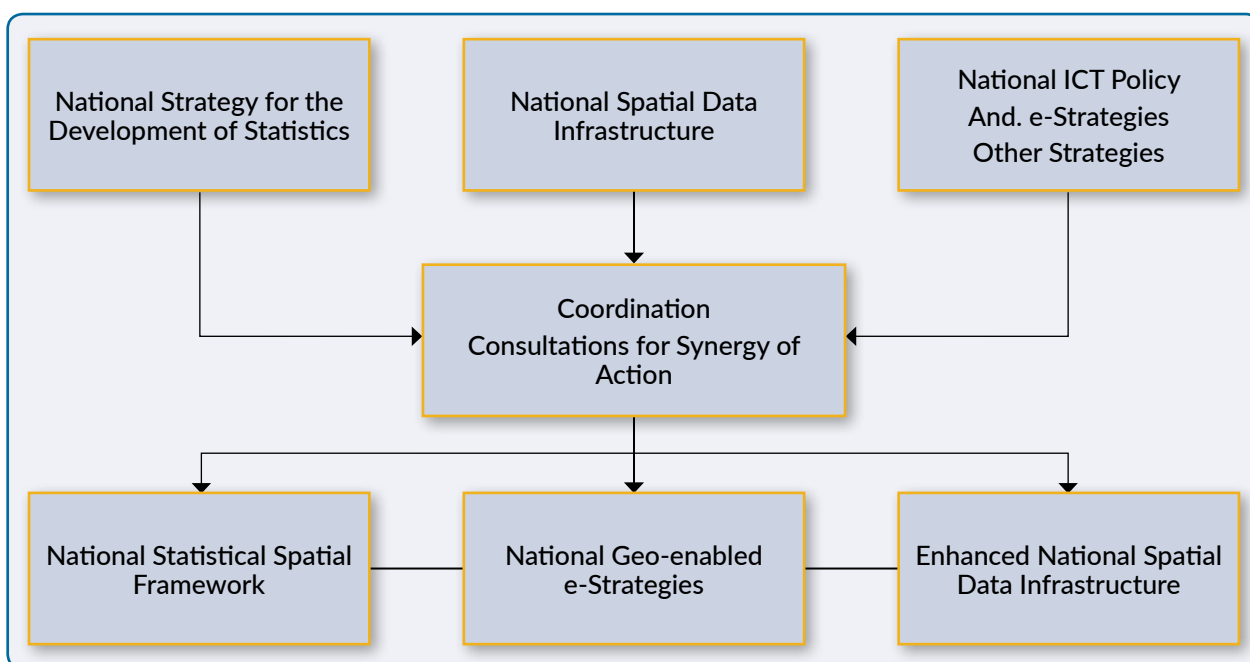
(d) Basis for integration of geospatial and statistical information in Africa

(i) Conceptual framework of integration at national level

The conceptual framework above for national level geospatial and statistical information integration shows in the first row the existing initiatives in most African countries in the three key areas of development information, as defined by the Africa Information Society Initiative. The level of development of each strategy varies from country to country, nevertheless the strategies constitute a basis rooted in each member State's development agenda for the provision of fit-for-purpose information for development.

The diagram also shows the possible and desirable connection between the three types of strategies at the country level that can enhance their contribution to a more productive and efficient effort towards the attainment of the Sustainable Development Goals and Agenda 2063 targets.

The national statistical spatial framework features in this conceptual vision of the future as the result of national-level efforts to build synergies of action between the national strategies for the development of statistics, national ICT policies and the information and communication infrastructure, and the national



spatial data infrastructures. It provides a way of enhancing the output of each strategy in the sustainable development domain, and should guide the development and dissemination of national statistical spatial frameworks in member States and their extension to the higher level of regional economic communities and Africa as a region.

(ii) Basic principle

As an introduction to the issue of geospatial and statistical information integration, the following basic principle helps to explain the process and guide its development.

In a vector-based geographic information system environment, just as a surrogate key enables tables to be linked and structured query language-based requests to be performed using chosen criteria in a relational database management system, so also a spatial code captured in a statistical table allows that table, or the result of a request involving that table, to be linked to the tabular data of a spatial database. This process not only enables visualization of the spatial distribution of the variable being analysed, but also shows the range of values the same variable takes for each linked spatial entity using a colour code scale, resulting in the capacity to visually compare the state of that variable in each geographic unit on the output map.

(iii) Dimensions of the integration

Strict application of this basic principle would be very restrictive in terms of practical applicability. Indeed, the type of basic analyses taken above as an example can only be widely used if all requests are performed in the same environment of relational database and vector data model. In real life, there is a variety of database models and spatial data models. Therefore, it is necessary to take into account all dimensions related to the possible interactions between geospatial information and statistics and to build by abstraction a generic integration model applicable irrespective of the type of technological environment prevailing. The successful integration of geospatial and statistical information requires consideration of the following dimensions: scale, policy, institutional arrangements, and modelling:

Scale

By scale we mean the scope of the geographic space in which the integration is to take place. The scale of geospatial and statistical information integration begins with the national level, including a downstream flow driven by the needs at subnational levels (state, region, districts, etc.). The upstream direction, through aggregation at data level and harmonization at policy level, will meet higher dimension needs of regional economic communities and Africa as a region. At each key position on the scale axis (national or subnational, subregional and regional) the other three dimensional elements (policy, institutional arrangements and modelling) have to be present or developed.

Policy

The policy dimension is what is necessary at all levels on the scale axis to initiate and harmonize the strategies and related regulations in order to smoothly achieve full integration. It will start at the national level as demand-driven, but will take into account regional economic community and continental level constraints. The national geospatial information policy on one hand, and the data policy sustaining the national strategy for the development of statistics on the other hand, will have to be critically reviewed and made compatible.

Institutional arrangements

This dimension has to do with the institutional arrangements necessary to achieve real integration, in accordance with the orientation of the two compatible policies (statistics and geospatial information). It starts at the national scale, and entails interaction between the geospatial information and statistics communities and their leadership, but also the involvement of institutional stakeholders from other sectors of the national economy. The same inclusive approach to agreeing on sustainable institutional arrangements applies to the regional economic communities and Africa as a whole.

Modelling

The modelling dimension is the component of the integration process dealing with the technical, technological and scientific abstraction and the related functional and procedural

interactions. The United Nations Expert Group on the Integration of Statistical and Geospatial Information has already developed a Global Statistical Geospatial Framework that responds to the modelling dimension of the integration. The framework is based on the following five layers, from bottom to top: (1) use of fundamental geospatial infrastructure and geocoding; (2) geocoded unit record data in a data management environment; (3) common geographies for dissemination of statistics; (4) interoperable data and metadata standards; (5) accessible and usable. The national model that will be derived from this global framework will be a National Statistical Spatial Framework to be adopted and adapted to each country's local conditions.

These four dimensions will generate a new field in the national landscape with implications for the financial and human resources of member States, regional economic communities and Africa as a region.

(iv) Adaptation of the Global Statistical Geospatial Framework to Africa

Global interoperability efforts

The Open Geospatial Consortium, a global consortium of geoprocessing technology providers and users, has made important progress towards interoperability between geoprocessing systems, employing practical test beds and a consensus specification development process to arrive at open specifications for standard interfaces and protocols that can be used by IT suppliers for particular information communities. Simultaneously, data coordination efforts worldwide have made progress towards semantic interoperability based on standard data dictionaries, metadata profiles and geospatial data modelling schemas. All this progress, when viewed together, benefits statisticians who seek to assimilate geospatial processing and geospatial data into their work. It is noticeable that the main obstacles to data integration are not technical but managerial, organizational and institutional. However, it will be seen that advances in technology do not merely support managerial, organizational and institutional progress – they force it.

