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Global Geospatial Information Management (GGIM)
Africa Action Plan

Addis Ababa, Ethiopia
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Geospatial Information

for Sustainable Development in Africa (GI4SD)

African Action Plan on Global Geospatial Information Management

(AAP-GGIM) 2016-2030

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EXECUTIVE SUMMARY

The United Nations Secretariat has launched the Global Geospatial Information Management (GGIM) initiative in 2011. It aims at setting up a formal mechanism under the UN auspices to discuss and coordinate GGIM activities and by involving Member States as the key players.

Two key programmes, namely the United Nations (UN) 2030 Agenda for Sustainable Development, adopted in September 2015 by the General Assembly of the UN, and the African Union (AU) Agenda 2063, approved in January 2015 by the African Union, further emphasise the need for a global coordination mechanism for Geospatial Information Management (GIM)

These two Agendas have a lot in common and are mutually supportive and coherent, while the Agenda 2063 is more specific on the needs of Africa. At its meeting in April 2016, the Conference of African ministers of finance, planning, economic development and integration highlighted these two Agendas as key to the next phase of Africa's development and noted the supportive relationship of the two.

Geospatial Information for Sustainable Development (GI4SD) in Africa, which is the African Action Plan on Global Geospatial Information Management (AAP-GGIM) is an implementation tool of UN-GGIM: Africa, the African component of the UN-GGIM initiative. It responds to the recommendation of the African GGIM Preparatory meeting 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 (GI4SD) in Africa focuses on four keys areas, namely

- Geospatial Information Policy and Governance;
- Common Framework and Tools;
- Capacity Building and Knowledge Transfer; and
- International Coordination and Cooperation in Meeting Global Needs.

It also contains a specific action area:

- Integration of Geospatial Information and Statistics.

The latter is very useful to provide decision makers with sound information products and services adapted to the attainment of the SDGs and the AU Agenda 2063 objectives, based on a National Statistic Spatial Framework (NSSF).

Each focus area, and the chapter on Integration of Statistics and GI is detailed in specific objectives, expected results, and estimated budget figures, with an idea of related activities.

Geospatial Information for Sustainable Development (GI4SD) in Africa, the African Action Plan covering the period extending from 2016 to 2030 requires a total provisional budget of US$ 154 300 000.

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ACRONYMS AND ABBREVIATIONS

AAG	Association of American Geographers
AAP-GGIM	African Action Plan on Global Geospatial Information Management
AARSE	Africa Association of Remote Sensing of the Environment
ABS	Australian Bureau of Statistics
ACMAD	African Centre for Meteorological Applications for Development, Niger Republic
AfDB	African Development Bank
AFREF	African Geodetic Reference Frame
AFRICOVER	Land Cover Classification and Mapping project
AGIRN	African Geo - Information Research Network
AGIS	Abuja Geographic Information Systems (Nigeria)
AGRHYMET	Agriculture, Hydrology and Meteorology Research Center
AISI	Africa Information Society Initiative
AMCOST	African Union Ministerial Committee on Science and Technology
AMESD	African Monitoring of the Environment for Sustainable Development
AOCRS	African Organization of Cartography and Remote Sensing
ARCSSTE –E	African Regional Centre for Space Science and Technology Education - in English Language, Nigeria
ARMS	African Resources Management Satellite
ARSDI	Africa Regional Spatial Data Infrastructure
ASTER	Advanced Space - borne Thermal Emission and Reflection Radiometer
AU	African Union
AUC	African Union Commission
AVIPS	Added-Value Information Products and Services
AVN	African VLBI Network
CATHALAC	*Centro del Agua del Trópico Húmedo para América Latina y El Caribe* (Water Centre for the Humid Tropics of Latin America and the Caribbean)
CDSF	Capacity Development Strategic Framework
CERSGIS	Centre for Remote Sensing and Geographic Information Services (Ghana)
CGB	Common Geographic Boundaries
CES	Committee on Earth Sciences
CODI	Committee on Development Information

CODIST	Committee on Development Information Science and Technology
CORS	Continuously Operating Reference Station
CPA	Consolidated Plan of Action
CPU	Central Processing Unit
CRASTE – LF	*Centre Régional Africain des Sciences et Technologies de l'Espace en Langue Française* (African Regional Centre for Space Science and Technology Education in French Language (Morocco)
CRTS (1)	*Centre Royal de Télédétection Spatiale* (Morocco)
CRTS (2)	Catalina Real - time Transient Survey
CSE	*Centre de Suivi Ecologique* (Senegal)
CZM	Coastal Zone Management
DB	Database
DDI	Data Documentation Initiative
DEM	Digital Elevation Model
DIP	Digital Image Processing
DVD	Digital Versatile Disk
ECA	Economic Commission for Africa
ECOSOC	Economic and Social Council of the UN
ECOWAS	Economic Community of West African States
EDGI	ECOWAS Geospatial Data Infrastructure
EIS	Environmental Information System(s)
EOS	Earth Observation Satellites
ESRI	Environmental Systems Research Institute
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FDs	Fundamental Datasets
FGDC	Federal Geographic Data Committee
FIG	*Fédération Internationale des Géomètres* (International Federation of Surveyors)
FOSS	Free and Open Source Software
GDEST	Global Dialogues on Emerging Science and Technology
GEO	Group of Earth Observation
GEONETCast	Global Network of Communication Satellite Based Data Dissemination Systems
GEOSS	Global Earth Observation System of Systems
GGIM	Global Geospatial Information Management
GGRF	Global Geodetic Reference Frame
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
GSDI	Global Spatial Data Infrastructure
IAG	International Association of Geodesy
ICA	International Cartographic Association
ICT	Information and Communication Technology
IGS	international GNSS Service
INSPIRE	Infrastructure for Spatial Information in the European Community
ISPRS	International Society of Photogrammetry and Remote Sensing
IT	Information Technology
IWRM	Integrated Water Resources Management
JBGIS	Joint Board of Geospatial Information Societies
JICA	Japan International Cooperation Agency
LVWATSAN	Lake Victoria Region Water and Sanitation Initiative

MAfA	Mapping Africa for Africa
MDGs	Millennium Development Goals
MESA	Monitoring for Environment and Security in Africa
NAF	(Geographic) National Address Framework
NAMF	National Address Management Framework
NASA	National Aeronotics and Space Administration
NARSDA	National Space Research and Development Agency (Nigeria)
NEPAD	New Partnership for Africa's Development
NFPI	National Focal Point Institution
NGDI	National Geospatial Data Infrastructure
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
OGC	Open Geospatial Consortium
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
RSDI	Regional Spatial Data infrastructure
RSSF	Regional Statistical Spatial Framework
SADC	Southern Africa Development Community
SALB	Second Administrative Level Boundaries
SATs	SDGs and Agenda 2063 Targets
SDGs	Sustainable Development Goals
SDI	Spatial Data Infrastructure
SERVIR-Africa	Regional Visualization and Monitoring System for Environmental Management and Disaster Response in Africa
SGS	Statistical Geography Standard
SLM	Sustainable Land Management
SSF	Statistical Spatial Framework
StatCom-Africa	African Statistical Commission
UAS	Unmanned Aerial System
UAV	Unmanned Aerial Vehicle
UNDG	United Nations Development Group
UNGGEN	United Nations Group of Experts on Geographical Names
UNSC	United Nations Statistical Commission
UN-SPIDER	United Nations Space-based Information for Disaster Management and Emergency Response
VLBI	Very Long Baseline Interferometry

1. INTRODUCTION

The world, in 2016, is at the dawn of a new era, a new step into the evolution of humanity, with hope, but also with many challenges for sustainable development, and 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 (MDGs). Over the past fifteen years, Geospatial Information (GI) has been used here and there to contribute to the implementation of the many initiatives taken around the world in an attempt to translate these MDGs 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 GI stakeholders under the auspices of the United Nations (UN).

It is against this background that the United Nations Secretariat has launched the Global Geospatial Information Management (GGIM) initiative in 2011, which aims at setting up a formal mechanism under the UN auspices, to discuss and coordinate GGIM activities and by involving Member States as the key players.

The need for a global coordination mechanism for Geospatial Information Management (GIM) has been further emphasised by two key programmes: the United Nations (UN) 2030 Agenda for Sustainable Development and the African Union (AU) Agenda 2063. In September 2015 the General Assembly of the UN adopted the 2030 Agenda for Sustainable Development – 'Transforming our world'. The 2030 Agenda for Sustainable Development consists of 17 Sustainable Development Goals (SDGs), with 169 associated targets. While at the continental level, the African Union in January 2015 approved the Agenda 2063 as a vision and an action plan for 'the future we want for Africa'. Agenda 2063 contains 7 Aspirations for Africa. Due to its long time frame, Agenda 2063 has been divided up into shorter term objectives. These two Agendas have a lot in common and are mutually supportive and coherent, while the Agenda 2063 is more specific on the needs of Africa. At its meeting in April 2016, the Conference of African ministers of finance, planning, economic development and integration highlighted these two Agendas as key to the next phase of Africa's development and noted the supportive relationship of the two.

The 17 SDGs, with their 169 associated targets are currently being further defined by the measurable indicators. Likewise, with the 7 Aspirations for Africa. These indicators will provide a rational basis for the measurement of progress towards the achievement of the respective targets. Once these indicators are approved, it may be necessary to review this Action Plan to provide it with greater focus and relevance. The baselines have been set on the 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 takes place at a place or in a space, that is location-based, the key information required is geospatial information. The use of Geospatial Information goes beyond monitoring indicators towards the attainment of the SDGs and the 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 indictors, and for the evaluation of the 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 closer together to achieve the meaningful development information.

The SDGs and Aspirations for Africa both recognise the important role of the 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 their rightful place alongside the other fundamental geospatial datasets.

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 socio-economic domain, and then in sustainable development. The organization of the former United Nations Regional Cartographic Conferences for Africa, followed by the Committee on Development Information (CODI) meetings - replaced by the Committee on Development Information, Science and Technology (CODIST) meetings - are a few examples of this institution's efforts in this area in Africa. Therefore, it was no surprise, when came the time to consider a global management of Geospatial Information (GI) under the aegis of the UN, to see ECA taking the initiative to convene an Africa-wide Preparatory Meeting to the Global Geospatial Information Management (GGIM) initiative in August 2011.

As earlier stated, the GGIM initiative was launched by the United Nations' Secretariat with aims at setting up a formal mechanism, under the UN auspices, to discuss and coordinate GGIM activities, and by involving Members States as the key players. The latter are expected to play the lead role in the development of a global policy to the attention of policy makers in view of building synergies between the decisions of UN Regional Cartographic Conferences - CODI(ST) Conferences as far as Africa is concerned - and facilitate quick responses to concerns and emergencies. The Africa Preparatory Meeting issued an Addis Ababa Declaration on GIM. The declaration recalls:

- the various recommendations and resolutions adopted on Space issues by the AU Ministerial Conference on Science and Technology (AMCOST), and the AU Consolidated Plan of Action on Science and Technology in Africa (CPA),
- the role of the Economic Commission for Africa as the coordinating body for Africa's regional Spatial Data Infrastructure through CODIST-Geo,
- the commendable efforts made towards the integration of geospatial information in the National Information and Communication Infrastructures (NICI) policy ,
- decades of efforts in building Spatial Data Infrastructure in Africa including the Mapping Africa for Africa (MAfA) and AFREF initiatives,
- national Space Programs in Africa;

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

Such an Action Plan, according to the Addis Ababa Declaration, should take into account the following issues: (1) Policy and Governance; (2) Common Framework and Tools, (3) Capacity Building and Knowledge Transfer; (4) International Coordination and Cooperation in Meeting Global Needs. The UN Economic Commission for Africa (ECA) has taken the role to lead the initiative in Africa, so as to ensure that GGIM adequately reflects African issues and shape its direction and dimension to reflect African interest.

3. JUSTIFICATION

The present document, Geospatial Information for Sustainable Development (GI4SD) in Africa, which is the African Action Plan on GGIM (AAP-GGIM) responds first to the recommendation of the Addis-Ababa Declaration on GIM. Precisely, it responds to the Action Plan finalisation assignment, while its implementation, second part of the recommendation will follow soon. Therefore, this document appears as the first step towards, and a pre-requisite to a complete fulfilment of the Addis-Ababa Declaration.

Furthermore, GI4SD in Africa, the AAP-GGIM is necessary to give a content to the global action expected from, and necessary to Africa's sustainable development, through the various channels of GI applications, in full harmony with the global agenda of the UN-GGIM initiative. In this regard, it should be seen as a top layer for decision making, necessary for the translation of the UN-SDGs targets and the AU Agenda 2063 objectives into reality for Africa, over the coming decades, precisely for the 2016-2030 period. The AAP-GGIM is necessary to split the content of the planned action according to the four (4) focus areas defined by the Addis-Ababa Declaration, namely "Policy and Governance", "Common Framework and Tools", "Capacity Building and Knowledge Transfer ", "International Coordination and Cooperation in Meeting Global Needs". A fifth focus area was added following the first UN-GGIM: Africa meeting held on November 23-25, 2015 in Nairobi, Kenya: "Integration of Geospatial Information and Statistics".

Lastly, the present GI4SD in Africa document outlines the logical framework of identified priority actions (objectives, results, and estimated costs) for UN-GGIM: Africa. From this framework will emerge specific implementation projects to achieve the objectives of the Action Plan over the period 2016 - 2030, and beyond at a later stage.

3.1 GI4SD VISION FOR AFRICA

The vision of GI4SD for the 2030 horizon on the African continent is "*Advancing Africa's Sustainable Development Agenda through sound Geospatial Information Management*". In this formulation, sound GIM refers to an inclusive production and use of GI, including its linkage to other strategies in development sectors such as ICT and Statistics.

3.2 GI4SD MISSION STATEMENT FOR AFRICA

The Mission Statement of GI4SD 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*. The authoritative and evidence-based GI refers to rigorously controlled best quality and "official" - consensus-based - GI, and its attribute of objective, logically-led and uncertainty-free or reduced source of decision making.

4. FOCUS AREAS OF THE AAP - GGIM

4.1 GOVERNANCE AND POLICY

4.1.1 Introduction

Modern geospatial information (GI) techniques are becoming more and more used in decision making. In many countries around the world, and on every continent, GI products and services are gradually being used in an increasing number of development sectors, thus contributing to an unprecedented growth of these products and services, and in the size of the GI community world-wide. Whereas 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, sub-regional, continental and global level institutions producing or making use of GI on a regular basis.

The challenge is not only on the availability of reliable sources of GI, but also on access, quality, completeness, currency, availability of standardized metadata, interoperability of GI datasets, traceability of GI products, rights of data producers, liability of GI service providers, GI products and services pricing, etc.

This multi-faceted challenge calls for a series of organizational and managerial strategies ranging from corporate-level GIM rules to global scope mechanisms to enable easy access to, and use of GI products and services for those who need them. This multi-dimensional series of measures targeting the efficient management of corporate data assets, national GI resource base, global coalition initiatives in the GIM sector, need some form or coordination with a view to avoiding inequities, conflicts and confusion when considering the inevitable reuse, exchange and integration of datasets from different origins. It is the role of GI policies and Governance to handle this complex issue.

This section of the African Action Plan for GGIM presents an order in the way to address the GI Policy and Governance issue in general, and more specifically in Africa. It is intended to guide Africa Member States' efforts in achieving a better coordination of geospatial information management internally, and at the Continent's and its Regional Economic Communities' levels.

4.1.2 Rationale: Need for a National Geospatial Information Policy

4.1.2.1 MAIN DRIVERS OF GI POLICY DEVELOPMENT IN AFRICA

The initiative to develop a national GI policy is driven by many considerations, among which the following five drivers seem to be the most important.

Economic Drivers

It is well known that one of the key benefits of using GI-based Added-Value Information Products and Services (AVIPS) 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 GI 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 needed GI 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 the 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 GI policy will be developed to ensure a continued service of this new section (data security, quality, standardized processes, variety of information products, GI services delivery to potential clients and sustainability of the services, investment in GI staff and technology, etc.). In this case, the development of the corporate GI policy will be influenced by the relative importance of the GI-related activity in the company, but the driver is firstly the 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 GI 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 June 17, 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 GI in mobile communication (the article is attached as an appendix to this Action Plan).