Fundamental data sets or spatial framework data (or core datasets) are a limited set of data layers – transportation, hydrography, cadastral and administrative boundaries, elevation, human settlements, digital imagery, geodetic control, etc. – which provide a base on which to collect, register, integrate and analyse statistical data. Fundamental data sets are meant to be publicly available, maintained for the common good, useful for many purposes, and each likely to comprise at least a subset of that data layer, for any particular information community. The ISO TC 211 metadata standard (ISO/CD 19115 Geographic Information – Metadata standard currently in a committee draft version) provides common schemas for describing these fundamental data sets, and ISO/CD 19107 Geographic Information – Spatial Schema, provides standard definitions of the geometric and topological characteristics of geospatial data, which can assist statisticians in their quest to produce reliable data for viable policy decision-making.

National Statistical Spatial Framework

From the Global Statistical Geospatial Framework – under discussion as the present Action Plan is being consolidated – a national framework will be derived for application in Africa. The resulting National Statistical Spatial Framework is the integration model that will be promoted, adopted and adapted to each member State's national environment and realities.

Efforts are under way to design and refine the National Statistical Spatial Framework under the auspices of the United Nations, including the Global Geospatial Information Management initiative. The Australian Bureau of Statistics has published findings on developing a statistical-spatial framework in national statistical systems and their achievement in the endeavour motivated the United Nations in 2013, through the United Nations Statistical Commission and the United Nations Committee of Experts on Global Geospatial Information Management, both to consider a programme review and recommendations to develop better linkages between geospatial and statistical communities, and to develop a global statistical-geospatial framework based on the Australian Statistical Spatial Framework. Both United Nations bodies

agreed to establish a United Nations group of experts and conduct an international discussion to pursue these aims.

In the African context, a major drawback of the current approaches in developing a national strategy for the development of statistics and a national spatial data infrastructure is that they are not linked to other initiatives related to other aspects of development information, despite the efforts invested by ECA under the CODIST initiative. In keeping with global trends in bringing geography and statistics together, the continent should pursue the necessary dialogue initiated by ECA and develop member States' capacities so as to ensure that national statistical, planning and mapping authorities collaborate effectively in the development of their respective data infrastructures and systems.

A national strategy for the development of statistics is a strategic approach that aims to bring together various stakeholders within a given national statistical system so as to strengthen coordination between the different data users and producers.

The national spatial data infrastructure enables information providers and users to participate in the growing (digital) spatial community at the national level. The NSDIs establish a connection for all users in the world to share and reuse the available data sets.

The national spatial data infrastructure and national strategies for the development of statistics have over the years been implemented separately by African countries, though all aimed at quality production of spatial and statistical data. Equally, these processes are being conducted without a framework and a statistical spatial framework is needed to link these and other efforts.

To this end, the strategy for integration of statistical and geospatial information consists of facilitating the establishment and implementation of the national statistical spatial frameworks – geared to the national spatial data infrastructure, national information and communication infrastructure and e-strategies agendas – in order

to bring about the integration of geospatial and statistical information, with the support of the ICT substratum and facilities and aimed at facilitating the attainment of the Sustainable Development Goals and other development goals in Africa, in particular Agenda 2063, through:

- 1) Advocacy for linking the development of national statistical spatial frameworks to the national spatial data infrastructure, ICT policy, national information and communication infrastructure, and e-strategies processes, to feed the various development agendas at national and subnational levels;
- 2) Facilitating policy dialogue between the development actors of national spatial data infrastructures, national information and communication infrastructures, e-strategies and national strategies for the development of statistics, with a view to raising awareness of the importance of addressing challenges that hamper the appropriate utilization of geospatial enabled statistics;
- 3) Coordinating and galvanizing the efforts of partners towards effective synergies and partnerships for the implementation of the national statistical spatial frameworks through coordination efforts with the above mentioned strategies;
- 4) Facilitating capacity-building at all levels in support of the development and implementation of national statistical spatial frameworks in Africa;
- 5) Promoting networking and knowledge sharing at all levels in order to promote the formulation and implementation of evidence-based national statistical spatial frameworks;
- 6) Developing and building capacity for monitoring and evaluation tools and systems in support of national statistical spatial frameworks policy development and implementation, in harmony with the other strategies mentioned above;
- 7) Providing technical support and advisory services to regional economic communities

and member States on development and implementation of national statistical spatial frameworks;

- 8) Facilitating resource mobilization in support of national statistical spatial frameworks-related research, advocacy, capacity-building, technical support and advisory services.

(e) Summary of strategic objectives and key expected results for the integration of geospatial and statistical information

The integration process will be based on the following strategic objectives and expected results:

SO 5.1 Action is taken to design a National Statistical Spatial Framework for the integration of geospatial and statistical information in Africa;

R 5.1.1 Africa, through United Nations-GGIM: Africa Working Group 5 on Integration of Geospatial and Statistical Information for Sectoral Applications, is fully involved in the NSSF design and development process;

R 5.1.2 The National Statistical Spatial Framework is widely discussed, separately and jointly, and then validated by the African geospatial information and statistics communities and adopted and endorsed by the appropriate policy level organ.

SO 5.2 Strong advocacy action is taken to ensure policy-level engagement and user commitment to employ the National Statistical Spatial Framework in Africa member States and the regional economic communities;

R 5.2.1 The majority of African Governments support the National Statistical Spatial Framework and adopt it for application in their Sustainable Development Goals and Agenda 2063 activities;

R 5.2.2 The National Statistical Spatial Framework is adopted in the regional economic communities for their regional activities related to the Sustainable Development Goals and Agenda 2063.

SO 5.3 Action is taken to ensure preparedness for the National Statistical Spatial Framework at United Nations-GGIM: Africa secretariat, member States, and partner levels;

R 5.3.1: The capacity of the National Statistical Spatial Framework secretariat is enhanced to facilitate the establishment and implementation of the framework;

R 5.3.2: Mainstreaming of the National Statistical Spatial Framework into the African sustainable development agenda is successfully carried out;

R 5.3.3: Synergies and coordination are enhanced, and resources mobilized in support of the National Statistical Spatial Framework.

SO 5.4: Action is taken to ensure effective implementation of the National Statistical Spatial Framework at the national, subregional and regional levels in Africa;

R 5.4.1: Knowledge generation and dissemination are enhanced to raise awareness and build evidence-based NSSF tools, products and services;

R 5.4.2 Capacity and skills are enhanced in support of NSSF policy development and implementation in Africa;

R 5.4.3 Coordination and harmonization are sought for the implementation of the African Statistical Spatial Framework with the Strategy for the Harmonization of Statistics in Africa and the United Nations Group of Experts on the Integration of Geospatial and Statistical Information

SO 5.5: Technological tools are designed and widely used to foster statistical spatial framework application in Africa;

R 5.5.1 Knowledge management tools are developed and their use popularized to facilitate evidence-based NSSF policymaking and implementation;

R 5.5.2 Monitoring and evaluation are enhanced in support of NSSF

formulation and implementation in Africa.

Details are provided in the consolidated logical framework (see section 4.6).

4.6 Logical framework

The following is the consolidated logical framework of the African Action Plan on Global Geospatial Information Management:

Table 1: Consolidated logical framework of the African Action Plan on Global Geospatial Information Management – strategic objective 1

Strategic objectives and expected results	Organization	Duration	Estimated cost (United States dollars\$)
SO 1.1 Geospatial information management is adopted as a critical development enabler by member States in Africa	ECA, AUC, REC, member States	2 years	900 000
R 1.1.1 <i>Publication of a position paper on how geospatial information can boost the attainment of the 17 Sustainable Development Goals in Africa, and the seven aspirations and 15 objectives of the African Union Agenda 2063.</i>			
Related activities include position paper production, review by United Nations GGIM: Africa Working Groups and adoption by United Nations GGIM: Africa Forum.			
R 1.1.2 <i>Strong advocacy action is taken throughout Africa using the position paper to achieve policy level engagement of African Governments in adopting geospatial information as a critical enabler for the sustainable development of the continent.</i>			
Activities include national and subregional (REC) level policy engagement forums, and production and dissemination of excerpts from the position paper on typical examples of application to selected Sustainable Development Goals and Agenda 2063 objectives.			
SO 1.2 A specific geospatial information policy is in force in every member State and every REC in Africa, under the special data infrastructure agenda for sustainable development.	ECA, RECs, member States, African Union	5 years	1 250 000
R 1.2.1 <i>A comprehensive study on the state of national geospatial information policy development and REC level geospatial information policy availability serves as the baseline for policy action planning in Africa.</i>			
Activities (\$625,000) include selection of five experts working in parallel on the study in the subregions, and also covering member States. the validation of their work during subregional workshops in RECs, and the production of a synthesis baseline for Africa as a region.			
R 1.2.2 <i>Needy member States and RECs are assisted in the development of their respective geospatial information policies.</i>			
Activities include the formulation (\$175,000) of a geospatial information policy development project for Africa using the baseline study results, the selection of experts for the concerned countries and RECs, and the parallel production, review and validation of draft national and REC level policies, followed by their endorsement at the appropriate levels.			
R 1.2.3 <i>The development of national space programmes in Africa is guided by and harmonized with the African Space Policy and Strategy</i>			
Related activities include consultation with Africa Member States to raise awareness of the Africa Space Policy and the Africa Space Strategy, consolidate and promote the ARMS constellation and initiate other space-related activities for the sustainable development of the continent.			
R 1.2.4 <i>Geospatial information policy directives are disseminated in order to mainstream attainment of the Sustainable Development Goals and Agenda 2063 and statistical geospatial information integration processes into the geospatial information policies of member States and regional economic communities.</i>			
To achieve this result, activities under specific projects will be carried out (\$450,000):			
<ul style="list-style-type: none"> • to develop policy directives aimed at harmonizing geospatial information policies within individual RECs and among RECs; mainstreaming Sustainable Development Goals and Agenda 2063 targets, and the geospatial and statistical information integration process into member States and REC level geospatial information policies • to disseminate the policy directives • to assist member States and RECs in the implementation of the policy directives. 			
SO 1.3 Africa member States take policy action to ensure integration of geospatial and statistical information.	ECA, RECs, member States	2 years	940 000
R 1.3.1 <i>Policy guidance is issued to engage Africa member States and RECs in a policy dialogue involving the geospatial information and the statistics communities</i>			
Activities required are the formulation of policy guidance, followed by the opening of consultations within member States and RECs between the geospatial information and statistics communities on the application of NSSF once designed and adapted.			
R 1.3.2 <i>A policy approach is adopted by RECs and Africa member States to jointly develop the information products and services needed for the attainment of the Sustainable Development Goals and Agenda 2063 targets.</i>			
To achieve this result, it will be necessary to assist Africa member States and RECs through workshops with the formulation of internal resolutions and road maps for geospatial information experts and statisticians to work jointly to develop the products and services required for the attainment of the Sustainable Development Goals and Agenda 2063 targets.			
Total for geospatial information Governance and Policy component	3 090 000		

Table 2: Consolidated logical framework of the African Action Plan on Global Geospatial Information Management – strategic objective 2

Strategic objectives and expected results	Organization	Duration	Estimated cost (United States dollars)
SO 2.1 Africa member States take action to use geospatial information for the attainment of the Sustainable Development Goals and Agenda 2063 targets.	ECA/RECs/member States	3 years	5 825 000
R 2.1.1 <i>National Goals and targets are used to design related, geospatial information-based added-value information products and services.</i>			
Related activities are assistance to member States with three-day national workshops to define and design added-value information products and services, followed by provision of technical resources and development of capacities to enable national institutions to deliver the relevant products and services.			
R 2.1.2 <i>National sets of Goals and targets-related added-value information products and services are aggregated into subregional sets for the RECs, and the latter aggregated into sets for Africa as a region.</i>			
Activities include assistance to RECs with the design of REC-level sets of aggregated added-value information products and services for attainment of the Goals and Agenda 2063 targets, followed by the organization of five subregional three-day workshops to adopt these REC level sets, and the design of a set of continental-level aggregated products and services, to be adopted during a three-day workshop, followed by the training of experts to deliver them.			
SO 2.2 A high-quality ground-level infrastructure is strengthened for sound geospatial information production in Africa.	ECA, AFREF, RECs, member States	18 months	6 693 000
R2.2.1 <i>National and regional geodetic infrastructure is further developed with CORS networks and other GNSS-based techniques, in compliance with General Assembly Resolution 69/266 on the Global Geodetic Reference Frame.</i>			
Activities include an AFREF-led inventory of already established CORS in every country; the design of regional CORS networks to optimize the design of national networks and to guide the second administrative levels in locating CORS in their jurisdictions; the development of other GNSS-based techniques (e.g. accurate height determination).			
R2.2.2 <i>Support is provided to ground-level infrastructure.</i>			
Activities include encouraging regional use of regionally owned communication satellites with appreciable increase in the density and bandwidth of Internet services; installing earth observation data receiving and dissemination facilities in five regional centres and national capacity-building institutions; and use of alternative energy sources in Africa, especially solar energy for continuous electricity supply to geospatial information facilities.			
SO 2.3 Fundamental data sets, metadata and geospatial standards are developed and geoportals set up for geospatial information management in Africa.	ECA, WG2, RECs, member States	3 years	119 478 000
R 2.3.1 <i>Fundamental data sets are produced for Africa with the support of Working Group 2 on fundamental data sets and standards</i>			
Related activities include updating the inventory of the status of all 10 fundamental data sets and the street address catalogue at the minimum; converting existing analogue fundamental data sets to digital form; completing the “Guidelines of Best Practice for the Acquisition, Storage, Maintenance and Dissemination of Fundamental Geospatial Data Sets”; filling the gaps of fundamental data sets where necessary; disseminating existing satellite image metadata from the continent’s space faring nations; producing seamless, uniform, orthorectified, 2.5 m natural colour, continental coverage using regionally-owned images.			
R 2.3.2 <i>Metadata and geospatial standards in Africa are disseminated on geoportals.</i>			
Activities include a \$18,360,000 project consisting of publication of an implementation guide for the Africa regional metadata profile; carrying out an inventory, review and evaluation of existing national geospatial standards; preparing national and subregional standard profiles for all fundamental data sets and components of geospatial standards; developing standardized geographical names in collaboration with UNGEGN and establishing geographical names authorities in member States where none exist; developing ECA-GISS geoportal and WMS and WFS capability using FOSS; assisting RECs and Africa member States to develop their geoportals.			
SO 2.4 The private sector is involved in the United Nations GGIM: Africa agenda and funding mobilized	ECA, RECs, member States AUC	3 years	90 000
R 2.4.1 <i>Public-private partnership is enabled for geospatial information management in Africa</i>			
Activities include PPP building in the production and management of geospatial information at country, REC and continental levels.			
R 2.4.2 <i>New scientific and technological opportunities are used for better geospatial information management in Africa.</i>			
Activities include monitoring by ECA of new trends and innovations in fields related to geospatial information, and keeping member States and RECs updated.			
Total budget for Common Framework and Tools	132 086 000		