If the issue is now analysed from a macro scale perspective, and being on the driver's seat of the government, one can see that the motivation for developing a national GI 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 GI 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, economic growth, not excluding the financial profit where this is possible. Thus, National Mapping Agencies (NMAs) 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 in view of re-using these sources of GI 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 GIS and Remote Sensing era, modern techniques have been developed to handle the issue, consisting of developing meta-databases of existing datasets and publishing them through a clearinghouse, while keeping control on access to the datasets themselves. Geospatial information needs to be open and shared, but there is an equal need for each organisation 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 GI policy.

Social Goal

From a government's point of view, availability of GI 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 GI 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 Datasets (FDs) are still necessary, in the spirit of meeting public interest needs (for more details on FDs, see Section 4.2.5.2 below "Production of Fundamental Datasets (FDs)").

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 (MDGs) and the present UN Sustainable Development Goals (SDGs), and the Aspirations and related shorter term objectives of the AU 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 GI 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 first instance. This explains the barriers to access to some types of GI data deemed highly sensitive and therefore classified in most countries. GI 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 GI policy. This widespread disclaimer is indeed an essential provision in GI policies and regulations worldwide.

Land Management

Just as a State, through its Government, can only exert sovereignty over its legally secured territories, so do individuals, families, communities, legal entities or municipalities and local governments over their recognized land assets. An important GI 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, 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 GI 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 main driver.

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

- Physical planning : it corresponds to the planning of how the nation's land resource will be used to meet the 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, IWRM, Protected Areas and

Biodiversity Conservation, Mining, CZM, etc.) cannot be dissociated from some form of land management.

- Urban and regional planning and management: Cities and their surroundings are in need of a careful and well planned use of the land supporting these areas of human activity concentration.
- Transportation: all transport types (terrestrial, aerial and river/sea) are related to land at some point, and GI is useful in the management of the flow of people and goods, and the related infrastructure. GI policy cannot ignore this specific sector.
- Agriculture and livestock: Sustainable Land Management (SLM), pastures, corridors for cattle movement, infrastructure for animal healthcare are all linked to planning the use of the land;
- Mining concessions, forest management concessions are also managed through specific rural cadastre techniques. In order to avoid conflicts due to overlapping concessions, or confusion in titles delivery, national land management regulations can only be very accurate on the location and concessions' physical limits, and the identity of valid concession title holders;
- etc.

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

Science and Technology

Scientific progress and technological innovation shape regularly the landscape of GI applications, extending their scope and deepening their influence on the development sectors. Recently, the use of ICT platforms as a medium for GI applications development resulted in new areas such as web mapping, opening doors to the development of GI-based solutions in the form of online collaborative workplaces and GI resources sharing facilities. The emergence of virtual social groups on the net is also influencing the way GI is produced. For example, by providing opportunities to social groups or individual users to interact by inputting GI data on a dataset open to the public online, new eras emerged, extending the benefits of the Participatory GIS concept. Volunteered Geographic Information (VGI) is one of them. This evolution needs to be taken into account in GI policy development, as it raises emergent issues such as the property rights on a participatory dataset, or the liability linked to the use of such sources of GI.

On the other hand, Africa is developing a Space programme through a few countries, and a new constellation of African Remote Sensing satellites is under discussion (see Section 4.2.5.3 "National & Regional, Space, Mapping and Geospatial information Policies"). Such a progress is an opening on a new area calling for a harmonized GI policy at continental level. Therefore, the inseparable scientific progress and technological innovation are another important driver for GI policy development in Africa.

4.1.2.2 RATIONALE FOR GI POLICY DEVELOPMENT

The National Level

As soon as a significant group of people decide to deal with a common issue, the need arises to set some rules to guide the process towards a satisfactory result. The size and number of the groups involved influence directly the scope of the control mechanism to be put in place.

Similarly, in the area of GIM, as the number of institutions in a country applying GI-related techniques increases, it becomes important to coordinate their efforts, so that the reuse of the GI products and services they deliver be a development opportunity, as opposed to a chaotic and uncontrollable anarchy. In any case, the role of any government is 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 become available. The challenging role of Government can be even to anticipate the development of the new sector and set rules beforehand. This is the first reason for every country in Africa to develop a national GI Policy in support of the SDI development process.

Beside this basic reason, the development of a national GI policy is justified by the following facts generally observed in almost every country:

- Quality issue: Non-professional GI producers may use inappropriate methods or tools to collect, and integrate data, with a certain level of risk linked to the use of the resulting dataset, even for the producers themselves;
- Duplication of data collection: At macro level, the same area of a country may repeatedly be subject to data collection activities from individual institutions working in isolation, whereas the data collected by the first actor could be used by the other concerned institutions for their respective application needs;
- Denial of access to datasets : some Governmental institutions, ignoring the principle of data custodianship, may deny access to their geospatial datasets by other public institutions working for the same national socio-economic development, sustainable development, or poverty alleviation common goal, when no valid reason explains the refusal to share these datasets;
- Existing datasets not documented : Some data producers may not put the necessary effort in documenting their existing datasets using standardized metadata, thus preventing potential users to know about the existence of these datasets, and/or to use them adequately;
- Violation of copyrights: some data users may develop added-value GI products or services without due recognition and respect of the rights linked to third party datasets they used as input data.
- Lack of clear status for some important datasets: some critical datasets, usually produced in the framework of specific development projects, may not have a clear status, thus limiting their re-use for various other applications. Others may be detained out of the country by partner institutions who claim ownership on them;
- Cost of Access: The absence of a clear and transparent basis for GI products and services costing in a country does not ensure fairness in the required competitive environment of GI 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 access such products.

This list is not exhaustive, and can be extended based on the experience of every individual country in Africa. But it shows that the efficient contribution of GI to sustainable development in a country is subject to the development of a specific GI policy addressing all these issues. Policy issues must be thoroughly considered and treated so that difficulties that may arise are dealt with anticipatively and action taken in advance.

As a result of the promotion of the development of Spatial Data Infrastructure (SDI) in Africa, many African countries have realized the need to implement components of the infrastructure

in their various countries. They are also conscious of the need to adopt policies for promoting greater awareness and public access to standard and coordinated geospatial data production, management and dissemination by all sectors including the establishment of a geospatial data clearinghouse at various levels in the country (local, state and federal) with linkages with the private sector. Towards the achievement of these objectives, various countries have put (or are putting) in place modalities to produce a National Geospatial Information Policy with South Africa being the first country known (as at the date of this report) to have enacted a national spatial information Act. An efficient functioning national SDI and the associated national policy should therefore be regarded as vital requirements for effective and efficient GIM in Africa.

Other levels

It is obvious that, if the above mentioned issues are not addressed at national level, they will affect GI applications in the concerned country at the sub-national levels and the quality of the country's contribution to higher level applications (sub-regional, continental, global) as well. Indeed, sub-regional initiatives - at the level of the RECs in Africa for example - need coherent national GI policies to reach full contribution of GI to the socio-economic development of these sub-regional entities.

GI applications at the sub-national level are automatically to comply with the national policy in place in a given country. Nevertheless, it may be necessary to issue specific regulations at the level of the concerned local government, but these regulations can only be the local application of the national policy that cannot be contradicted.

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

The same applies to the sub-regional groupings vis-à-vis the continent as a whole. Africa as a region can only succeed in developing a continent-wide consensus-based GI Policy if the majority - or a reasonable number - of Member States and their respective sub-regions 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 GI policy for Africa can impact positively on those countries lagging behind.

Fortunately, even before the GGIM initiative, the GI Policy issue had been identified and recommended by CODI(ST)-Geo 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 toward the development of Spatial Data Infrastructure (SDI) as the appropriate mechanism for the production, management, dissemination and use of spatial data and information products. The report of the study was received by the second edition of the Committee on Development Information (CODI), held in 2001 and became ECA's guiding principle for its advocacy work in the area of geospatial information management in Africa.

In conclusion, GI 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 GI use in

the implementation of development strategies at national and sub-regional levels in Africa. At the same time it goes beyond to meet global needs such as those at the origin of the GGIM initiative.

4.1.2.3 GEOSPATIAL INFORMATION AND GOOD GOVERNANCE

GI-based decision making has the privilege 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 could be an indicator of good governance. Indeed a dedicated geospatial database can show the present population distribution including the school-age children statistics, existing educational facilities with their attributes such as number of classrooms, number of school boys and girls per classroom, the road network and the natural obstacles on the ways to existing schools, the status of each administrative entity with regard to the national targeted school attendance ratio set for the development targets (SDGs). An algorithm can be built-in to compute automatically the progress towards the SDGs targets at local level. It then can 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 new site the effect on the administrative entity's needs satisfaction (school attendance ratio and extent of geographic coverage for example). This type of tool supporting decision making could be a widespread process for planning the extension of educational infrastructure, driven by the seeking for equity in access to education. Unfortunately, most of the time, the political and social influence of some leaders is what 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 that of road network development and maintenance, etc. Therefore, GI 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 GI policy can result in good governance based on objective, fair and equity-driven decision making.

A National GI Policy is the means by which a government, looking for transparency in its governance actions, can promote easy access to GI-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 GI policy will facilitate necessary access and make the information available to commercial organisations, civil society organisations and the public at large, allowing government agencies such as the national surveying and mapping agency to share fundamental datasets with other public and private sector organisations and the industry. This will in turn enhance private sector opportunities to develop more innovative applications.

4.1.3 Status of GI Policy Development in Africa

It was mentioned above the role of the former CODIST-Geo in promoting 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 this initiative is the publication of an online background document entitled "SDI-Africa: an Implementation Guide" (see http://geoinfo.uneca.org/sdiafrica/default1.htm). Chapter Four of this guide is devoted to Data Policy, in the context of Spatial Data Infrastructure development.

4.1.3.1 NATIONAL LEVEL

Despite this strategic effort, only a few countries have formally adopted a National GI Policy in the spirit of the NSDI. Sensitization events were organized in this regard, with the support of ECA in some cases, to raise awareness of GI Policy, this legal tool and booster of GI effectiveness and efficiency in socio-economic development.

The following countries are examples of Member States known in Africa to have adopted a national GI Policy or initiated its process:

- South Africa: In 2003, the Spatial Data Infrastructure Act was passed The scope of the Act is : to establish the South African Spatial Data Infrastructure, the Committee for Spatial Information, and an electronic metadata catalogue; to provide for the determination of standards and prescriptions with regard to the facilitation of the sharing of spatial information; to provide for the capture and publishing of metadata and the avoidance of the duplication of such capture; and to provide for matters connected therewith. Additional legal instruments related to the GI policy include a custodianship policy and a policy on the pricing for spatial information products and services.

- Kenya: In 2009 this country developed a draft policy on the Kenya National Spatial Data Infrastructure (KNSDI) to address the issue of Geospatial Information Management (GIM) in Kenya. The policy formulation was steered by the Survey of Kenya which is the National Mapping Agency (NMA) in collaboration with key stakeholders that included Agriculture, Culture and Recreation, Education, Energy, Environment, Forestry, Finance, County Governments, Security, Tourism and Transport and Communication. The stakeholders constituted a secretariat that will be housed by the NMA at the Kenya National Geospatial Data Centre (KNGDC). The policy aims at addressing legal and institutional framework for GIM, gives guidelines as a measure to address copyright issues, data pricing, data standards, metadata, and data security and facilitates training and capacity development. Kenya has already developed KNSDI digitization and data capture manual standards that are in line with international standards. Currently the 2009 draft KNSDI policy is undergoing the process of aligning it with the Constitution of Kenya 2010 before its approval.

- Ethiopia: The Ethiopian National Spatial Data Infrastructure (Ethio-SDI) had been initiated by the proclamation No. 808/2013, Article 13 under the mandate of INSA (FNG, 2014) to integrate spatial dataset and to share through the network of clearinghouse. This collaborative geospatial data sharing entity serves as an umbrella to develop sound geospatial data policy and legislation, prepare and impose standards, and assure the quality and compatibility of geospatial data (H. S. Gelagay, 2016)

- Nigeria: In September 2003, Nigeria under the leadership of the Federal Ministry of Science and Technology issued a National Geoinformation Policy. Part A provides a General Background and defines the philosophy of the policy. Part B deals with Policy Issues and gives details of the NGDI Components. Part C of the policy is devoted to Policy Implementation. The draft policy was revised in January 2010 but still in the process of being approved.

- Burkina Faso: with the support of the UNECA, Burkina Faso initiated in 2003 the development of a National Geospatial information Policy. The draft was adopted by a National Forum in June 2006. It contains the following Chapters : Aim and objectives of the National Geospatial information Policy; the means for the attainment of the Policy

objectives; Scope of the Policy and basic definitions; Coordination Authority; Specialized Working Groups; Partner institutions' Network; External needs satisfaction; Financing and Maintenance of Fundamental datasets; Monitoring and evaluation of the Policy implementation; amendment; dispute and enforcement of the policy. The policy is still in the process of being approved as a law.

- Namibia: In the frame of the National Spatial Data Infrastructure, Namibia initiated in September 2003 a draft Spatial Data Sharing Policy. It covers the following topics: Namibia's Spatial Data infrastructure; Spatial datasets; Data standards and Metadata; Pricing Strategies; Legal Issues

Other countries are known to have initiated the formulation of a National GI Policy

- Benin: an Information Charter was adopted in the framework of the SISEI (Internet -based Environmental monitoring and information system) project, to define the rights and obligations of the data providers and data users part taking in the SISEI network.

- Ghana: The country had streamlined its geospatial information policy into its broader ICT policy through the National Information and Communication Infrastructures (NICI's) 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 has been 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. Additionally, incorporating geospatial information policy into broader ICT strategy, which is often well funded, could provide the necessary financial foundation to the NSDI process with high priority in the Government agenda, and a firm and broad-base commitment to its implementation.

4.1.3.2 SUB-REGIONAL LEVEL

East Africa

The former East African Africover project led by FAO resulted in an intergovernmental data policy called Guidelines for Custodianship. Data distribution and management are based on these Guidelines, whereas specific data access policies were developed in agreement with the National Focal Point Institutions (NFPI) for the different types of datasets.

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 (EGDI) Policy and the ECOWAS Cartographic Strategy. The need for the policy and strategy came from the realisation that early warning and disaster mitigation and management cannot be done 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.

4.1.3.3 REGIONAL LEVELS

ECA initiated, since the Year 2000, the African Regional Spatial Data Infrastructure (ARSDI), a Cooperative Geospatial information Management process in Africa, with the following vision: 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. ARSDI is about Need for Complex Information, unlocking the hidden potential in the data, Producing Once, Using Many Times; making information available to decision makers when they need it.

The following initiatives are all features of the ARSDI:

- Mapping Africa for Africa (MAfA)
- Definition of Fundamental Geospatial Datasets 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 (AFREF), and
  - the Harmonized Administrative Boundaries known as the Second Administrative Level Boundaries (SALB) project outcome in its Africa component.

4.1.4 Basis of Geospatial Information Policy and Governance in Africa

The precedent section introduced the need for a GI 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 GI Policy as a contribution to the global initiative for GIM.

4.1.4.1 GI MANAGEMENT AND GI GOVERNANCE

Definitions

To explain the subtle difference between GI Management and GI Governance, the definition of the two terms, Management and Governance is necessary. Management is defined by the Business Dictionary 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". Therefore Governance is only meaningful when Policies have been formulated, adopted and enforced.

Strategy for GI Policy Development and Governance

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

The following goal can be set for UN-GGIM: Africa in terms of GI Governance and Policy: "A specific GI Policy, continuously monitored for the best of SDIs processes and for SDGs and

Agenda 2063 targets attainment, is in force in every Member State in Africa, every REC and at the continental level".

The establishment of such policies and continuous monitoring of their implementation requires a carefully designed strategy, to be approved by consensus. Such a strategy is justified by the expanding scope of GIM in Africa, with number of nations stepping into the era of Space programmes development. The strategy proposed here is based on the way the United States, Canada, Spain, and other industrialised nations developed or are developing national GI policies. It also builds on, and takes account of efforts already invested regarding new developments in the Earth Observation domain in Africa and abroad, such as the AU Africa Space Policy and the Africa Space Strategy, the AfriGEOSS.