Table 3: Consolidated logical framework of the African Action Plan on Global Geospatial Information Management – strategic objective 3

Strategic objectives and expected results	Organization	Duration	Estimated cost (United States dollars)
SO 3.1 Institutional capacity in geospatial information management is developed in Africa			13 430 000
<i>R 3.1.1 Accurate and comprehensive knowledge of the state of Africa's geospatial information management capacity for Sustainable Development Goals and Agenda 2063 production is available to support the demand-driven capacity development planning for the African Action Plan</i>			
A series of activities are related to this expected result. They include carrying out a comprehensive study on national-level institutional geospatial information capacity, and building subnational level awareness of value of geospatial information in creating an enabling environment for attainment of Goals and Agenda 2063, etc.			
<i>R 3.1.2 Targeted actions are taken to enable Sustainable Development Goals and Agenda 2063-oriented capacity development at institutional levels in member States in Africa.</i>			
Activities include retraining and retaining cadres, and building NMA capacity to support SDI, AFREF, ISO TC 211 standards, etc. building and strengthening formal NSDIs, building partnership between NMAs and NSOs to ensure preparedness for NSSF; ECA and RECs build preparedness for SSF-compliant added-value information products and services delivery.			
<i>R 3.1.3 Targeted actions are taken to strengthen earth observation capacity in Africa and consolidate the technological capacity of ECA.</i>			
Related activities include supporting the satisfaction of African Space Policy and Strategy implementation needs through capacity strengthening.			
<i>R 3.1.4 Targeted actions are taken to improve university and high school curricula.</i>			
Activities include building ministries of education, geospatial information curricula and technical capacity (laboratories), supporting the Pan-African University with a geospatial information content, etc.			
SO 3.2 Infrastructural capacity in geospatial information management is built in Africa	ECA, RECs, member States	2 years	180 000
<i>R 3.2.1 A series of national-level comprehensive studies are carried out on key components of the special data infrastructure.</i>			
Related activities include comprehensive national studies on infrastructural capacity and on related ICT infrastructure.			
SO 3.3 Individual capacity in geospatial information management is built in Africa ECA, RECs, member States, Pan-African University		5 years	490 000
<i>R 3.3.1 Actions are taken to build African indigenous capacity and retain skills.</i>			
Activities include a comprehensive study on individual geospatial information capacity in Africa, introduction of GIS and space science in high school curricula, internship and fellowship programmes in geospatial science and technology, geospatial information accreditation and certification for professionals, web-based open geospatial information platforms.			
Total budget for Capacity Development and Knowledge Transfer			14 100 000

Table 4: Consolidated logical framework of the African Action Plan on Global Geospatial Information Management – strategic objective 4

Strategic objectives and expected results	Organization	Duration	Estimated cost (United States dollars)
SO 4.1 United Nations GGIM: Africa operations are based on United Nations project and programme management rules.	ECA, member States, RECs, United Nations GGIM secretariat	6 months	90 000
R 4.1.1 <i>United Nations GGIM: Africa stakeholders understand and comply with the rules of its management.</i>			
Activities include incorporation and submission of United Nations administrative and financial rules of procedure to cooperation and collaboration partners during entry into agreement.			
R 4.1.2 <i>The United Nations monitoring and evaluation mechanism is built into United Nations GGIM: Africa management process.</i>			
Activities include application of United Nations monitoring and evaluation mechanism to operations of United Nations GGIM: Africa			
Total budget for International Coordination, Collaboration and Cooperation in Meeting Regional and Global Needs			90 000

Table 5: Consolidated logical framework of the African Action Plan on Global Geospatial Information Management – strategic objective 5

Strategic objectives and expected results	Organization	Duration	Estimated cost (United States dollars\$)
SO 5.1 Action is taken to design a National Statistical Spatial Framework for the integration of geospatial and statistical information in Africa.	ECA, UN EG-ISGI, WG5, WG2, RECs, member States, AUC	3 years	400 000
R 5.1.1 <i>Africa, through United Nations GGIM: Africa Working Group 5 on Integration of Geospatial and Statistical Information for Sectoral Applications, is fully involved in the NSSF design and development process.</i>			
Related activities include: WG55, assisted by WG2 on Institutional Arrangements and Legal Frameworks will contribute to the NSSF design and development process (based on Africa's own experience in successful integration processes e.g. in Rwanda) and report regularly to United Nations GGIM: Africa; it will liaise with the United Nations expert group and take part in technical meetings to ensure that NSSF is adapted to African realities and meets African needs.			
R 5.1.2 <i>NSSF is widely discussed, separately and jointly, and then validated by the African geospatial information and statistics communities and adopted endorsed by the appropriate policy level organ.</i>			
Related activities will consist of broad user engagement and consultations, with REC-level workshops and an Africa-wide forum to validate the Framework, followed by its formal adoption and endorsement at policy level.			
SO 5.2 Strong advocacy action is taken to ensure policy-level engagement and user commitment to employ the NSSF in Africa member States, and the RECs.	ECA, RECs, member States	1 year	120 000
R 5.2.1 <i>The majority of African Governments support NSSF and adopt it for application in their Sustainable Development Goals and Agenda 2063 activities.</i>			
Related activities will focus on country level workshops to inform, raise awareness and launch the use of NSSF.			
R 5.2.2 <i>NSSF is adopted in the RECs for their regional activities related to the Sustainable Development Goals and Agenda 2063.</i>			
Related activities will be information, sensitization and formal adoption of NSSF for REC development activities.			
SO 5.3 Action is taken to ensure preparedness for NSSF at United Nations GGIM: Africa secretariat, member States, and partner levels.	ECA/AUC/AfDB/Member States	6 years	3 355 000
R 5.3.1 <i>The capacity of the NSSF secretariat is enhanced to facilitate the establishment and implementation of the framework.</i>			
Activities include NSSF development planning and monitoring, funding mechanisms, and regular implementation meetings.			
R 5.3.2 <i>Mainstreaming of NSSF into the African sustainable development agenda is successfully carried out.</i>			
Activities include programme reviews by AUC, ECA and AfDB to mainstream NSSF into their respective programmes and plans.			
R 5.3.3 <i>Synergies and coordination are enhanced, and resources mobilized in support of NSSF.</i>			
Related activities will target national coordination and synergy building for NSDI, ICT policy, NICI, e-strategies, NSDS and other strategies in support of NSSF and resources mobilization.			

Strategic objectives and expected results	Organization	Duration	Estimated cost (United States dollars\$)
SO 5.4: Action is taken to ensure effective implementation of NSSF at the national, subregional and regional levels in Africa	ECA, AUC, AfDB, member States	6 years	738 000
<i>R 5.4.1: Knowledge generation and dissemination are enhanced to raise awareness and build evidence-based NSSF tools, products, and services.</i>			
Activities will focus on the production of NSSF-related research and development material and their dissemination (e.g. for address data collection following geocoding standards and procedures, common geographic boundaries, metadata standards for geospatially-enabled statistics, privacy data confidentiality, mapping and visualization of statistics, etc.)			
<i>R 5.4.2 Capacity and skills are enhanced in support of NSSF policy development and implementation in Africa.</i>			
Activities will target formulation and implementation of NSSF capacity development strategy; review and improvement of curriculum on SSFs and learning facilities in higher education institutions in Africa; research to fill knowledge gaps on SSF implementation-related issues; technical assistance to member States, etc.			
<i>R 5.4.3 Coordination and harmonization are sought for the implementation of the African Statistical Spatial Framework with the Strategy for the Harmonization of Statistics in Africa and the United Nations Group of Experts on the Integration of Geospatial and Statistical Information</i>			
Related activities include consultations between the Strategy experts and UN EG-ISGI; agenda for design and development of ASSF and broad review, adoption and assistance for its implementation.			
SO 5.5 Technological tools are designed and widely used to foster statistical spatial framework application in Africa.	ECA, AUC, AfDB, member States	6 years	320 000
<i>R 5.5.1 Knowledge management tools are developed and their use popularized to facilitate evidence-based NSSF policymaking and implementation.</i>			
Activities include operationalizing the virtual NSSF database and a biennial conference on SSF policy in Africa.			
<i>R 5.5.2 Monitoring and evaluation are enhanced in support of NSSF formulation and implementation in Africa.</i>			
Activities include development of a framework with indicators for monitoring and evaluation, and reporting on achievement of NSSF application.			
Total budget for Integration of Statistics and Geospatial Information			4 933 000

Grand total: \$154 299 000 ≈ 154 300 000

5. Conclusion

This document started out to discuss the desirable actions for geospatial information management in Africa. Though geospatial information does not arouse political interest in Africa, it is the basic infrastructure for sustainable national development. With the developments in space and digital technologies in the past two decades, the time and cost involved in making geospatial information and maps available for development and management purposes have been greatly reduced.

Therefore, to ensure that appropriate geospatial information products are used in policymaking and hence sustainable development, the continent needs to evolve a geospatial information policy, create regional and national fundamental data sets, and invest in capacity development, among others. That is best done by adopting an infrastructure approach, namely a spatial data infrastructure, the backbone of the challenge in using geospatial information for development in Africa.

Even though more than a decade of work has been done on spatial data infrastructure development in Africa, it still reflects an incoherent piecemeal approach characterized by loose networks and informal relationships. There is no evidence

of one model; rather, there is evidence of a complete lack of national geospatial information policies on the continent.

The present document argues that the key principles and issues for successful geospatial information management for sustainable development on the continent should include:

- Targeting the attainment of the United Nations Sustainable Development Goals and Agenda 2063 aspirations through integrated geospatial information and statistical data as support for decision-making
- Development of geospatially-enabled government services for end user needs and ensuring that appropriate products and services are provided
- Developing transparent, shared and interoperable systems of public geoscientific information for decision makers, investors, education, research, national and international institutions
- Exploiting the appropriate use of global geospatial data sets for the production of fundamental data sets.

Appendix: Capacity development process

Capacity for what?

Current ICT tools provide a very dynamic infrastructure for managing, accessing and using all kinds of information, including the ability of IT infrastructure to handle location-specific data in open, standard ways. Geospatial data has now become the raw resource for creating location-specific information, and the collection and use of geospatial data is no longer the exclusive preserve of geospatial information specialists. “Map” data are more easily and freely available; map-enabled applications (location-based services) have become commonplace; and GPS and navigation tools are almost taken for granted.

What do these technological shifts mean for geospatial information management in Africa? What kind of personnel, institutions and institutional arrangements, and systems (including infrastructure) are needed in order for Africa to make the most of these technologies in the area of geospatial information? The good news is that the current environment also provides opportunities never seen before for achieving wider and more effective use of geospatial information. Computing platforms and devices are more diverse, increasingly more powerful, while becoming more portable and cheaper. New players, partnerships and financial models have also emerged, and there are more intuitive ways to share information and transfer knowledge.

The question raised is why, with all the investments in geospatial information capacity-building cited above, the subject of “capacity” is still relevant and particularly prevalent in Africa. In the first place, capacity “development” ought to be an ongoing processing of a constantly changing world. In the area of human resources, for instance, there will always be need for training and education to replace personnel who move on for one reason or the other. Secondly, and more importantly, capacity is not developed in a vacuum. To be of use it must be rooted in a broader development objective, for instance, in a national development strategy, a plan for

economic or social empowerment, or an initiative with a particular theme such as geospatial information management. Thus, it should be recognized that “capacity” is contextual.

Effective capacity development responses should begin with fundamental questions, answers to which would shape the design of each capacity response according to the specific priorities and issues at stake. The first of these questions that should always be asked is: “capacity for what?” To what end do we need to develop this capacity? What will be its purpose? For the present discussion, it is strongly argued that ongoing development of capacity is needed to meet new emerging challenges; as new technologies and new processes are developed, so is there need to reskill people, and to retool organizations to adapt and deal with, or function effectively in the new circumstances. Failure to do this renders both knowledge and systems obsolete, creating a capacity gap. It has been pointed out that the lack of provision for continuing education and training for African geoinformatics lecturers makes them rapidly out of date and therefore unable to sustain a dynamic curriculum, and that many of the same few institutions are still running obsolete programmes.

To set the context for the capacity challenge, the NEPAD programme provides a clear agenda appropriate for a demand-driven, pan-African geospatial information programme for which capacity needs to be developed. Africa requires “transformational capacities” across all sectors in order to respond to its renewal, security, integration and growth agenda. Geospatial information that is harmonized across national boundaries is fundamental for the realization of this agenda, with a critical need to address the capacity for the production and management, dissemination and access, utilization and application, knowledge generation, and entrepreneurship development in geospatial information. There is a great need in the capacity to innovate, to build a new professional cadre, as well as management models that are appropriate for Africa. There is also an urgent need to

create a supportive environment for geospatial information activities to flourish and adapt to a rapidly changing landscape.

Levels of capacities

The ECA position paper of 2001 clearly articulates capacity-building measures to address personnel and skills development for geospatial information management in Africa. It also underscores the “utility infrastructure” (reliable electricity and telecommunications) needed to be in place to support geospatial information development, management and utilization. However, as much as these are key inputs, the changed and still evolving ICT landscape of today requires new capacities – a different kind of holistic capacity that sustains itself.

The United Nations Development Group approach to capacity development provides a systematic methodology that is very appropriate for analysing the multidimensional aspects and identifying holistic interventions for addressing the capacity challenge in geospatial information management in Africa. The UNDG methodology identifies three points where capacity should be grown and nurtured: within individuals, in organizations, and in the enabling environment (see table 1A below).