For example the SDI feature of public access to GI, driver of the Fundamental Datasets concept, further expressed in the GEO's 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.

4.1.4.2 GI POLICY DEVELOPMENT STRATEGY AT NATIONAL LEVEL

GI as a Critical Development Enabler

The development of a GI Policy can only be effective and justified if GI 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 on-going National Spatial Data Infrastructure initiatives is the best framework for achieving this objective in a coherent and coordinated way.

The adoption on February 26, 2015 of Resolution 69/266 on a Global Geodetic Reference Frame (GGRF) for Sustainable Development by the United Nations General Assembly contributes to leveraging GI 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 (SST) programmes in Africa. Various UN Agencies such as UN-ECA, UNEP, UNOOSA and international/regional organizations and development partners such as EU, GEO, NASA, JICA, etc. are implementing space-technology related projects in Africa such as SERVIR-Africa, AMESD and TIGER. The EU-AU meeting of 7th December 2007 on GMES and Africa also emphasised the need to utilize data from Earth Observation satellites for the global monitoring for environment and security. These various on-going and future regional SST-related activities require a regional policy framework for sustainable implementation. The development of regional space programmes such as ARMS constellation and AfricaGeoSat should be situated within the policy, including the identification and development of other regional SST programmes. African countries that are aspiring to launch EO and communication satellites should also be encouraged to develop national space policies as first step.

The regional space programmes and policy would be better realised if a coordinating agency in form of an African Space Agency, can be put in place. The joint UNESCO/African Union high-level scientific workshop on the Critical role of satellite remote sensing applications for Africa's

sustainable development, 30th May to 1st 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 Honourable African Commissioners to UNESCO for integration into the AU's science and technology programmes. The adopted declaration also featured prominently as key aspect of Africa's position at the fourth plenary meeting of the Group on Earth Observations (GEO-IV) in Cape Town, South Africa from 28th to 30th November 2007 as well as in the declaration of the 7th and 8th biennial conferences of the African Association of Remote Sensing of the Environment (AARSE) in 2008 and 2010 respectively. The agency would then be an effective platform for the sustainable implementation of regional African satellites as well as the coordination of all regional SST programmes including simulation of private sector participation in the space industry.

In addition to having a national GI policy, it is also necessary to put in place a national mapping policy to address in detail the activities of national topographic mapping, provision of geodetic framework as well as cadastral mapping including the funding modalities for them. These cannot be treated in depth within the national GI policy and its absence can deter production of these vital fundamental datasets.

Strategy for National GI Policy Development

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

- Where we stand now: a survey and classification of all existing legal and policy documents oriented towards or related to GI 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 GI Policy (see the goal proposed above in 4.1.4.1 for UN-GGIM: Africa's Policy and Governance), developing the policy in a participatory way, with the contribution of thematic groups guided by the demand from the national SDGs and AU Agenda 2063 targets, and formally adopting it by the Government and/or the parliament;

- Setting the National GI Policy development in a National SDI Development Plan, linked to the National ICT Policy/NICI process/E-strategies, and the National Strategy for the Development of Statistics (NSDS),: The National GI Policy is a piece of the national SDI development puzzle. Therefore its development has to be set in the wider frame of the national SDI development process. In addition, as recommended by the UNECA and the CODI(ST) meetings, the National SDI Development Plan in turn must be linked, at the higher level, to the National Information and Communication Infrastructure (NICI) process in the country, or the E-strategies or other strategies such as National Land Policies, with a component on integration of GI and Statistical information for sustainable development. This ensures coherency and mutual nurture of these processes, especially for the attainment of the SDGs and Agenda 2063 Aspirations/Objectives.

- Advocacy action directed to the policy makers, partner institutions and development initiatives, and the donors: Buy-in is key to a successful strategy for the development of

a transformative GI policy at national level. This justifies a strong advocacy action towards all the stakeholders.

4.1.4.3 COHERENT GI POLICIES DEVELOPMENT AT SUB-REGIONAL LEVEL

While national GI policies are necessary for the national SDI 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 sub-region. Similarly to other sector policies (such as Environment, Transportation, Agriculture, Industry, Land, etc.) for which efforts are put at the Regional Economic Communities (RECs) level in the development of sectoral strategies and policies for coherency and convergence, so should national GI policies benefit from the same approach.

In this regard, Sub-regional consultations should allow defining key orientations, and the latter should be captured in Sub-regional GI Policy directives for use by the concerned member States. These directives should target in priority the SDGs and the AU Agenda 2063 needs for the considered sub-regions.

By so doing, the resulting REC level GI policies will be demand-driven as 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 guiding principles of GI management internationally accepted and applied.

4.1.4.4 PUBLIC ACCESS TO GEOSPATIAL INFORMATION FOR DEVELOPMENT IN AFRICA

The sub-regional directives mentioned above should not only reflect the individual socio-economic and political agenda options in the concerned RECs (in particular those supporting the SDGs and AU Agenda 2063 implementation), but also be guided by strategic objectives set at the higher level of the continent, taking into account technological and GI policy evolution trends in the world on one hand, and Africa-specific needs on the other hand. Among such Africa-specific needs, the area of Land Management, including the neglected marine and inland water environments - as highlighted by the SDGs - deserves full attention in terms of policy content definition.

Specific continent-wide efforts - at the image of the Aarhus Convention on Public Access to Geospatial information for Europe - should be put in generating the required conditions for a spread use and reuse of geospatial data and the derived information products and services for development in Africa.

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

- GIM as a critical development enabler in Africa
- Easy access to GI by the civil society at large in Africa

The first objective will influence positively Member States and motivate them to devote full attention and political support to the GI sector and consequently allocate the required resources to the institutions in charge, in order to launch or propel the SDI development process waiting to be speeded up in many countries. As mentioned earlier, Resolution 69/266 on a Global Geodetic Reference Frame (GGRF) for Sustainable Development by the United Nations

General Assembly should be an incentive for African Governments to leverage GIM in their respective political agendas. However the adoption of the resolution must be followed by an advocacy action to popularise its understanding in both the policy makers' circles and among the sustainable development actors throughout the continent.

The second objective will open doors for an effective use of GI by the public in Africa, where unfortunately GI is often kept inaccessible most of the time to those who need it. UN-GGIM: Africa should be the appropriate frame to focus the common effort in, and discuss largely for its acceptance and support by the appropriate policy organs. This objective which is the overarching goal of SDI development will also greatly contribute to boost the continent's sustainable development.

In fine, the outcome of the present AAP-GGIM, once implemented, should impact positively the SDI development agenda in Africa and give it an irreversible momentum.

4.1.4.5 Policy orientation for Geospatial and Statistical Information Integration in Africa

To optimize the outcomes of the AAP-GGIM, there is a need to set up and monitor a policy level mechanism, leading to a harmonious integration of Geospatial and Statistical information for sustainable development in Africa. To this end, specific orientation should be issued to guide a concerted development of Spatial Data Infrastructure (SDI) and Statistical Spatial Framework (SSF) at national level (NSDI and NSSF respectively) and sub-regional level (RSDI and RSSF respectively), with a coordination function at the Africa Region's level (ARSDI and ARSSF respectively).

In practical terms, the formulation of the policy orientation will be based on a needs and gaps analysis to be conducted at national, then sub-regional level. This analysis will lead to the definition of requirements for the delivery of information products designed to support the implementation of SDGs and AU Agenda 2063 objectives in Africa. To prioritise the SSF-related application needs in this context, the following key questions must be answered:

- What elements need to be provided through the SDI development process for successful applications of the SSF at all levels?
- What elements are readily available and which ones need to be produced?
- What is required from the SDI development side to timely provide the missing elements as input to the SSF implementation process?

A clear picture of the technical, organisational and financial implications of these new requirements will shape the content of the joint SDI_SSF effort at the required levels.

4.1.5 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 GIM Policy and Governance:

Goal

To enforce a specific GI Policy, continuously monitored for the best of SDIs processes and for SDGs and Agenda 2063 targets attainment for sustainable development, in every Member State in Africa, every REC and for the continental level.

Strategic Objectives and Key Expected Results

SO 1.1: Geospatial Information Management (GIM) is adopted as a critical development enabler by Member States in Africa;

R 1.1.1: A position paper on How GI can boost the attainment of the 17 goals of the UN Sustainable Development Agenda in Africa on one hand, and the 7 aspirations and their 15 objectives of the AU Agenda 2063, on the other hand, is published;

R 1.1.2: A strong advocacy action is taken throughout Africa using the Position paper to achieve policy level engagement of African Governments in adopting GI as a critical enabler for sustainable development of the continent.

SO 1.2: A specific geospatial information policy is in force in every Member State and every REC in Africa, under the SDI agenda for sustainable development

R 1.2.1 A comprehensive study on the state of national GI policy development and REC level GI policy availability serves as baseline for policy action planning in Africa

R 1.2.2 Needy Member States and RECs are assisted in the development of their respective GI policies

R 1.2.3 The development of national space programmes in Africa are guided and harmonised by the Africa Space Policy and the Africa Space Strategy

R 1.2.4 GI policy directives are disseminated to mainstream SATs attainment and Statistical GI integration processes into Member States and REC level GI policies

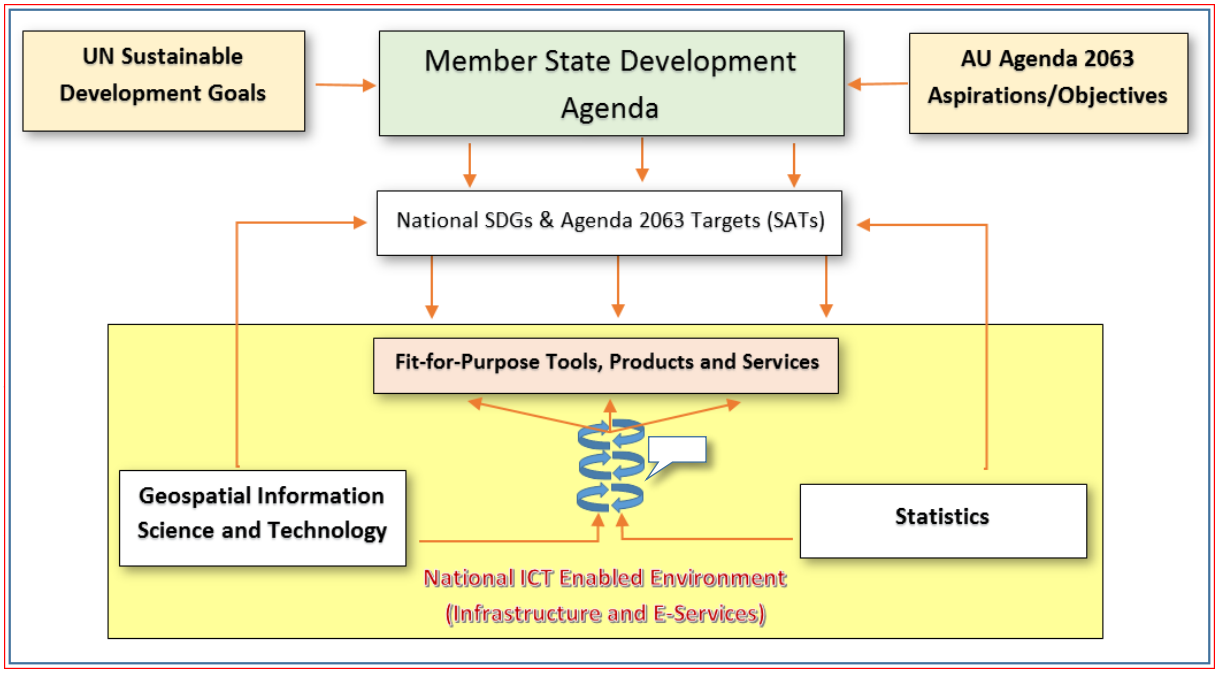
Details are provided in the consolidated logical framework (see 4.6.1 below)

4.2 COMMON FRAMEWORK AND TOOLS

4.2.1. Introduction

To achieve the UN-SDGs and AU Agenda 2063 targets at national, sub-regional and regional levels in Africa, good governance and sound policies in Geospatial Information Management are necessary, as shown in the precedent section. They will guide the way African countries, the RECs and the AU will get organised and operate in order to reap the best fruit of the GIM labour, as a rewarding contribution to the achievement of the SDGs and Agenda 2063 aspirations on the continent. In fine, it will be necessary to use the appropriate technological and scientific tools, in an enabling environment, within a common conceptual framework to deliver the expected results. Figure 1 illustrates the way to proceed, from SDGs and Agenda 2063, to the delivery of fit-for-purpose added-value information products and services over the AAP-GGIM first period 2016-2030. The **S**DGs and **A**genda 2063 **T**argets (SATs) are to be derived for national, sub-regional and the Africa Region levels.

Figure 1: Conceptual Framework of the AAP-GGIM for the national level



Thus this section discusses the current status of Geospatial Information Management (GIM) in Africa, some of the challenges facing efficient uptake of Geospatial Information (GI) in the continent, existing opportunities and some essential issues to consider towards the development of common framework and tools for GIM in Africa. The aim is to ensure that geospatial information permeate every aspect of society and are made available to people who need them, when they need them, and in a form useable to make decisions with minimal pre-processing.

4.2.2. Rationale: Need for a Common Framework and Tools

To be successful in this complex mission consisting of providing the best input to and drawing the best benefit from GI application to the sustainable development agenda of the continent, one needs to know where we come from, where we stand and where we would like to be after the implementation of the Action Plan.

The common framework helps to foster the efforts at all levels, and to optimise their impact on the expected results, while providing a clear view of the direction we engage in. As nowadays a plethora of tools is available, thanks to the opportunities offered by Science and Technology, it is wise to choose the most suitable to our goal beforehand. Hence the need to define, based on the targets, the GI-based tools to select and the GI products and services to deliver and to use.

4.2.3. Overview of Geospatial Information Status in Africa

An assessment of the current status of geospatial information in Africa is a necessary precursor for the development of meaningful and sustainable common frames and tools for geospatial information management in the continent. Unfortunately, a comprehensive study and documentation of the status of GI in the continent is lacking at the moment and perhaps should be one of the priority areas to be addressed in the GGIM initiative. However, noteworthy are the commendable efforts made or being made by various international, regional and national organisations such as UN-ECA, UNOOSA, UNEP, UNDP, AARSE, etc. to facilitate the uptake of EO and GI technology in Africa through the promotion of, among others, the Spatial Data Infrastructure (SDI) and Space Science and Technology (SST) in African countries. To make geospatial datasets available, discoverable, better accessible, shareable, interoperable and re-usable. UNECA's CODI/CODIST has paid much attention to the development of Spatial Data Infrastructure (SDI) in Africa, as earlier mentioned in the GI Policy and Governance section.

Within the SDI initiative and through the efforts of the CODIST-Geo Working Group on fundamental datasets as part of the Mapping Africa for Africa (MAfA) initiative, the following projects were already completed: definition and determination of fundamental geospatial datasets for Africa; catalogue of available fundamental geospatial datasets for Africa and gap analysis for all the countries; while the project on "Guidelines for Best Practices for the Acquisition, Storage, Maintenance and Dissemination of Fundamental Geo-spatial Datasets" is in progress, with the outline of the document and document specification completed.

At the regional level, ten themes of fundamental datasets have been defined but these datasets are either not available at all in many countries, or they are largely not available in the form and currency required to contribute to the fundamental datasets 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/databases are mostly not available; coherent and standardized geographic names are not available yet; while 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 datasets.

Further on the SDI initiative, a metadata profile for Africa has been developed but this has to be implemented in a case study to guide adaptation at national level.

Notable progress has also been made on the implementation of AFREF with about 65 IGS approved continuously operating GNSS reference stations (CORS) operational regionally within the AFREF project as at 2015, while many Member States have also established a number of CORS on their territories; for example, the Office of the Surveyor General of the Federation of Nigeria has, between 2008 and May 2013, established 15 zero-order GNSS Continuously Operating Reference Stations (CORS) in the Nigerian permanent GNSS Network (NIGNET)

Many countries have also contributed to the Second Administrative Level Boundaries (SALB) database, which is an important dataset for planning and implementation of development projects at national and regional levels.