The three levels influence each other in a fluid way, and the strength of each depends on, and determines the strength of the others. The approach goes beyond the traditional capacity “building” through training and technical assistance. An essential ingredient (and outcome) in this approach is transformation, and for an activity to meet this standard it must bring about

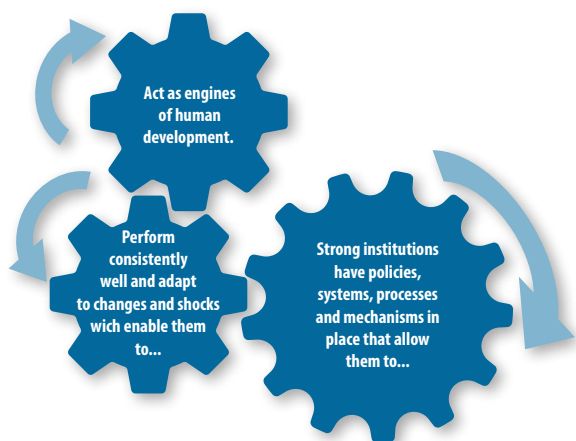
transformation that is generated and sustained over time, and from within. Transformation of this kind goes beyond performing tasks.

Applying the three-tier “integrated system” and the transformation “lens” to the capacity-building efforts over the past decades it would appear that the area where more permanent and visible results were achieved from the investments in geospatial information management is at the individual level. This is not in any way to deride the achievements that were made with regard to the other two levels; one very important outcome was the strengthening of (a few) key institutions or the establishment of new ones. However, the fact remains that not the same level of investment was made at the two other levels, and much less sustained efforts and success have been recorded particularly at the level of the enabling environment. Success in investments in individual capacities did not always translate into transformative policies backed by legislation, systems and processes, institutionalization of knowledge, innovation, and entrepreneurship.

Individuals are important cogwheels in the overall system; knowledge originates from individual minds. Individual capacity-building must focus on creating and sharing knowledge, through education and training initiatives. However, there is always a risk that knowledge residing in an individual would become lost to the organization when the individual is not available. Thus, brain drain in any form is a significant obstacle to the future success of geospatial information management. Individuals function and indeed are more effective as the backbone of institutions.

Table 1A: Content of the three levels of UNDG methodology

Individual level	Skills, experience and knowledge that allow each person to perform. Some of these are acquired formally, through education and training, while others come informally, through doing and observing. Access to resources and experiences that can develop individual capacity are largely shaped by the organizational and environmental factors indicated above, which in turn are influenced by the degree of capacity development in each individual.
Organizational level	Refers to the internal structure, policies, systems (including technology and infrastructure), processes, and procedures that determine an entity’s effectiveness. It is here that the benefits of the enabling environment are put into action and a collection of individuals comes together. The better resourced and aligned these elements are, the greater the potential for growing capacity.
The enabling environment	The broad social system within which people and organizations function. It includes all the rules, laws, policies, power relations and social norms that govern civic engagement. It is the enabling environment that sets the overall scope for capacity development.



Organizational capacity development is necessary for the continuity and sustainability of the geospatial information management knowledge base; strong and stable organizations are important in supporting applications of geospatial information management. Therefore it is important to institutionalize knowledge (and capacity) through, for instance, the establishment and investment in centres of excellence.

When there are well developed institutions, supported by knowledge structures and clear accountability mechanisms, institutions are stronger – resilient, adaptable, efficient and high-performing. Strong institutions are the pillars of capable States. And capable States are better able to weather external shocks and bounce back faster when hit by them, no matter what the shocks are.

Governments create the enabling environment for the development initiatives and application of geospatial information management through provision of financial and political support. In many countries in Africa aid agencies and the international community play a vital role in supporting this process. A defining characteristic of such organizations is their broad agendas and the trade-offs which they must consider in allocating support to a wide variety of competing initiatives. For this reason, engagement with government agencies as well as international organizations is critical, and must be framed in ways that justify political or financial investment in geospatial information management initiatives. Cost-benefit analyses are needed to demonstrate the value of investment in

geospatial information management. One model that is currently under way is the development of a spatial data infrastructure in Uganda, which began by budgeting the total investment needed to establish the infrastructure, as well as the estimated benefits (details published by Geo-Information Communication Ltd and Esri Canada in 2010). Integrative efforts are essential, and there is great merit in integrating geospatial information management into national ICT policy, as has been done, for instance, in Ghana. In addition, the incorporation of geospatial information as core to census and national statistics in general would be a major policy shift and driver for creating an environment for geospatial information management activities to flourish.

Key levers of change

“Capacity” has many dimensions and variables, depending on the context. The interplay among these can be complex, and attributions and contributions to successful outcomes are not always linear. Therefore in seeking to address capacity challenges it is helpful to identify and clearly articulate so-called “core issues” which if addressed would have the greatest impact on capacity development outcomes at the different levels described above.

From empirical evidence and first-hand experience, United Nations Development Programme identifies four core issues that seem to have the greatest influence on capacity development; it is in these four domains that the bulk of the change in capacity happens. An attempt is made to relate some core issues (non-exhaustive) in geospatial information capacity to these in the matrix below:

The three levels of capacity and the core issues taken together break from the piecemeal, supply-driven capacity-building measures founded on training and technical assistance. They provide a comprehensive, robust and holistic framework to guide the assessment of capacities and formulation of interventions to deal with capacity development in a manner that is self-sustaining over time. The model implies that geospatial information capacity cannot, and should not, be

Table 2A: Core issues in geospatial information capacity distributed over the four UNDP domains of capacity development

Core issue	Description	Geospatial information issues
Institutional arrangements	The policies, practices and systems that allow for effective functioning of an organization or group. These may include “hard” rules such as laws or the terms of a contract, or “soft” rules like codes of conduct or generally accepted values [and norms].	<ul style="list-style-type: none"> • ICT policy frameworks and legislation • Data producers, custodians and brokers • Stakeholder engagement mechanisms • Data standards, protocols and norms • Data and information access/exchange policies, mechanisms and procedures • Institutional strengthening/reforms • Resourcing (skill sets, financial) • Human resource management • Infrastructure to support the discovery, access and applications of geospatial information
Leadership	The ability to influence, inspire and motivate others to achieve or even go beyond their goals. It is also the ability to anticipate and respond to change. Leadership is not necessarily synonymous with a position of authority; it can also be informal and be held at many levels; it also exists within the enabling environment and at the organizational level.	<ul style="list-style-type: none"> • Visionary leadership that creates an imperative and space for various actors to engage, innovate, and chart a clear course for the development and application of geospatial information in new ways. Examples: • The leadership and authority for the establishment of the United States Federal Geographic Data Committee in 1990 • Leadership demonstrated by Google in democratizing geospatial information
Knowledge	Knowledge, or literally what people know, underpins their capacities and hence capacity development. Seen from the perspective of the three levels of capacity (identified above), knowledge has traditionally been fostered at the individual level, mostly through education. But it can also be created and shared within an organization, such as through on-the-job training or even outside a formal organizational setting through general life experience, and supported through an enabling environment of effective educational systems and policies.	<ul style="list-style-type: none"> • Knowledge systems that provide for: • Maintaining relevance of (policy-oriented) content, and for generation and production • Mechanisms and facilities for the capture, utilization, and exchange of knowledge, as well as incentives for innovation in geospatial information technologies and services • Mechanisms for the access, acquisition, and transfer of knowledge (including appropriate institutional frameworks and capacities for geospatial information training, education, and research) • Geospatial information products and services (e.g. metadata, spatial data directories, atlases, online cadastral-based services, community resource centres) • Geospatial information management toolkits • Planning and decision support tools
Accountability	<p>Accountability exists when rights holders are able to make duty bearers deliver on their obligations. From a capacity development perspective, the focus is on the interface between a service provider and its clients or service providers and oversight bodies. More specifically, it is about the willingness and abilities of [service-oriented] institutions to put in place systems and mechanisms to engage [user] groups, capture and utilize their feedback, as well as the capacities of the latter to make use of such platforms.</p> <p>Accountability is important because it allows organizations and systems to monitor, learn, self-regulate and adjust their behaviour in interaction with those to whom they are accountable. It provides legitimacy to decision-making, increases transparency and responsiveness, and helps reduce the influence of vested interests.</p>	<ul style="list-style-type: none"> • More dynamic, less structured, and service-oriented relationship between data users and data suppliers • Direct engagement between industry actors and user communities that include civil society • Stakeholder engagement mechanisms • Open engagement with non-traditional users, civil society • Demand-driven products and services • Interactive stakeholder feedback to make geospatial information more demand-driven and service-oriented • Collective learning and creation of demand-side capacity through awareness creation and user-oriented products and services (through collaborative computing – wikis, social networks, etc.)

isolated from the environment (broader social context) within which geospatial information is applied. For instance, experience to date has amply shown that, even with perhaps thousands of trained personnel in geospatial information management in Africa today, the development and growth of geospatial information technology has been severely curtailed by the lack of

capacities in other areas of the political economy of countries – electricity and telecommunication infrastructure being the most frequently cited.