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

Data accessibility is also improving through the increasing development of geospatial web portals in Africa such as SERVIR-Africa and AGIRN, and accessibility to geospatial information through Internet. However, according to the World Bank (2008), only 2% of the population of Africa has Internet access, thus effort has to be made to increase this number by huge investments either in communication satellites, or by improving the undersea cable infrastructure. Other initiatives like GEONETCast and PUMA/AMESD focusing on connectivity to transfer geospatial data sets to users are also noteworthy.

The use of Earth Observation (EO) satellite data to generate development information is rapidly improving in Africa as attested to by the 2008 USGS Remote Sensing in Africa cited above. This is especially so, following the launching of EO 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 of decision makers and civil society in the applications of EO and GIS. The availability of free archived Landsat data and SRTM DEMs and cheap alternatives like ASTER data are also making satellite data become more affordable. All these are expected to improve the production of fundamental datasets in Africa.

Specifically Nigeria's last EO satellites, NigeriaSat-2 and NigeriaSat-X were launched on 17th August, 2011. The NigeriaSat-X was built completely by Nigerian Engineers who were trained at the Surrey Satellite Technology Ltd. The satellite carries two pay loads: a 32m resolution (as continuation of NigeriaSat-1) and another 22m resolution sensor. NigeriaSat-2 is a highly advanced 300 kg Earth observation satellite with four multispectral channels with 2.5m spatial resolution in panchromatic mode and 5m 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.

The African Resource Management Satellite (ARMS) constellation programme has also been officially endorsed by the governments of Algeria, Nigeria, South Africa and Kenya, 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 ARMS initiative thus signalling its practical implementation with the expected improved availability of satellite

images for geospatial information production in Africa. The goals of the ARMS initiative include:

- Building on indigenous knowledge to develop and transfer satellite technology;
- Developing African human resources by means of joint participation and knowledge sharing; and
- 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 GI production, management and use in Africa.

In the area of GI capacity development, specialised regional Centres of excellence and Organisations exist. These include the following:

- Regional Centres: RECTAS (a bilingual Centre – English & French, offering education and training programmes at technical and postgraduate levels), RCMRD (short-courses and project training), AOCRS (networking), ACMAD (weather-related courses/projects), ARCSSTE-E (postgraduate courses in English), CRASTE-LF (postgraduate courses in French), AGRHYMET (short-courses/project training in French);
- National specialised institutions offering regular and/or short-term training programmes in GI, such as: CRTS (Morocco), CSE (Senegal), CERSGIS and Ghana School of Surveying and Mapping (Ghana), Federal School of Surveying (Nigeria);
- Universities and Polytechnics offering courses at diploma, first degree and postgraduate levels;
- Organisations/Professional Networks that regularly organise conferences and workshops such as: AARSE, EIS-Africa and African Leadership Conference on Space Science and Technology.

In the area of GI funding, the common trend is lack of proper funding of GI activities in the continent. For example, the 2008 USGS' Africa Remote Sensing Survey indicated that on the average, less than US$ 200 k was budgeted for geospatial information technology (GIT) by the respondent organisations in Africa. However, for countries that painstakingly funded GI, evidence now exists of positive returns on investment apart from the intangible benefits. For example, the Nigeria's Abuja Geographic Information Systems (AGIS) generated a total revenue of over N22.0 billion (approx US$145.0 million) and foreign currency up to US$ 2.2 million from September 2004 to November 2008.

4.2.4. Challenges facing GIM 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 GI in Africa. Some of these challenges are:

- Barriers to adequate access to Earth Observation satellite data - Getting archived and current images still poses a challenge due to selective coverage by producers; persistent clouds in the equatorial region; absence of permanent receiving stations in the region for the commercial high and medium resolution sensors, except for the African-owned satellites, and high cost of images. Even the images from regionally owned satellites are difficult to access by other African countries.

- Inadequate geodetic infrastructure Elevation data are not adequate in many African countries. As earlier indicated, 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 whereas 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 GI 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 utilisation and knowledge transfer - Many GI professionals, technologists and technicians in various organizations were trained in the obsolete methods of map production while the equipment base is also obsolete. To compound this 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 un-related tasks and are not able to utilise or transfer the knowledge gained to others. There is also a lack of participation in relevant international events and organisations due to financial constraint.

- Weak link or communication gap between policy level and GI expertise due to inappropriate strategy to generate awareness on the benefits to be derived from GI 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 & Communication technologies offer tremendous opportunities but changes are often so rapid for organisations and personnel to catch up with usually due to financial constraint to purchase updates or re-train staff.

- Uncoordinated planning, design and implementation of development projects due to donor preferences, closed focus areas/sectors, and coordination gap or link 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 GI technology in Africa is largely constraint by non-availability of efficient national infrastructures, from information and communication to power including widespread 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 seven percent economic growth in order to halve extreme poverty by 2015 and to reach the millennium development goals. Despite the appreciable growth recorded in ICT infrastructure a 2008 World Bank report indicated that only 2% of the population in Africa have Internet access as at 2008; this figure moved to 26.8% 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

the cost as the Internet Service Providers within the countries require huge foreign exchange to pay for the Internet backbones located outside Africa. The power sector is particularly worrisome in many countries. Inefficient electricity supply affects utilisation 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 N6.7 billion (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% 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 organisations do generate some income which is by law paid directly into the Government treasury but which the organisation has no access to and in fact 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 GI in Africa is often limited due to some institutional barriers. As earlier mentioned in the previous section, 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 this sector. Similar challenges come from the restriction or ban on the use of Unmanned Aerial Vehicle (UAV) for GI production in many countries.

4.2.5. Opportunities for Geospatial Information Management in Africa

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

- Availability of African national EO and communication satellites, which are essential data infrastructure components that, if properly co-ordinated, can contribute immensely to this process.
- On-going global and regional initiatives such as GMES and Africa, UNSPIDER, GEOSS, former AMESD and various internationally supported national land reform programmes through which fundamental datasets are being made available and capacity are being built upon, as well as support of international geospatial organisations for regional development programmes such as the ICA's Working Group on MAfA, ICA, ISPRS, IAG and FIG
- Availability of adaptable best practices e.g. GSDI, INSPIRE
- Availability of regional capacity building structures/networks such as AARSE, EIS-Africa, etc. and Centres of Excellence such as RECTAS, RCMRD, ARCSSTE-E, CRASTE-LF, SEAMIC, ACMAD and AGRHYMET; as well as high-quality national capacity building institutions; and
- Availability of open source software and global data.

Current advances in space and Geo-ICT technologies offer great opportunities for effectiveness of UN-GGIM: Africa. Of particular interest to this initiative are:

- Use of global datasets on Africa, including - but not limited to - SALB datasets, Google Earth/Maps, free GlobeLand30[1], free EO archive data, DEM, future ARMS constellation data, AMESD/MESA/GMES-Africa datasets, etc. to build and share fundamental datasets at cheaper rates;
- Cloud computing especially for the storage of high volume geospatial datasets in the cloud;
- UAV/UAS Technology emerging as a new exploration means, and pictures taken from UAV 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 (VGI) / Community mapping, Participatory GIS offering possibilities for continuous updating of some datasets such as roads network, built-up areas, addressing extension, etc.;
- Use of free and open source software, especially for metadata catalogue and clearinghouse implementation;
- In the EO domain, nanosatellite technology, developed from the cubesatellite idea, is a low cost solution in research to quickly acquire practical knowledge and experience in EO satellite design, building and launch.

4.2.6. Basis for the development of common frameworks and tools for GIM in Africa

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

4.2.6.1 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 AFREF as well as other national geodetic control points. As indicated earlier, many countries have established CORS apart from those established under the AFREF project; therefore, immediate inventory of the already established CORS 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

[1] GlobeLand30, promoted during the Fourth High Level Forum on GGIM in April 2016 in Addis-Ababa 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 dataset was donated to the UN on Sept 22, 2014. The two-date coverage (2000 and 2010) allows to map land cover changes on the basis of the following ten classes: cultivated land, forest, grassland, shrubland, wetland, water bodies, tundra, artificial surfaces, bareland and permanent snow and ice. Among the many possible applications these datasets can be used for, two land cover datasets (2000 and 2010) are readily available for Africa. These can be used to derive an Africa-specific Land Cover dataset - one of the fundamental datasets (with a consensus-based number of LC classes) in combination with other data sources if needed.

optimize the design of national networks. Similarly, the national network design should guide the second administrative levels (states, regions, districts, provinces, etc.) in locating CORS in their jurisdictions. International and national development programmes that include establishment of CORS (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 the national CORS should be compliant with the UN General Assembly Resolution 69/266 of February 2015 – A 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 AVN stations could be used for geodesy purposes as well.

4.2.6.2 PRODUCTION OF FUNDAMENTAL DATASETS (FDS)

Even though an inventory of existing FDs had been carried out some years ago as reported above, certainly some countries must have undertaken (or currently undertaking) mapping activities internally. Thus an update of the inventory is essential. The updated inventory should include the current status of all the ten fundamental datasets and Street Address Catalogue at the minimum. It should also include the status of the national fundamental datasets 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 e.g., 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 datasets should be informed by the needs expressed by users. However, the neglected marine and inland waters by GI activities, highlighted by the SDGs, call for a careful insight into this issue while reviewing the FDs for Member States, RECs and the whole continent. The information required for the indicators of the SDGs and Agenda 2063 Aspirations/Objectives should be a key driver for GIM in Africa, as explained in the "***Strategy for National GI Policy Development***" paragraph, 3rd bullet, in 4.1.4.2 above). Reliable and relevant fundamental datasets 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 socio-economic development enabler in Africa.

Early completion of the "Guidelines of Best Practice for the Acquisition, Storage, Maintenance and Dissemination of Fundamental Geo-spatial Datasets", started by the (former) CODIST-Geo Working Group on FDS for the Mapping Africa for Africa initiative will contribute significantly to the production of FDs 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 space faring nations (Algeria, Egypt, Nigeria and South Africa) should be encouraged for the production of the FDs 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 to be spearheaded by a joint AUC-ECA SST in consultation with the ARMS 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 EO satellites with other African

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

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

Geospatial information relating to the marine and inland water environments is often neglected. The SDGs recognise the importance of these environments and as such the collection and management of information on marine and inland waters must be included with other FDs.

4.2.6.3 DEVELOPMENT OF METADATA, GEOSPATIAL STANDARDS AND GEOPORTAL

Availability of multi-scale geospatial standards is a *sine-qua-non* condition for efficient GIM-in Africa. Consequently, UN-GGIM: Africa has a working group dealing with geospatial standards, likewise at the national level in various countries as part of the SDI process. The geospatial standards working group of CODIST-Geo 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 national level. The working group in collaboration with regional and international partners also needs to prepare profiles for all the fundamental datasets and components of geospatial standards:

- ***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/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/product distribution standards*** (Policies, Catalogue and fee schedule for products/services, Procedures for responding to and tracking requests); and
- ***Software and application standards*** (GIS software package(s), GIS-related software packages, RDBMS standards, Application development software standards, Application design and documentation standards).

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

a) Inventory, review & evaluation of existing national standards
b) Review of existing related international standards
c) Development of the draft national standards in conformity with generic ISO standards
d) Registration of the national standards with the national standards organisations and ISO
e) Development or adoption of standard terminologies
f) Publication of the supported standards for use by the GI community
g) Development of best practice guidelines & advice on application of the standards

Furthermore, development of standardised geographical names in collaboration with UNGEGN and UN-ECA, and the establishment of geographical names authorities in African countries should be encouraged as recommended by CODIST-II.

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

In this regard, (1) African countries should be assisted by UN-GGIM: Africa to develop such national geospatial platforms, and (2) RECs to set up and operate sub-regional geospatial platforms, especially designed to deliver REC-level information products, to be used in GI application to SDGs and Agenda 2063 implementation at that level.

4.2.6.4 FUNDING OF GEOSPATIAL INFORMATION ACTIVITIES

An effective funding model is necessary for sustainable and successful GIM in Africa. Such model can include strategy for public private partnership (PPP) for the production of key geospatial datasets. However, 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 in allowing the agency to spend a certain percentage of its internally-generated income on its mapping activities. The percentage could be determined by 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 agency to be properly funded and thus be in a position to implement new innovation systems in its production strategies.

Opportunities such as funding facilities offered by (1) African institutions like the African Development Bank, NEPAD, (2) multilateral and bilateral donor or development agencies like the UN institutions (UNDP, UNEP, etc.), the World Bank, the European Union, USAID, China, Japan, France, Germany, etc. have to be explored and funding secured for the AAP-GGIM. Financial support should be provided either as a direct contribution to the UN-GGIM: Africa core budget, or through funding specific program/projects identified in the AAP-GGIM.

On-going initiatives, and imminent major projects in Africa should be approached to explore and assess the possibility to use part of their financial resources to implement in partnership some of their activities through AU-GGIM: Africa.

However, a long term solution to GI funding in Africa could be drawn from the experience of the ICT community, with their Universal Access and/or Service[2] (UA/S) concept, built into ICT policies in recent years, and funded under the Universal Access and Service Fund (UASF) principle.

4.2.6.5 CAPACITY BUILDING AND TECHNOLOGY TRANSFER

In geospatial information (GI) production and management, advances in space and information technologies have impacted positively human capacity globally through availability of geospatial information technology (GIT) tools. To be fully utilized however, the acquisition of GIT 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.

4.2.6.6 INFRASTRUCTURE SUPPORT

Effectiveness of UN-GGIM: Africa requires an efficient infrastructure support, especially electrical power and ICT.

It is noted that a few number of African countries, including Egypt, Nigeria and Morocco have communication satellites. The services of these satellites should be maximised as much as possible to promote regional development in Africa through special pan-Africa price regime that will contribute to appreciable increase in the density as well as 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 EO 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, especially realizing 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 (UASF) 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 : http://www.ictregulationtoolkit.org/).

4.2.6.7 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 (CCMEO) is of particular interest as they contract certified private companies to deliver EO-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 GI service providers and consolidates the role of the private sector as an active player of GIM in the country.

4.2.7. Summary of Goal, Objectives and Results for Common Framework and Tools

The following Goal, Strategic Objectives (SOs) and Results (Rs) will guide the development of Common Framework and Tools for Africa's GIM

Goal

A Common Framework for the delivery of Fit-For-Purpose tools, products and services, generated from the integration of Statistical and Geospatial Information (NSSF), and GI-based tools are adopted and applied for UN-GGIM: Africa.

Strategic Objectives and Key Expected Results

SO 2.1 Africa Member States take action to use GI for the attainment of the SATs

R 2.1.1 The national SATs are used to design SATs-related, GI-based Added-Value Information Products and Services (AVIPS);

R 2.1.2 The national sets of SATs-related AVIPS are aggregated into sub-regional sets of AVIPS for the RECs, and the latter aggregated into sets of AVIPS for Africa as a region

SO. 2.2 A high quality ground level infrastructure is strengthened for sound GI production in Africa

R 2.2.1 National and regional geodetic infrastructure is further developed with CORS networks and other GNSS-based techniques, in fulfilment of UN General Assembly Resolution 69/266 on GGRF

R 2.2.2 Support is provided to the ground level Infrastructure

SO 2.3 Fundamental Datasets (FDs), Metadata, Geospatial Standards are Developed and Geo-portals set up for GIM in Africa

R 2.3.1 Fundamental datasets are produced for Africa with the support of WG2 on FDs 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 UN-GGIM: Africa agenda and funding mobilized

R 2.4.1 Public-Private Partnership is enabled for GIM in Africa

R 2.4.2 New scientific and technological opportunities are used for a better GIM in Africa

4.3 CAPACITY DEVELOPMENT AND KNOWLEDGE TRANSFER

4.3.1 Introduction

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

A handful of nations have implemented comprehensive GIM 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 (LVWATSAN), Kenya Open Government Data Portal, and South Africa's National Spatial Information Framework. Despite the huge potential for catalysing progress in development, however, examples of comprehensive GIM 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 GIM initiatives, and the substantial coordination problems that such efforts must overcome.