The model also embraces more stakeholders, from political leadership, to state institutions, and non-state actors (civil society and private sector) alike. It therefore creates space for effective

partnerships through which the assets of the partners can be leveraged, effective collective capacity, and additional gaps identified and dealt with. Partners bring intellectual capital, expertise, content, material and technical assets, as well as financial resources for mutual benefits.

Capacity for whom?

The collection, processing, management, analysis, usage and distribution of geospatial information involve several actors operating at various levels. Geospatial information management must therefore be addressed through the development of special data infrastructure which, by definition, requires buy-in from a diverse group of stakeholders. These stakeholders include geospatial information management experts and technicians, users of geospatial information, and policymakers and decision makers in public agencies, private corporations and civil society organizations. Capacity development must shift its focus from training of technical specialists, to engaging with the full spectrum of the stakeholder network.

Each of the various actors needs to be “capacitated” to varying degrees. Typically, however, the process of “building capacity” under

project conditions is selective, and emphasis has tended to be placed on technicians (specialists) and managers. Sometimes reference is made to policy or decision makers, however often very little investment is made in “building” the capacity of this category of actors. In order for geospatial information activities to truly take off, there has to be a concerted effort to target kingpins in the political economy in Africa, otherwise Africa will continue to lag behind and not fully benefit from the overall potential of geospatial information and related technologies.

In the context of Africa’s transformation agenda it is instructive to look to the African Union-NEPAD Capacity Development Strategic Framework for guidance with respect to the questions:

- Whose capacities need to be developed? Which groups or individuals need to be empowered?
- What kinds of capacities need to be developed by these groups or individuals to achieve the broader development objectives?

The Framework is founded on six cornerstones which inherently identify broad groups of actors

Table 3A: Suggested geospatial information capacity development targets based on NEPAD Capacity Development Strategic Framework

Cornerstone	Description	Suggested geospatial information capacity development target
Leadership transformation	Leaders at political and technical levels committed to collective transformation and performance while fostering the growth and development of African human potential.	Senior sector policymakers Legislature (parliamentary committees) Industry leaders
Citizen transformation	Well-informed and empowered citizenry to foster and claim accountability for quality services, while taking full ownership of the development agenda and processes alongside state and non-state actors.	Professional associations, e.g. institutes of surveyors, engineers, architects, etc. Trade associations (chambers of commerce, mines, etc.) Providers of location-based services
Evidence-based knowledge and innovation	Knowledge-based and innovation-driven processes that enhance evidence-focused decision-making and encourage increased investment in knowledge, and science and technology, including scientific institutions.	Academics Technicians and earth scientists Researchers Experts in thematic application areas Management and professional staff ICT sector professionals Technical support staff
Utilizing African potentials, skills and resources	Mobilizing African financial and human resources for development and transformation – nationally, continentally and globally	
Capacity of capacity developers	Adaptive capacity development institutions driving a progressive agenda for capacity development and producing an entrepreneurial client-oriented product.	
Integrated planning and implementation for results	Integrated and coordinated approaches for planning and implementation of development programmes and projects within and across levels aligned to key sustainability principles, to promote development results.	Planners Policymakers Mid-level development managers Technical support staff

to be involved in all capacity development activities, as shown in the table 3A below:

All these target groups need an appreciation, understanding and knowledge that is specific to their line of work. It is therefore important that space for engagement is created to allow them to identify their specific interests, opportunities, and incentives for investing in the development of their own capacities. Governments and the currently established leadership in geospatial information activities have a responsibility to bring this about; once opportunities and incentives are identified it is most likely that the interest groups will put in place appropriate mechanisms to sustain their interest, including developing their own self-serving strategies.

A multi-stakeholder approach helps to overcome the coordination problems, creates momentum on a broad front rather than in a piecemeal fashion, and ensures harmonized processes including interoperability of data and systems. In this regard, capacity development in geospatial information management can benefit from the experience of ICT capacity builders, who have seen success in overcoming issues related to coordination, including legal and privacy restrictions on sharing information; organizational barriers between agencies that operate as separate silos; incomplete grasp of what services exist, which are needed and how they will be governed; legal and management constraints on cross-agency service agreements; resistance to perceived loss of control over information and processes; absence of business managers to steer the development of interoperability; resistance to perceived loss of intellectual property; resistance to perceived loss of business opportunities; fear of fierce competition; and security considerations.

Capacity development process

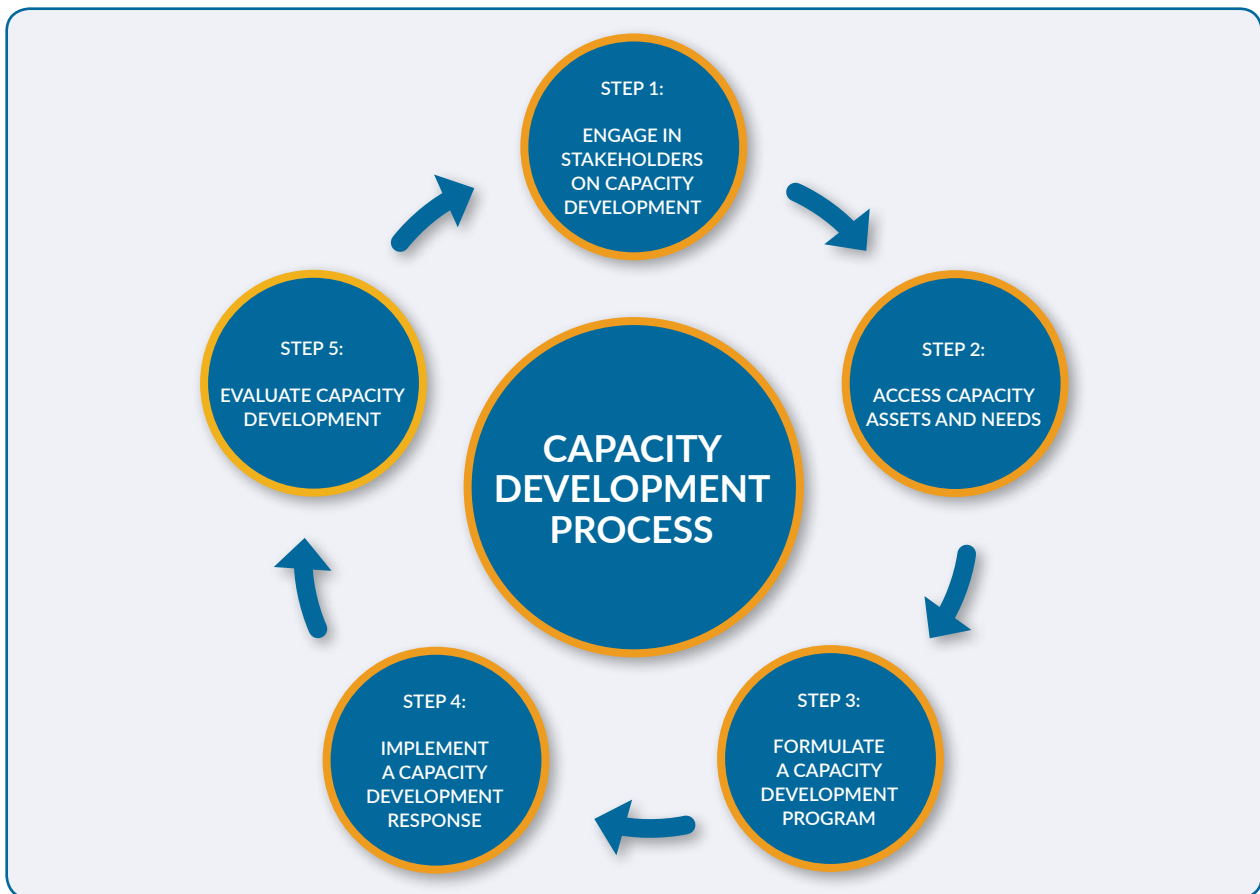
Transformative capacity development keeps the focus on development results and institutions, fosters broad national ownership, and ensures alignment with national development priorities, strategies, processes and systems. It addresses technical and functional capacities; defines stakeholders and beneficiaries; and