The section discusses the subject of capacity development using the United Nations Development Group (UNDG) Capacity Development methodology overlaid with the African Union (AU)/New Partnership for Africa's Development (NEPAD)'s Capacity Development Strategic Framework (CDSF)[3]. It emphasises a shift from stop-gap, supply-driven measures to 'build' capacity, to a more comprehensive, holistic, vision-driven, long-term transformative development process that had internal energy to sustain itself over time.

4.3.2 Rationale: Need for a New Capacity Development Approach

Efforts to build capacity in GIM 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 GIM 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 GIM have continued to expand in scope and relevance, but without a strong demand-driven agenda for building capacity in GIM, the outcomes of such efforts will continue to fall short of their true potential. In particular, efforts to develop capacity in GIM in Africa have been largely piece-meal, short-term, and context-dependent.

[3] The Capacity Development Strategic Framework (CDSF) 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 CD, and attempts to address the problem of fragmentation by forging a common approach, and with needs as defined by Africans. It has been endorsed by the Africa Union Assembly of Heads of State in February 2010.

This is why the development of capacity is necessary—to support the operative requirements of GIM 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.

4.3.3 Status and Review of GIM 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 of a few professionals, mainly from the Surveyor-General departments, and equipping these organisations 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 integrated development information needs. A legacy of these programmes include regional training centres (RECTAS, RCMRD, etc.) which still run training and service programmes to support member governments.

The environment movement in the '80s 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 UN system, led by the United Nations Institute for Training and Research (UNITAR) and the United Nations Environment Programme (UNEP), 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 Program on Environment Information Systems in Sub-Saharan Africa (EIS Program), the first Africa-wide initiative to facilitate capacity building in spatial information management at a scale sufficient to have a long-lasting impact.

The AfricaGIS and the African Association of Remote Sensing of the Environment (AARSE) conference and exhibition series were launched as part of the knowledge exchange and learning process associated with the Program. The Program also spawned off several sub-regional initiatives aimed at strengthening capacity, including the Southern Africa Development Community (SADC) EIS Programme launched in 1993; the Regional Environmental Information Management Programme for Central Africa in 1998; and the Regional Integrated Information System of the Inter-Governmental Authority on Development in 1999.

The EIS initiative spun off many new agency- and mandate-related capacity building initiatives in the '90s. Notable among these were:

- UNEP's *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* initiative launched by the Food and Agriculture Organisation (FAO) in 1994 to build capacity to establish and maintain, for the whole of Africa (at sub-national, national and regional levels), a digital geo-referenced database on land cover and a geographic referential base including: geodesy, toponomy, roads, and hydrography; and
- UNITAR's implementation 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' (SDI). However, by its very nature EIS was a 'native SDI'. 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 formalised concept of national SDIs brought much needed order to a chaotic world of competing GISs; many African countries went on established National SDIs.

These initiatives did yield significant capacity outcomes. Among these were the following:
A cadre of GIS/EIS professionals emerged across Africa from a wide variety of backgrounds and application areas;

a) Existing institutions were strengthened and new institutions were created for the purpose of training and providing geospatial information services;
b) In some countries policy frameworks to support the development, exchange, and application of geospatial data were put in place;
c) Institutional arrangements to facilitate the production and exchange of harmonized geospatial datasets were put in place;
d) An active, pan-African network or community of geospatial information practitioners emerged;

In this landscape, the UNECA - 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 GI training in Africa, in particular the RECTAS, RCMRD, the former CRTO, were created under the aegis of the Economic Commission for Africa of the United Nations back in the 70s. ECA's position paper in 2001 on"The Future Orientation of Geoinformation Activities in Africa" was a very important milestone. It formally marked the transition in Africa from EIS as an institutional and technical response to the need to improve the role and benefits of information in environmental management, to SDI as it is widely understood and used today. The paper provided guiding principles for advocacy and recommendations for the development of SDI as the appropriate mechanism for making reliable

information easily available for policy, investment, planning, management, monitoring and evaluation purposes at the regional and sub-regional scales.

4.3.4 Basis and Elements of GIM Capacity Development in Africa

It is emphasised that the use of the term 'capacity development' in this paper 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 institutionalised and brings about improvements in performance, stability and adaptable institutions and institutional frameworks requires a fundamental shift from a supply-driven stop-gap paradigm to a demand driven, transformative process that is founded on the following:

a) Facilitates multi-stake-holder engagement;
b) Facilitates access to knowledge;
c) Promotes participatory policy dialogue and advocacy;
d) Reflects and integrates with the broader development context; and
e) Creates space for learning by doing.

Details of basic principles in the Capacity Development approach are provided as an appendix to this Action Plan

4.3.4.1 Definition of Capacity Development

Capacity development, in contrast with project-oriented capacity building often implemented through technical assistance, is therefore not a one-off activity, but an on-going 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:

> "Capacity is defined as the ability of people, communities, organisations, 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.
>
> "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)."

4.3.4.2 NEED FOR A HOLISTIC STRATEGY FOR GIM 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 SDI-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 elements[4]:

- Data availability and accessibility (including mechanisms for discovery) in the form(s) that users require (see under 4.2.5.4 above African Convention on Public and Easy Access to Geospatial Information for Development) ;
- Establishment or strengthening and maintenance of GIM service centres to provide support and expert advisory services;
- Skills to collect, build appropriate datasets, 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/exchanging and 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; GIM 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.

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

[4]Based on Feeney, M-E.F., Williamson, I. P., & Bishop, I. D. (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)

stakeholders that have been involved in previous capacity building initiatives, strategies must explicitly seek to build partnerships with individuals and organizations from fields that have not formally been aligned with GIM 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 datasets in many regions, sophisticated infrastructure platforms for disseminating data, and extensive networks for engaging researchers and policy-makers.

The ICT community is a particularly attractive partner for practitioners of GIM 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 GIM and SDI, and vice versa.

Public/Private Partnership

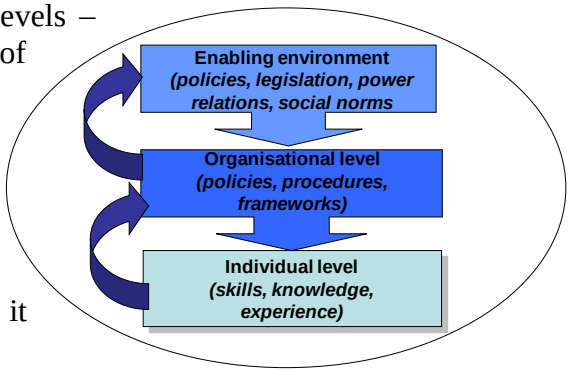
A capacity development strategy for GIM activities should have a strong partnership component. The private sector has been the primary driver in the uptake and near-ubiquity of geospatial information applications as we know them today, and national strategies should build Public-Private Partnerships in order to benefit from the expertise and resources from 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 to/for partners who should commit to support 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, sharing best practices and lessons learned.

Partners should commit to facilitating access, working at 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 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 inter-relatedness, 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 optimisation 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 GIM leaders identify the most productive uses of geospatial information (ranging from which data to disseminate to the structures of SDI).

Interventions must also focus on strengthening linkages between education and training organizations on the one hand, 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 capacity development in geospatial information, by facilitating the transfer of knowledge, resources among individuals and among 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 the effort of such organizations.

Change and Change Readiness

Introducing information systems often requires, and causes changes. Societies that have understood, developed, or/and adapted policies, legislation, systems, and business processes to this reality, have, and continue to, benefit from 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 SDI. 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 (e.g., NEPAD, the Kenya Open Government Data Portal, among others). The

experience in North America and numerous European countries demonstrates the potential for geospatial information and SDI 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/or 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, and there are many examples of highly trained skilled individuals who are unable to function at their full potential because the organisational 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, open-minded and positive attitudes in using the related technology, that gives information and knowledge its strategic importance, 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 the entire society is 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 the whole society needs to be capacitated in order to bring about change. This requires that the capacity development strategy for geospatial information should not only address technician and policy makers, 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.

4.3.4.3 CAPACITY DEVELOPMENT SUGGESTIONS FOR THE 2016 - 2030 PERIOD OF THE ACTION PLAN

The holistic approach applied to GI4SD over the 2016 - 2030 period could consist of the following actions, to be refined based on the deep review of the GI Capacity in Africa:

GI Governance and policy

At GI policy level, needy countries should be assisted, not only to develop their national Geospatial Information policies (see 4.1.4.2 above), but also to undertake measures aimed at creating the institutional capacities necessary to generate the full potential of Geospatial

Information Management (GIM) as a driver of economic growth and development. At the GI governance level, this entails institutional reforms to better reflect the basic principle of Separation of powers, whereby the GI policy development and monitoring role is separated from that of GI production, and private sector stimulation through PPP is effective. At continental level, coordination of policy efforts for a better utilisation of present and future space programmes complaint with the Africa Space Policy and Strategy is essential for the capacity development at policy level.

The UN-GGIM:Africa Working Group on Institutional Arrangements and Legal Frameworks (WG 3) should be assisted to play a key role in ensuring quality GI Governance at all levels in Africa.

Common Framework and Tools

The outcome of the baseline study on Fundamental datasets and standards will shape the Capacity Development action in this domain. However, there is evidence of the need to empower the GI and Statistics communities to work together in order to develop jointly Added Value Information Products and Services for the attainment of the SATs. Therefore capacity development efforts should target:

- Human individual capacities to design and contribute to fit-for-purpose AVIPS at national, sub-regional and continental levels;
- Institutional capacities to produce, deliver and disseminate these AVIPS for the Member States and the RECs (including technological platforms and their operational requirements, CORS and Other GNSS-based techniques deployment, promotion of new technological opportunities including UAV, VGI, etc.);
- Enabling environment in terms of regulations and institutional arrangements profitable to this collaborative work involving GI experts and Statistics experts for Africa's sustainable development.

Capacity Development

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

The various integration areas should be explored more deeply in order to formalise where necessary the required arrangements between disciplines (ICT, GI, Statistics). In particular NSSF should be given full attention as an implementation tool for the SDGs and Agenda 2063 implementation.

Specific research should be initiated in critical domains such as adequate funding solution for GIM 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 GI, in view of develop accurate mapping solutions for below water surfaces and their natural resources.

4.3.5 Summary of Goal, Objectives and Results for Capacity Development and Knowledge Transfer

The following Goal, Strategic Objectives (SOs) and Results (Rs) will guide Capacity Development and Knowledge Transfer for GIM in Africa, over 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 GIM is developed in Africa

R 3.1.1 An accurate and comprehensive knowledge of the state of Africa's GIM capacity for SATs production is available to support the demand-driven capacity development planning for the AAP-GGIM;

R 3.1.2 Targeted actions are taken to enable SATs-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 ECA's Technological capacity;

R 3.1.4 Targeted actions are taken to improve university and high School curricula;

SO 3.2: Infrastructural capacity in GIM is built in Africa

R3.2.1 A series of national level comprehensive studies are carried out on key components of the SDI

SO 3.3: Individual capacity in GIM is built in Africa

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

Details are available in the consolidated logical framework of the AAP-GGIM (see section 4.6 below)

4.4 INTERNATIONAL COORDINATION, COLLABORATION, AND COOPERATION IN MEETING REGIONAL AND GLOBAL NEEDS

4.4.1 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 sub-regional 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 the precedent 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 work to influence both the policy level, and the 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 organisations, and to facilitate their use and application in the various fields of sustainable development, is the answer to ECA's successful agenda on GIM in Africa.

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

This section discusses international coordination, cooperation and collaboration in general in the GIM domain highlights several of the most prominent options, describes their actions, and considers some strategy options of interest to the AAP-GGIM.

4.4.2 Rationale: Need for a sound International Coordination, Cooperation, and Collaboration in development effort for GGIM 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, of both financial, and human nature or material, can be wasted and development objectives missed.

As far as the UN-GGIM initiative is concerned, its design and early development process so far has been conform to openness and synergy building. Indeed, a large and long consultation process took place, since the beginning of the 2010 decade, in an inclusive spirit, gathering all the stakeholders. In Africa, one can say that the good connections with past achievements were made, so that only the financial resources are being gathered 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, reason why it is of utmost importance that, in a proactive manner, the critical issue of coordination, cooperation, collaboration in development efforts be addressed in the action plan.

4.4.3 Basis for International Coordination, Cooperation, and Collaboration in development effort

4.4.3.1 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 GI4SD document.

Coordination
It 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." (from the Business Dictionary).

By Coordination in our context, we are talking about the consensus-based function assigned to who (what institution) is responsible for consulting, planning, distributing the tasks, allocating the related resources, following up on the 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).

By this term we understand that there is an voluntary agreement between UN-GGIM:Africa and its stakeholders as the latter consider that it is of their interest to work together toward the overarching goal of GIM in Africa.

Collaboration
Three aspects are distinguished with this term:

1. General: "Cooperative arrangement in which two or more parties (which may or may not have any previous relationship) work jointly towards a common goal." (from the Business Dictionary);
2. Knowledge Management (KM): "Effective method of transferring 'know how' among individuals, therefore critical to creating and sustaining a competitive advantage. Collaboration is a key tenet of KM." (from the Business Dictionary).
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." (from the Business Dictionary).

This term is more generic than the two first and may, in the general sense, be close in meaning to cooperation. However, in the GI4SD environment, we will use this term for occasional interaction with UN-GGIM Africa for a limited period of time. Therefore, UN-GGIM: Africa will collaborate with specific partners for specific action on specific periods of time. It is very explicit in the Knowledge Management context.

4.4.3.2 SUGGESTIONS FOR UN-GGIM COORDINATION

Two levels of coordination should be distinguished: (1) the global level coordination performed from the UN-GGIM Secretariat based in New York, and (2) the regional coordination level for Africa, assumed by the UNECA, in its capacity as UN-GGIM: Africa Secretariat, following the decision taken by the same UN-GGIM: Africa 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 RECs, for example for the harmonisation of GI policies at sub-regional levels, if this is not against the governance rules at global level. In any case, such delegation of "coordination powers" does not lift ECA's institutional responsibility and accountability as a regional Coordination body for Africa. ECA remains accountable for its overall performance, including that of its power-delegated entities (if any).

4.4.3.3 SUGGESTIONS FOR COOPERATION WITHIN UN-GGIM:AFRICA

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

Mapping Africa for Africa

The Mapping Africa for Africa (MAfA) initiative was launched by the UNECA, the Government of South Africa, and the ICA, and functions to spur the development of geospatial information resources in support of the (previous) Millennium Development Goals (MDG) and now the UN SDGs and AU Agenda 2063, and the goals of New Partnership for Africa's Development (NEPAD). The Catalogue of Fundamental Geospatial Datasets 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 the MAfA initiative.

The MAfA initiative attracted significant attention to the value of SDI among African governments. Much of this attention has focused on efforts to capture or consolidate geospatial information identified in the Catalogue of Fundamental Geospatial Datasets.

Cooperation with this initiative will for example ensure smooth continuity of actions taken under the MAfA project, while allowing UN-GGIM: Africa to capitalise on these achievements, learn from the experience acquired in areas such as fundamental datasets development, ISO standards and metadata profile development, etc.

Standards and Interoperability

Standards are of absolute necessity 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 (OGC) 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 OGC certification has become more and more valuable.

Knowing that the foundation of accurate geospatial information starts with a uniform coordinate reference system, ECA pursues in partnership with the African Union Commission its effort to develop the African Geodetic Reference Frame (AFREF) 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 geo-referencing (e.g. 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 aimed that there should be at least one IGS station in every country. When completed, it is envisaged that users will not be more than 1000 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 of importance on various societal benefit areas, namely: climate change, peace and security (border issues), trans-boundary resources management, economics, etc.

UNGGIM: Africa will work in cooperation with the AFREF project, which explains the fact that the first Working Group set up under UN-GGIM: Africa is on AFREF. UN General Assembly resolution 69/266 of February 2015 reinforces this action and provides it full legitimacy for the whole continent

GEO/GEOSS/AfriGEOSS

The Group on Earth Observations (GEO) 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 (GEOSS), to focus on nine "Societal Benefit Areas", namely disasters, health, energy, climate, water, weather, ecosystems, agriculture and biodiversity. Furthermore, the GEO 2016-2025 Strategic Plan outlines eight Societal Benefit Areas (SBAs), which are the domains in which Earth observations and geospatial information are translated into support for decision-making. These domains are: Biodiversity and Ecosystem Sustainability, Disaster Resilience, Energy and Mineral Resources Management, Food Security and Sustainable Agriculture, Infrastructure & Transportation Management, Public Health Surveillance, Sustainable Urban Development, Water Resources Management.

In Africa, 27 Member States and seven Africa-based Participating Organisations, participate to some degree in GEO/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's objectives and programmes for Africa's benefit through the AfriGEOSS initiative. The concept of the AfriGEOSS initiative was fully endorsed by the GEO-IX Plenary in November 2012, with several GEO Members and POs expressing their willingness to provide contributions. The initiative was then officially launched on 5 November 2013 during the joint Africa GIS 2013 and GSDI 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 mechanism, such as already been put in place in South Africa, SA-GEO. 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 having environmental indicators taking into consideration access to geospatial and earth observations data and information. Indicators based on environmental parameters have been lost in the globally defined SDG indicators. We also need to stress the use of EO and geospatial information in achieving the goals not only 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.

Also recognizing that the national mapping agencies are not the sole custodians of geospatial data and hence are expected (by UNGGIM) to coordinate at national level the use of geospatial data and engage with the national statistical agencies in support of SDGs. The GEO national coordination mechanism, strengthens this aspect of the work, as all national relevant entities are represented.

GEOSS has addressed the needs identified under Title 4.3 above, through its Capacity Building Working Group, and through efforts to raise the stature of SDI initiatives within members' governments.

As highlighted under the GI Policy and Governance section on one hand, and the Common framework and Tools section on the other hand, the space sector is key to Africa's future in terms of availability and access to EO data. Cooperation with GEO/AfriGEOSS can only boost the achievements in this field, especially through synergy of action between their Societal Benefit Areas (SBA) and the SDG s and Agenda 2063 driving our GI4SD document. The GEO Work Programme includes an Initiative on Earth Observations in Service of the 2030 Agenda for Sustainable Development http://www.earthobservations.org/activity.php?id=52. UNGGIM is part of the Task Team leading this task. The Initiative is looking for pilot countries to showcase the use of EO and geospatial information in achieving the SDGs and also pilot the integration of this information with the statistical data.

The GSDI Association

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

The GSDI has been a consistent supporter of SDI initiatives on the African continent. Examples include the monthly SDI-Africa Newsletter, the GSDI Small Grants Program, and a series of

trainings offered in partnership with local organisations (for example, in Swaziland and Lesotho). These activities have directly addressed some of the needs identified under 4.3 above : "Capacity Development and Knowledge Transfer", in particular by providing funding for SDI-related initiatives (GSDI small grants) and by strengthening human capacity.

Cooperation with the GSDI Association is key to UN-GGIM: Africa as this association has been an active player on the SDI development agenda in Africa, particularly in networking, SDI-related information dissemination, and incentives for SDI components advancement through the Small Grants program. Funding agreements may emerge from a well negotiated cooperation profile between the two entities.

In addition, GSDI is part of the Joint Board of Geospatial Information Societies (JBGIS), which would be an opportunity for UN-GGIM: Africa to broaden its partnership horizon and increase win-win cooperation opportunities.

Global Monitoring for Environment and Security in Africa (GMES &Africa)

GMES & Africa is a Pan African Initiative, and partnership between the African Union Commission (AUC) and the European Union (EU). Started in 2015, the GMES & Africa initiative, addresses the need for improved environmental monitoring towards sustainable management of natural resources, water resources, coastal and marine resources in the five sub-regions of Africa.

GMES & Africa's was designed based on the experience gained from previous programmes such as African Monitoring of Environment for Sustainable Development (AMESD) and Monitoring for Environment and Security in Africa (MESA), with the objective to provide 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 program 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 & Africa extends the operational use of Earth observation technologies and data from meteorological to environment and climate monitoring applications. The initiative will enable all African national and regional institutions focusing on 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 & 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 national level.

Cooperation with GMES Africa is essential from many viewpoints: GMES Africa promotes the concept of GMES, based on free access to EO data for environment and security (weather-related security). Also interesting is the notion of "services" readily useable by particular user groups, in the context of GI production and dissemination. These trends and new developments

are important to consider from UN-GGIM: Africa side, in order to harmonise the policy options the continent is exposed to.

UN-SPIDER

The United Nations Outer Space Affairs (UNOOSA), as one of its objectives to assisting developing countries in using space technology for development, has been working in awareness raising and capacity building in Africa. In its resolution 61/110 of 14 December 2006, the United Nations General Assembly agreed to establish 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 working in disaster risk management.

UN-SPIDER aims at providing universal access to all types of space-based information and services relevant to disaster management by being 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.

UN-SPIDER provides training opportunities to facilitate the development of knowledge and skills of individuals regarding the use of space-based data and information for disaster and risk management. Since, Capacity Building goes beyond the training of individuals, Institutional strengthening through UN-SPIDER activities also aims 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 the capacity building, UN-SPIDER conduct awareness and outreach activities at the international and regional level Based on awareness campaigns, outreach workshops and other related activities, UN-SPIDER offers Technical Advisory Support (TAS) at the national level. It has also regional support offices in countries in Africa.

Cooperation with UN-GGIM: Africa can be seen as an opportunity for the latter to broaden its scope by providing EO-based and ground level GI data into the disaster risk reduction (DRR) field in Africa, and possibly benefit from some facilities such as the training opportunities to ease the development of knowledge and skills of individuals. Areas of cooperation with mutual benefits to both parties are obvious, not mentioning the possibility to tap into some funding resources for joint activities.

SERVIR-Africa

SERVIR is the Regional Visualization and Monitoring System for environmental management and disaster response. Developed in 2005 at the behest of the eight countries of Mesoamerica, 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 (Water Center for the Humid Tropics of Latin America and the Caribbean), another SERVIR’s regional operational facility for Mesoamerica and the

Caribbean, partnered with RCMRD to setting up SERVIR's East Africa node, building upon RCMRD's existing strengths, and augmenting RCMRD's 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, as well as improved products to address flood forecasting and Rift Valley Fever using unique NASA space-based assets.

USAID and NASA just launched SERVIR West-Africa on July 14, 2016 at the AGRHYMET Regional Centre in Niamey, Niger. Cooperation with this initiative will definitely be profitable to both UN-GGIM: Africa and SERVIR, as their objectives converge and their common means of operation is Earth Observation. In addition, this node being the second on the African continent after the opening of SERVIR East Africa, this initiative has already accumulated some practical experience of operation in Africa that UN-GGIM: Africa can tap into.

This list is not exhaustive and others may have been overlooked or may be imminent, or launched in the coming years. UN-GGIM: Africa should monitor the development cooperation field continuously, to be able to identify and take advantage of new cooperation opportunities.

There is no need to mention that other stakeholders or subsidiary bodies of the UN-GGIM initiative such as the global Working Groups or UN-GGIM: Africa's own Working Groups, or GI professional organisations operational in Africa such as EIS-Africa, AARSE, are de facto potential Cooperation partners of the UN-GGIM: Africa implementation process.

4.4.3.4 SUGGESTIONS FOR COLLABORATION

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

4.4.4 Opportunities and intervention points

The above examples of GIM-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 real contribution of GIM to sustainable development. In this regard the present AAP-GGIM takes the option to build on past achievements and strengthen international cooperation and collaboration around the GIM issue in Africa. A contemporary best practice is to focus on geospatial information management in applications and the importance of "quick wins." Following are strategy options of interest to the AAP-GGIM

4.4.4.1 USE OF GEOSPATIAL INFORMATION IN STRATEGIC PLANNING AND GOVERNANCE

The South African experience points to the potential for geospatial information to support strategic planning as well as overall government decision-making at all tiers of government (local district to international). Not only does this approach elevate and recognize the crucial role of geospatial information for 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. From this point of view, setting the frame of reference became the fundamental task of the national spatial guideline. Spatial frameworks established an overarching mechanism to provide a 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.

4.4.4.2 MAINSTREAMING GEOSPATIAL INFORMATION INTO BROADER INFRASTRUCTURES

As an emerging field that has quickly become a valuable asset to planning initiatives, information communication technology (ICT) shares a common role and history with geospatial information technology. More importantly, the integration of the two rapidly developing fields can help governments improve their services and businesses, 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 Infrastructures (NICI's) 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 has been ICT and geospatial information policy that promotes economic development, but through a people–centred, inclusive framework. For example, the policy focuses 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 programs

This policy framework is a new approach, and a promising model for how to integrate geospatial information in governance. Additionally, incorporating geospatial information policy into broader ICT, which is often well funded, could provide the necessary funding to see NSDI have a firm financial foundation and receive prioritisation from Government.

4.4.4.3 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 countries progress in achieving their 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.

4.4.4.4 SYNERGY OF ACTION

Geospatial Information Management is by nature under multi-stakeholders responsibility, as described under the GI Policy and Governance chapter (see 4.1.2 above). As a multi-stakeholder endeavour, GIM can only succeed with a close cooperation between the actors, in order to get the most efficient form of contribution from each partner. In this regard, it is essential that not only the technical capacity or scientific expertise of partner institutions be used as a resource base, or the funding potential of donor institutions and beneficiary Member States, but it is highly advisable that their respective inputs be coordinated, following a commonly agreed upon form of strategy and organisation.

Beside the organisational structure of UN-GGIM as an entity and the legal instruments guiding the operations of the UN-GGIM: Africa initiative, in all the focus areas exposed in this AAP-GGIM document, 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 their implementation (to monitor the performance and re-adjust short term activities where necessary) and at the stage of their evaluation (to learn from the experience and evaluate the accuracy and realism of the targets and associated indicators defined).

Opportunity should be given to all partners to share their views, and opinion, so that the resulting decisions be consensus-based. Therefore, planned actions, on-going projects and programs directly or indirectly related to the objectives of GI4SD 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 a not-ear-marked contribution to the global budget of the AAP-GGIM, In fine, beneficiary Member States' needs should guide decision making where low motivation may exist due to discrepancies between donor orientation and UN-GGIM: Africa priority options and strategies.

4.4.5 Summary of Goal, Objectives and Results for International Coordination, Cooperation, Collaboration for meeting Regional and Global needs

The following Goal, Strategic Objective (SOs) and Result (R) will guide International Coordination, Cooperation and Collaboration for GIM in Africa, over the period 2016 - 2030

Goal

To apply the most efficient management rules in terms of international Coordination, Cooperation and Collaboration for the operation of UN-GGIM: Africa.

Strategic Objective and Key Expected Result

SO 5.1 UN-GGIM: Africa operations are based on UN project/programme management rules

R 5.1.1 UN-GGIM: Africa stakeholders understand and comply to the rules of its management

R 5.1.2 The UN Monitoring and Evaluation mechanism is built into UN-GGIM: Africa's management process

4.5 INTEGRATION OF GEOSPATIAL INFORMATION AND STATISTICS

4.5.1 Introduction

This section of the AAP-GGIM is about a specific action in the spirit of the initiatives introduced in Section 4.4 above, on "International Coordination, Collaboration and Cooperation in Meeting Regional and Global Needs", specifically under 4.4.8 "Opportunities and intervention points".

Better than the summary of an initiative, this section is the expression of a new action identified as critical to GI4SD in Africa. For this reason, it is a more developed formulation, well suited for the overarching goal of Sustainable Development, and facilitating the attainment of the UN-SDGs and AU Agenda 2063 Targets (SATs), through integrated Statistical and GI data, and the development of GI-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, in recent years, the interest and ability of government, businesses and the public to make practical use of this data has upsurge. This had led to a focus on Spatial Data Infrastructure (SDI), underpinned by data and metadata standards, at a national and transnational levels. There is an increasing focus by statistical agencies at the national and international level on seizing the opportunities to define and promote interoperability between statistical and spatial data infrastructure. Over the years it has been noticed that the key element of promoting interoperability is to promote better understanding, documenting and applying the relationships between relevant frameworks and standards related to statistical and spatial information (data and metadata).

Regarding openness and cross-sector interaction and cooperation, UNECA was not only a pioneer in Africa, but also a visionary. This can be illustrated by the decision taken 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 Information[5] (CODI) initiative. Since its first edition in 1999, policy issues and strategies pertaining to the economic development of Member States in Africa, based on an intelligent coordination of efforts in these three sectors, have been discussed and resolutions adopted in order to take action on the various issues identified and their joint solutions. In 2005, a study was conducted by ECA on the integration of SDI development process into National Information and Communication Infrastructure (NICI) policies. The integration of Geospatial Information and Statistics was the missing link of the Development Information chain. An effort to ensure this integration can only optimize the impact of the UN-GGIM: Africa initiative on the sustainable development of

[5] After the fourth edition of the CODI meeting - held in April 2005 in Addis-Ababa - its name was changed to CODIST to include Science and Technology. Three editions were organized under this new acronym : CODIST I in 2009, CODIST II in 2011, and CODIST III in 2013, before the advent of GGIM.

the continent. However, this global picture should not overshadow initiatives in the field in Africa, in particular a best practice in Rwanda, and an on-going project launched by the UN-GGIM: Africa WG5 in Kenya and Namibia to generate spatially enabled population census data.

4.5.2 Rationale: Need for integrating statistical and geospatial information

The integration of statistical and geospatial information in the implementation of this action plan will benefit Member States in the provision of services for the attainment of international and national 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 labor), economic statistics (business surveys, trade, transport, tourism, agriculture, etc.) and environment statistics. Geospatial information intervenes in all the different phases of statistical production, and it 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. Everything and everyone is somewhere, and statisticians are uniquely aware of how boundary conditions can affect sampling and therefore their results.

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

Seen from the GI field, statistical techniques are very important as means to solve issues or provide solutions to methodological options, like in Digital Image Processing (DIP) and interpretation of classification results, using stochastic rules. In the design of GI solutions, sampling techniques allow GI 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 to visualize the quality of the data used to map a specific theme, and therefore to show 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 GI and Statistics, and the need to strive for a concerted action towards the delivery of 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 offer statisticians and geospatial information practitioners extraordinary opportunities for collecting, analyzing, and presenting statistical data from a spatial perspective, thus increasing the use of statistical data in GI-based tools, and delivering added-value products and services.

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

- 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; and
- 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 GI and statistical information for smarter solutions in sustainable development justify the initiative to engage the two communities into a collaborative work towards the production of standardised spatially enabled statistical datasets.

4.5.3 Status of GI and Statistical Information integration in Africa

Globally, the use of frameworks has been limited 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 the related address coding. These methods provide highly accurate and flexible geocodes by producing location coordinates and/or small area geographic codes. Direct capture using GPS, or similar technologies, in the field is being increasingly used, especially in Africa, which seem 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 means of providing small area geography.