includes response and support strategies for investments in long-term education and learning, strengthened public systems, mechanisms for engagement and accountability between citizen and state, and necessary institutional reforms that ensure responsive public and private sectors that manage and deliver services to those who need them most.

It is instructive to start the capacity development process with a clear understanding of the context, challenges, existing capacity assets, as well as opportunities and gaps. In this context technical capacities refer to subject-matter knowledge, such as geodesy, surveying, remote sensing, etc. these are skills required to provide necessary information, techniques and approaches for problem analysis, and identifying and implementing solutions. Functional capacities, on the other hand, may be considered as the essential catalytic and management skills that allow for planning, implementing, and monitoring and evaluating initiatives for growth. The latter is at the heart of transformation and drives the process.

An assessment of capacity is therefore an essential first step in the capacity development process. In previous capacity-building efforts the focus of assessments tended to be on (data) user needs; the capacity of the data provider, usually a government agency, was defined and limited to training and equipment. In the more comprehensive approach being proposed, a broad range of issues have to be determined and an analysis of desired capacities compared with existing capacity needs undertaken. A capacity assessment therefore offers a systematic way to collect information and knowledge regarding assets and gaps in capacity. The information and knowledge generated would then be used to formulate capacity development responses that will allow the strengthening of capacities in areas that are necessary or the optimization of use of existing capacities.

Ideally, it would be useful to undertake a capacity assessment before any investment is made. However, since the approach to capacity development assumes that some capacity exists already, assessments can be undertaken at any



point in the development cycle; it is not always necessary to start afresh with a comprehensive assessment. Indeed, it is best to identify an “entry point” based on what exists already, using that to identify and understand issues related to capacities at the three levels: individual, organizational and enabling environment.

No matter where the process starts, however, the identification of, and effective engagement with, stakeholders are key steps. The assessment process should itself offer a platform for dialogue with stakeholders. Given the variety of ways in which people use geospatial information today it is important that stakeholders should be defined as widely as practically possible, particularly including youth and women’s groups. A good assessment should also assist in validating priority areas for action; defining a point of departure for the formulation of strategies and responses; and enhancing understanding of operational issues for implementation of interventions that are proposed.

User-driven approaches will better identify needs and related capacity issues. Not only will

user-driven approaches increase the likelihood that initiatives will be successful through wider engagement with end users, but they will also provide a critical feedback mechanism that will help geospatial information management leaders identify the most productive uses of geospatial information (ranging from which data to disseminate to the structures of spatial data infrastructure).

Interventions must also focus on strengthening linkages between education and training organizations on the one hand, and research and implementing organizations on the other. This will not only counter brain drain, but will also increase the immediate impact of human capacity-building on the realization of development objectives, and engender innovation.

Regional network organizations, such as EIS-Africa and the African Association of Remote Sensing of the Environment, have played, and are still playing, key capacity development roles in geospatial information, by facilitating the transfer of knowledge and resources among individuals and organizations. In turn, to further increase the

effectiveness of these efforts, a comprehensive capacity development strategy must not neglect network organizations, but rather integrate and complement their efforts.

Change and change readiness

Introducing information systems often requires, and causes changes. Societies that have understood, developed, and adapted policies, legislation, systems, and business processes to this reality, have benefited from the challenges and opportunities of ICT. The domain of ICT is constantly changing, and the ICT movement has become highly adaptive and capable of responding and contributing to advances in technology in ways that create wealth and improve decision-making.

Geospatial technologies have also advanced rapidly and have become fully integrated and institutionalized throughout the principal sectors of many countries through geospatial information management and spatial data infrastructure. While African countries have fully embraced ICT, the same cannot be said for geospatial technologies. Rather, instances of geospatial information development have been piecemeal, ad hoc, and largely uncoordinated with a few important exceptions (e.g. NEPAD, the Kenya Open Data Portal). The experience in North America and numerous European countries demonstrates the potential for geospatial information and spatial data infrastructure to drive economic development.

Capacity development itself also entails change – a change from one state to another that is more desirable, and should therefore be managed as such. In order for Africa to benefit fully from the opportunities provided by geospatial information, it is necessary to develop and strengthen capacities to embrace change, innovation and adaptation in the constantly changing ICT environment. ICT is a logical partner for geospatial information, and greater integration of both types of initiatives would prove mutually beneficial.

However, this requires a fundamental rethinking of capacity development. It requires capacity development that is much more than supporting training programmes and the use of national expertise. Training will provide skills, and there are many examples of highly trained skilled individuals who are unable to function at their full potential because the organizational and enabling environments are not conducive to productivity.

It is the combination of the skilled personnel with an enduring and credible vision, a comprehension of the application context, existence of appropriate infrastructure, availability of IT technology and adherence to IT policies and procedures, and open-minded and positive attitudes in using the related technology, that gives information and knowledge its strategic importance, and brings about innovation and adaptation, without which capacity is transient and unsustainable.

In addition, business processes need to be changed. For the present discussion this implies that location and geospatial information should become part of the way individuals, groups, and society as a whole are structured and work; this is already happening, driven by external interests and forces, including the private sector. Without appropriate national ICT policies that create space for responsive procedures and associated processes to be designed and implemented to facilitate, encourage and even force such changes in behaviour, potential benefits to economies from geospatial information will remain a pipe dream.

This implies that all society needs to be capacitated in order to bring about change. It requires that the capacity development strategy for geospatial information should not only address technicians and policymakers, but people across and at all levels of society – thought leaders, knowledge workers, and all categories of implementers (doers) alike. A broad base of stakeholders should be exposed to and be part of the capacity development process which creates space, infrastructure, engaging process and capacity for change to become an information society that is spatially enabled.