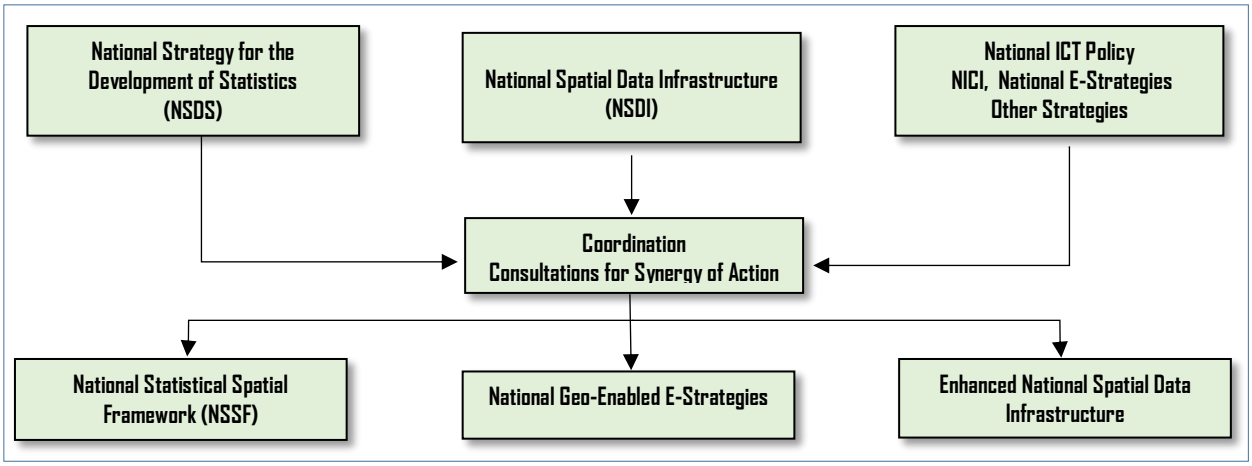
In Africa, initiatives such as the LandScan global population project (showing population distribution by daytime and night-time) influenced the grid approach to population distribution representation. However, the most common application of statistical information with the spatial dimension remains the use of the early basic principle exposed below in 4.5.3.2. Poverty mapping in the beginning of the New Millennium also had an impact on the introduction or use of GI in statistical data production by number of NSOs in Africa. Back in 2005, a study carried out by ECA revealed that, over a total number of 28 African countries part taking in a survey, 18 Member States representing 67% of the participating countries used GIS in their National Statistics Office. Eight others (representing 29%) were planning, at that time, to introduce GIS in their activities, in a two-year time period in average. The national registers approach was promoted recently by an initiative such as the publication by the AfDB of guidelines for building Statistical Business Registers (SBR) in 2014. This is an indicator of a widespread need of this approach in Africa, but the guidelines did not consider associating the spatial dimension to the process.

The 2011 population census of Namibia was used to develop an atlas designed to complement and enrich information on the figures and statistics using GIS; Rwanda won the "Geospatial World Excellence Award 2014" for its successful 4th Population and Housing Census (RPHC4), conducted in August 2012 using GI-based tools. The UN-GGIM: Africa Working Group 5 on Integration of Geospatial and Statistical Information for Sectoral Applications also launched recently a project related to population census in Kenya and Namibia.

These non-exhaustive examples 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.

4.5.4 Basis for the integration of GI and Statistical Information in Africa

4.5.3.1 CONCEPTUAL FRAMEWORK OF THE INTEGRATION AT NATIONAL LEVEL



The conceptual framework above for national level GI and Statistical Information integration shows on the first row existing initiatives in most countries in Africa in the three key areas of development information, as defined under the Africa Information Society Initiative (AISI). It is true that the development of each strategy (NSDS, ICT Policy/NICI/E-Strategies, NSDI) is at a given level, varying from country to country. However these strategies constitute a basis rooted in each Member State development Agenda regarding the provision of fit-for-purpose information for development.

The schema also shows the possible and advisable connection between the three types of strategies at country level, in order to enhance their common contribution to a more productive and efficient effort toward the attainment of the SDGs and AU Agenda 2063 Targets (SATs).

Under this conceptual vision of the future, the National Statistical Spatial Framework appears as the result of a national level effort in building synergies of action between the National Strategy for the Development of Statistics (NSDS), the National ICT Policy/Information and Communication Infrastructure (NICI)/E-Strategies, and the National Spatial Data Infrastructure (NSDI). It provides a way of enhancing each other's output on the sustainable development

ground, and should guide the development and dissemination of the NSSF in Member States and its extension at the higher levels for the RECs and Africa as a region.

4.5.3.2 BASIC PRINCIPLE

To introduce the issue of GI and Statistical Information integration, the following basic principle is exposed to help understand the process and guide its development.

In a vector-based GIS environment, just as a surrogate key allows to join tables and perform SQL-based requests using chosen criteria in a Relational Database Management System, similarly a spatial code captured in a statistical table also allows to link that table - or the result of a request involving that table - to the tabular data of a spatial database. This process allows, not only to visualise the spatial distribution of the variable being analysed, but also to show 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.

4.5.3.3 DIMENSIONS OF THE INTEGRATION

Applying this basic principle *stricto sensu* would be very restrictive in terms of practical applicability. Indeed, the type of basic analyses taken above as 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 the Statistics domain and the GI sphere and build by abstraction a generic integration model applicable irrespective of the type of technological environment prevailing. A successful integration of GI and Statistical Information requires to look at the following dimensions: (1) Scale; (2) Policy; (3) Institutional; (4) Modelling

Scale
By scale it is meant the scope of the geographic space in which the integration is due to take place. The scale of GI and Statistical Information integration will start by the national level, including a downstream flow driven by the needs at sub-national levels (state, region, districts, etc.). The upstream direction, through aggregation at data level, and harmonisation at policy level, will meet higher dimension needs (RECs and Africa as a region). At each key position on the Scale axis (national/sub-national, sub-regional, regional) the other three dimension elements (policy, institutional 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 harmonise the strategies and related regulations in order to smoothly achieve full integration. It will start by the national level to be demand-driven, but will take into account REC level and continental level constraints. The national GI 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
This dimension has to do with the institutional arrangements necessary to achieve real integration, in accordance with the orientation of the two compatible policies (Stats and GI). It

starts at the national scale, and entails interaction between the GI and the Statistics communities and their leadership, but also the involvement of the institutional stakeholders from the other sectors of the national economy. The same inclusive approach to agreeing on sustainable institutional arrangements applies to the RECs and Africa levels.

Modelling

The Modelling dimension is the component of the integration process dealing with the technical, technological, scientific abstraction and their related functional and procedural interactions. The United Nations Expert Group on the Integration of Statistical and Geospatial Information (UN EG-ISGI) has already developed a Global Statistical Geospatial Framework (GSGF) that responds to the modelling dimension of the integration. This 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 GSGF will be a National Statistical Spatial Framework (NSSF) 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 on the financial and human resources of the Member State under consideration, the REC, and Africa as region

4.5.3.4 ADAPTATION OF THE GLOBAL STATISTICAL GEOSPATIAL FRAMEWORK TO AFRICA

Global interoperability efforts

The Open GIS Consortium (OGC), a global consortium of geo-processing technology providers and users, has made important progress toward interoperability between geo-processing systems, employing practical testbeds and a consensus specification development process to arrive at open specifications for standard interfaces and protocols that can be used by Information Technology (IT) suppliers for particular information communities. Simultaneously, data coordination efforts worldwide have made progress toward semantic interoperability based on standard data dictionaries, metadata profiles and geospatial data modelling schemas. All of this progress, when viewed together, benefits statisticians who seek to assimilate geospatial processing and geospatial data into their work. It has been noticed that the main obstacles to data integration are not technical but managerial, organizational and institutional. However, it will be seen that advances in technology don't merely support managerial, organizational and institutional progress - they force such progress.

Fundamental datasets (FDs) 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, and geodetic control, etc. - which provide a base on which to collect, register, integrate and analyze statistical data. Fundamental datasets are meant to be publicly available, maintained for the common good, useful for many purposes, and each is likely to comprise at least a subset of that data layer, for any particular Information Community. ISO TC/211's metadata standard (ISO/CD 19115 Geographic Information - Metadata currently in a committee draft version) provides common schemas for describing these fundamental datasets, and ISO/CD 19107 Geographic information - Spatial Schema, provides standard definitions of the geometric and topologic characteristics of geospatial data, which can assist statisticians in their quest to produce reliable data for viable policy decision making.

National Statistical Spatial Framework (NSSF)

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

Efforts are underway for the design and refinement of the NSSF under the auspices of the United Nations, including the GGIM initiative. In this regard, the Australian Bureau of Statistics (ABS) has published findings on, "Developing a Statistical-Spatial framework in national Statistical Systems". The achievement of ABS, in this endeavor motivated the United Nations in 2013, through the UNSC and the United Nations - Committee of Experts on Global Geospatial Information Management (UN-GGIM) both to consider a programme review and accepted recommendations to develop better linkages between geospatial and statistical communities, and develop a global statistical-geospatial framework based on the ABS Statistical Spatial Framework. Both UN bodies agreed to establish a UN Experts Group 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 (NSDS) and a National Spatial Data Infrastructure (NSDI) is that they are not linked to other initiatives related to other aspects of development information, despite the efforts invested by ECA under the CODI(ST) initiative. In keeping with global trends of 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 have effective collaboration between them in the development of respective data infrastructures and systems.

A National Strategy for the Development of Statistics (NSDS) is a strategic approach that aims at bringing 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 (NSDI) facilitates information providers and users to participate in the growing (digital) spatial community at national level. The NSDIs establish connection for all users in the world to share and reuse the available datasets.

The National Spatial Data Infrastructure (NSDI) and the National Strategies for the Development of Statistics (NSDS) has over the years been implemented separately by African countries all aimed at the 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 consists of facilitating the establishment and implementation of the National Statistical Spatial Frameworks (NSSFs) - geared to the NSDI/NICI/E-strategies agendas - in order to bring forth the integration of geospatial information and statistical information, with the support of the ICT substratum and facilities, aimed at facilitating the attainment of the SDGs and other development goals in Africa, in particular the AU Agenda 2063, through:

1. Advocacy for linking the National Statistical Spatial Frameworks (NSSFs) development to the NSDI, ICT policy/NICI/E-strategies' processes, to feed the various development agendas at national and sub-national levels;

2. Facilitating policy dialogue between the development actors of National Spatial Data Infrastructure, National Information and Communication Infrastructure, E-Strategies and National Strategy for the Development of Statistics, with a view to raising awareness on 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 (NSSFs) as a result of coordination effort with the above mentioned strategies;

4. Facilitating capacity building at all levels in support of National Statistical Spatial Frameworks (NSSFs) development and implementation in Africa;

5. Promoting networking and knowledge sharing at all levels in order to promote evidence-based National Statistical Spatial Frameworks (NSSFs) formulation and implementation;

6. Developing and building capacity for monitoring and evaluation tools and systems in support of National Statistical Spatial Frameworks (NSSFs) policy development and implementation, in harmony with the other strategies mentioned above;

7. Providing technical support and advisory services to RECs and Members States on National Statistical Spatial Frameworks (NSSFs) development and implementation;

8. Facilitating resource mobilization in support of National Statistical Spatial Frameworks (NSSFs) related research, advocacy, capacity building, technical support and advisory services.

4.5.5 Summary of Goal, Strategic Objectives and key Expected Results for the Integration of GI and Statistical Information

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

SO 4.1 Action is taken to design a National Statistical Spatial Framework (NSSF) for the Integration of GI and Statistical Information in Africa.

R 4.1.1 Africa, through the UN-GGIM: Africa Working Group number 5 on Integration of Geospatial and Statistical Information for Sectoral Applications, is fully involved in the NSSF Design and Development process;

R 4.1.2 The NSSF is widely discussed, separately and jointly, and then commonly validated by the African GI and Statistics communities and adopted, endorsed by the appropriate policy level organ.

SO 4.2 A strong advocacy action is taken to ensure policy level engagement and user commitment to use the NSSF in Africa Member States, and the RECs

R 4.2.1 The majority of African Governments support the NSSF and adopt it for application in their SDGs and Agenda 2063 activities

R 4.2.2 NSSF is adopted in the RECs for their regional activities related to SDGs and Agenda 2063

SO 4.3 Action is taken to ensure preparedness for NSSF at UN-GGIM: Africa Secretariat, Member States, and partners levels

R 4.3.1 : Capacity of the NSSFs Secretariat is enhanced to facilitate the Establishment and Implementation of NSSFs

R 4.3.2 : Mainstreaming of NSSF into the Agenda for Africa Sustainable Development is successfully performed;

R 4.3.3 : Synergies and Coordination are enhanced, and resources mobilized in Support of NSSF;

SO 4.4 : Action is taken to ensure effective implementation of NSSF at national, sub-regional and regional levels in Africa

R 4.4.1 : Knowledge Generation and Dissemination are Enhanced to Raise Awareness and Build Evidence-based NSSF Tools, products, and services;

R 4.4.2 Capacity and skills are enhanced in support of NSSF policy development and implementation in Africa;

R4.4.3 Coordination and harmonisation are sought for the implementation of the continental Statistical Spatial Framework (ASSF) with the Strategy for the Harmonisation of Statistics in Africa (SHaSA) and the United Nations Group of Experts on the Integration of Geospatial and Statistical Information (UN-EG-ISGI)

SO 4.5 : Technological tools are designed and widely used to foster SSF application in Africa

R 4.5.1 Knowledge management tools are developed and their use popularized to facilitate evidence base NSSF policymaking and implementation

R 4.5.2 Enhance Monitoring and Evaluation 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 consolidated logical framework of the AAP-GGIM is as follows:

Strategic Objectives and Expected Results	*Organisation*	*Duration*	*Estimated cost (US$)*
SO 1.1 Geospatial Information Management (GIM) is adopted as a critical Development enabler by Member States in Africa	ECA, AUC, REC, Member States	2 years	900 000
R 1.1.1 ***A position paper on how GI can boost the attainment of the 17 goals of the UN Sustainable Development Agenda in Africa on one hand, and the 7 aspirations and their 15 objectives of the AU Agenda 2063 on the other hand, is published;*** Related activities include position paper production, review by the UN-GGIM: Africa Working Groups and adoption by the UN-GGIM: Africa Forum			
R 1.1.2 ***A strong advocacy action is taken throughout Africa using the Position paper to achieve policy level engagement of African Governments to adopt GI as a critical enabler for the sustainable development of the continent.*** Activities include national and sub-regional (REC) level policy engagement fora, and production and dissemination of excerpts of the position paper on typical examples of application to selected SDGs and Agenda 2063 objectives			
SO 1.2 A specific geospatial information policy is in force in every Member State and every REC in Africa, under the SDI agenda for sustainable development	ECA, RECs, Member States, AU	5 years	1 250 000
R 1.2.1 ***A comprehensive study on the state of national GI policy development and REC level GI policy availability serves as baseline for policy action planning in Africa*** Activities involved (US$ 625 k) include the selection of five experts working in parallel on the study in the sub-regions - and covering also the Member States - the validation of their work during sub-regional workshops in the RECs, and the production of a synthesis baseline for Africa as a region			
R 1.2.2 ***Needy Member States and RECs are assisted in the development of their respective GI policies*** Activities to be carried out include the formulation of a (US$ 175 k) GI 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.			

Strategic Objectives and Expected Results	*Organisation*	*Duration*	*Estimated cost (US$)*
R 1.2.3 ***The development of National Space Programmes in Africa are guided by and harmonised by the Africa Space Policy and the Africa Space Strategy*** Activities related to this result include consultation with Africa Member States to raise awareness of the Africa Space Policy and the Africa Space Strategy, consolidate and promote the ARMS constellation and initiate other space-related activities for the sustainable development of the continent			
R 1.2.4 ***GI policy directives are disseminated to mainstream SATs attainment and Statistical_GI integration processes into Member States and REC level GI policies*** To achieve this result, activities under a (US$ 450 k) specific project will be carried out : A. to develop policy directives aiming at (1) harmonizing GI policies within individual RECs and among RECs; (2) mainstreaming (2.a) the SDGs and Agenda 2063 targets (SATs), and (2.b) Stats_GI integration process into Member States and REC level GI policies; B. to disseminate the policy directives; C. to assist Member States and RECs in the implementation of these policy directives			
SO 1.3 Africa Member States take policy action to ensure integration of GI and Statistical Information	ECA, RECs, Member States	2 years	940 000
R 1.3.1 ***Policy guidance is issued to engage Africa Member States and RECs into a policy dialogue involving the GI and the Statistics communities;*** This result requires as activities the formulation of a policy guidance followed by the opening of consultations within Members States and RECs between the GI and Statistics communities for the application of the NSSF once designed and adapted			
R1.3.2 ***A policy approach is adopted by RECs and Africa Member States to developing jointly the information products and services needed for the attainment of the SDGs and Agenda 2063 Targets (SATs)*** 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 the GI Experts and Statisticians to work jointly to develop the products and services required for the attainment of the SATs			
Total for the "GI Governance and Policy" component			***3 090 000***

Strategic Objectives and Expected Results	*Organisation*	*Duration*	*Estimated cost (US$)*
SO 2.1 Africa Member States take action to use GI for the attainment of the SDGs and Agenda 2063 Targets - SATs	ECA/RECs/Member States	3 years	5 825 000
R 2.1.1 ***The national SDGs and Agenda 2063 targets are used to design SATs-related, GI-based Added-Value Information Products and Services (AVIPS);*** Activities related to this result concern assisting Member States with 3-day national workshops to define and design the AVIPS, followed by the supply of technical resources and development of capacities to enable national institutions to deliver the designed SATs-related AVIPS			
R 2.1.2 ***The national sets of SATs-related AVIPS are aggregated into sub-regional sets of AVIPS for the RECs, and the latter aggregated into sets of AVIPS for Africa as a region*** Activities include assistance to RECs with the design of REC level sets of aggregated AVIPS for SATs attainment, followed by the organization of 5 sub-regional 3-day workshops to adopt these sets of REC level aggregated AVIPS, and the design of a set of continental level aggregated AVIPS, to be adopted during a three-day workshop, followed by the training of experts to deliver regularly these AVIPS			
SO 2.2 A high quality ground level infrastructure is strengthened for sound GI production in Africa	ECA, AFREF, RECs, Member States	18 months	6 693 000
R2.2.1 ***National and regional geodetic infrastructure is further developed with CORS networks and other GNSS-based techniques, in fulfillment of UN General Assembly Resolution 69/266 on GGRF*** Activities related to this result 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, to guide the second administrative levels (states, regions, districts, provinces, etc.) in locating CORS in their jurisdictions, the development of other GNSS-based techniques (such as accurate height determination)			
R2.2.2 ***Support is provided to the ground level Infrastructure*** Activities feeding this result include the following: to encourage in the regional utilisation of regionally owned communication satellites with appreciable increase in the density as well as the bandwidth of Internet services, to install EO data receiving and dissemination facilities in 5 regional centres and national capacity building institutions, to use alternative energy sources in Africa, especially solar energy for continuous electricity supply to GI facilities.			
SO 2.3 Fundamental Datasets (FDs), Metadata, Geospatial Standards are Developed and Geo-portals set up for GIM in Africa	ECA, WG2, RECs, Member States	3 years	119 478 000

Strategic Objectives and Expected Results	*Organisation*	*Duration*	*Estimated cost (US$)*
R2.3.1 ***Fundamental datasets are produced for Africa with the support of WG2 on FDs and Standards*** Related activities include: update the inventory of the status of all the ten fundamental datasets and Street Address Catalogue at the minimum; convert existing analogue fundamental datasets to digital form; complete the "Guidelines of Best Practice for the Acquisition, Storage, Maintenance and Dissemination of Fundamental Geo-spatial Datasets"; fill the gaps of fundamental datasets where necessary; disseminate existing satellite images' metadata from the continent's space faring nations; produce seamless, uniform, ortho-rectified, 2.5m natural colour, continental coverage (similar to SPOTMaps) using regionally-owned images			
R2.3.2 ***Metadata and geospatial standards in Africa are disseminated on geoportals*** Among the activities to undertake : A US$18 360 k project consisting of the following: Publish an implementation guide for the Africa regional metadata profile; carry out an inventory, review and evaluation of existing national geospatial standards; prepare national and sub-regional standard profiles for all the fundamental datasets and components of geospatial standards; develop standardised geographical names in collaboration with UNGEGN, establish geographical names authorities in Member States where none exists; develop/strengthen Geoportal at ECA-GISS and WMS/WFS capability using FOSS; assist RECs and Africa Member States develop their geoportals			
SO 2.4 The Private Sector is involved in the UN-GGIM: Africa agenda and funding mobilized	ECA/RECs/Member States/AUC	3 years	90 000
R2.4.1 ***Public-Private Partnership is enabled for GIM in Africa*** Activities involved include PPP building in the production and management of GI at country, REC and continental levels;			
R 2.4.2 ***New scientific and technological opportunities are used for a better GIM in Africa*** Activities linked to this result include the monitoring by ECA of the new trends and innovations in the fields related to GI, keep Member States nd RECs updated			
Total budget for "Common Framework and Tools"			***132 086 000***

Note:

Assuming 80% coverage of the continent @ 1:50000 = approximately 10067 map sheets x 0.8 = approximately 8054 map sheets @ $50 each = $402700.

Strategic Objectives and Expected Results	*Organisation*	*Duration*	*Estimated cost (US$)*
SO 3.1 Institutional capacity in GIM is developed in Africa			13 430 000
R3.1.1 ***An accurate and comprehensive knowledge of the state of Africa's GIM capacity for SATs production is available to support the demand-driven capacity development planning for the AAP-GGIM*** A series of activities are related to this expected result. They include a comprehensive study on national level institutional GI capacity, build sub-national level awareness of value of GI to create an enabling environment for SATs attainment, etc.			
R 3.1.2 ***Targeted actions are taken to enable SATs-oriented capacity development at institutional levels in Member States in Africa*** Activities include retraining and retaining, and building NMAs capacity to support SDI, AFREF, ISO TC 211 Standards, etc., build and strengthen formal NSDIs, build partnership between NMAs and NSOs to ensure preparedness for NSSF, ECA and REC build preparedness for SSF-compliant AVIPS delivery			
R 3.1.3 ***Targeted actions are taken to strengthen Earth Observation capacity in Africa*** Related activities include : support satisfaction of Africa Space Policy and Strategy implementation needs through capacity strengthening			
R3.1.4 ***Targeted actions are taken to improve university and high School curricula*** Activities feeding this result include building ministries of Education GI curricula and technical capacity (laboratories,) supporting the Pan-African University with a GI content, etc.			
SO 3.2 Infrastructural capacity in GIM is built in Africa	ECA/RECs/Member States	2 years	180 000
R3.2.1 ***A series of national level comprehensive studies are carried out on key components of the SDI*** Related activities include comprehensive national studies on infrastructural capacity, on related ICT infrastructure			
SO 3.3 Individual capacity in GIM is built in Africa	ECA/RECs/Member States/PanAf Univ	5 years	490 000
R3.3.1 ***Actions are taken to build African indigenous capacity and retain skills*** Activities involved include a comprehensive study on individual GI capacity in Africa, introduction of GIS and Space Science in high school curricula, internship and fellowship programmes on Geospatial Science and Technology, GI accreditation and certification for professionals, web-based open GI open platforms			
Total budget for "Capacity Development and Knowledge Transfer"			***14 100 000***

Strategic Objectives and Expected Results	*Organisation*	*Duration*	*Estimated cost (US$)*
SO 4.1 Action is taken to design a National Statistical Spatial Framework (NSSF) for the Integration of GI and Statistical Information in Africa	ECA, UN EG-ISGI, WG5, WG2, RECs, Africa Member States, AUC	3 years	400 000
R 4.1.1 ***Africa, through the UN-GGIM: Africa Working Group number 5 on Integration of Geospatial and Statistical Information for Sectoral Applications, is fully involved in the NSSF Design and Development process;*** Related activities will consist, for UN-GGIM: Africa WG 5 - assisted by WG 2 on Institutional Arrangements and Legal Frameworks - of quality contribution to the design and development process of the NSSF (based on Africa's own experience in successful integration processes like in Rwanda and reporting regularly to UN-GGIM: Africa (liaison with the United Nations Expert Group on the Integration of Statistical and Geospatial Information (UN EG-ISGI), scientific contribution, part taking in technical meeting, to ensure that the NSSF is adapted to African realities and meet African needs, etc.);			
R 4.1.2 ***The NSSF is widely discussed, separately and jointly, and then commonly validated by the African GI and Statistics communities and adopted endorsed by the appropriate policy level organ.*** Related activities will essentially consist of a wide user engagement consultation with REC level workshops and an Africa-wide forum to validate the NSSF, followed by its formal adoption and endorsement at policy level			
SO 4.2 A strong advocacy action is taken to ensure policy level engagement and user commitment to use the NSSF in Africa Member States, and the RECs	ECA, RECs, Africa Member States	1 year	120 000
R 4.2.1 ***The majority of African Governments support the NSSF and adopt it for application in their SDGs and Agenda 2063 activities*** Related activities will focus on country level workshops to inform, raise awareness and launch the use of NSSF			
R 4.2.2 ***NSSF is adopted in the RECs for their regional activities related to SDGs and Agenda 2063*** The activities related to this result will be information, sensitisation, and formal adoption of the NSSF for RECs' development activities.			

Strategic Objectives and Expected Results	*Organisation*	*Duration*	*Estimated cost (US$)*
SO 4.3 : Action is taken to ensure preparedness for NSSF at UN-GGIM: Africa Secretariat, Member States, and partners levels	ECA/AUC/AfDB/ Member States	6 Years	3 355 000
R 4.3.1 : ***Capacity of the NSSFs Secretariat is enhanced to facilitate the Establishment and Implementation of NSSFs*** Activities feeding this result include NSSF development planning and monitoring, funding mechanisms, and regular implementation meetings			
R 4.3.2 : ***Mainstreaming of NSSF into the Agenda for Africa Sustainable Development is successfully performed*** Activities involved concern program review with AUC, ECA and AfDB to mainstream NSSF into their respective programs and plans.			
R 4.3.3 : ***Synergies and Coordination are enhanced, and resources mobilized in Support of NSSF*** Related activities will target national coordination and synergy building for NSDI, ICT Policy/NICI/E-strategies, NSDS and other strategies in support of the NSSF and resources mobilisation			
SO 4.4 : Action is taken to ensure effective implementation of NSSF at national, sub-regional and regional levels in Africa	ECA/AUC/AfDB/ Member States	6 Years	738 000
R 4.4.1 : ***Knowledge Generation and Dissemination are Enhanced to Raise Awareness and Build Evidence-based NSSF Tools, products, and services*** 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.)			
R 4.4.2 ***Capacity and skills are enhanced in support of NSSF policy development and implementation in Africa*** Activities will target the formulation and implementation of an NSSF capacity development strategy, the review and improvement of Curriculum on SSFs and learning facilities in institutions of higher learning in Africa, Research to fill knowledge gaps on SSF implementation-related issues , technical assistance to Member States, etc.			
R4.4.3 ***Coordination and harmonisation are sought for the implementation of the continental Statistical Spatial Framework (ASSF) with the Strategy for the Harmonisation of Statistics in Africa (SHaSA) and the United Nations Group of Experts on the Integration of Geospatial and Statistical Information (UN-EG-ISGI)***			

Strategic Objectives and Expected Results	*Organisation*	*Duration*	*Estimated cost (US$)*
Related activities include consultations between the SHaSa experts and the UN-EG-ISGI, agenda for design and development of the ASSF, wide review and adoption and assistance for implementation			
SO 4.5 : Technological tools are designed and widely used to foster SSF application in Africa	ECA/AUC/AfDB/ Member States	6 Years	320 000
R 4.5.1 ***Knowledge management tools are developed and their use popularized to facilitate evidence base NSSF policymaking and implementation*** Activities concern operationalizing the virtual NSSF database, and a biennial conference on SSF policy in Africa			
R 4.5.2 ***Enhance Monitoring and Evaluation in Support of NSSF Formulation and Implementation in Africa*** Activities include the development of a framework with indicators for M & E, and reporting on the achievement of NSSF application			
SO 5.1 : UN-GGIM: Africa's operations are based on UN project/programme management rules	ECA/Member States/RECs/UN-GGIM Secret	6 months	90 000
R 5.1.1 ***UN-GGIM: Africa stakeholders understand and comply with the rules of its management*** Activities include incorporation and submission of UN administrative and financial rules of procedure to Cooperation and Collaboration partners during the entry into agreement			
R 5.1.2 ***The UN Monitoring and Evaluation mechanism is built into UN-GGIM: Africa's management process*** Activities include application of the UN Monitoring and Evaluation mechanism to the operations of UN-GGIM: Africa-			
Total budget for Integration of Statistics and Geospatial Information			***5 023 000***

Grand total : US$ 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 development in space and digital technologies in the past two decades, the time and cost for making geospatial information and maps available for development and management purposes has been greatly reduced.

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

Even though more than a decade's work has been done with regards to SDI development in Africa, it still reflects an incoherent piece-meal approach characterised 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 document outlined that key principles and issues for successful geospatial information management for Sustainable Development in the continent should include:

- Target the attainment of the UN-SDGs and the AU Agenda 2063 aspirations through integrated GI and Statistical data as support for decision making
- Start developing geospatially-enabled government services for end user needs and ensure that appropriate products and services are provided,
- Develop transparent, shared, and interoperable systems of public geoscientific information for decision makers, investors, education, research, national and international institutions,
- Exploit the appropriate use of global geospatial data sets for the production of fundamental data sets.

Appendix

CAPACITY DEVELOPMENT BASIC PRINCIPLES

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 GI specialists. 'Map' data more easily/freely available; map-enabled applications (location-based services) have become commonplace; and GPS and navigation tools 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.

One may wonder why, with all the investments in geospatial information 'capacity building' cited above, the subject of 'capacity' is still relevant and ever so prevalent in Africa. In the first place, capacity 'development' ought to be an on-going processing 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 GIM. Thus, it should be recognised 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 on-going development of capacity is needed to meet new emerging challenges; as new technologies and new processes are developed, so is there need to re-skill people, and to re-tool organisations 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 make 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 programs.

To set the context for the capacity challenge the NEPAD program 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 harmonised across national boundaries is fundamental for the realisation of this agenda, with a critical need to address the capacity for the production and management, dissemination and access, utilisation 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 UNECA 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 utilisation. 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 UN Development Group approach to capacity development provides a systematic methodology that is very appropriate for analysing the multi-dimensional aspects of, 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 4 below).

These three levels influence each other in a fluid way, and the strength of each depends on, and determines the strength of the others. This 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.

Table 4: Content of the Three Levels of the UNDG Methodology

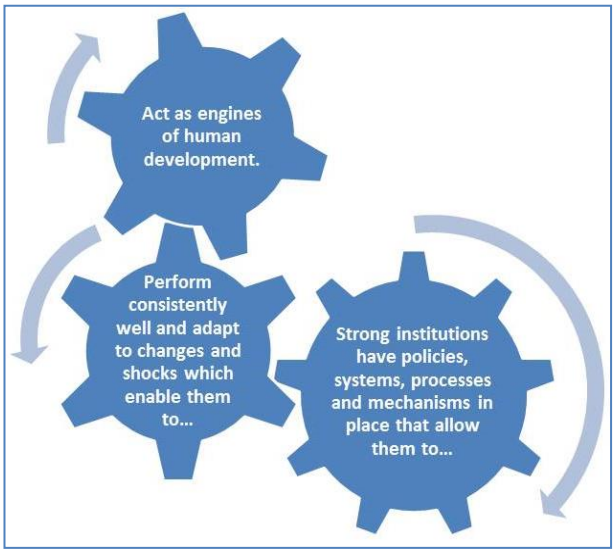
Individual level	Skills, experience and knowledge that allow each person to perform. Some of these are acquired formally, through education and training, while others come informally, through doing and observing. Access to resources and experiences that can develop individual capacity are largely shaped 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 come 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.

Applying the 3-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 was made with regard to the other two levels; after all one very important outcome was the strengthening of (a few) key institutions or the establishment of new ones. However that 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, institutionalisation 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's would become lost to the organisation when the individual is not available. Thus, brain-drain in any form is a significant obstacle to the future success of GIM. Individuals function and indeed are more effective as the backbone of institutions.

Organizational capacity development is necessary for the continuity and sustainability of the GIM knowledge base; strong and stable organizations are important in supporting applications of GIM. Therefore it is important to institutionalise 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 external shocks, no matter what these shocks are.

Governments create the enabling environment for the development initiatives and application of GIM 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 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 GIM initiatives. Cost-

benefit analyses are needed to demonstrate the value of investment in GIM. One model is the effort underway to develop an SDI in Uganda, which began by budgeting the total investment needed to establish an SDI, as well the estimated benefits (Geo-Information Communication and ESRI Canada 2010). Integrative efforts are essential, and there is great merit in integrating GIM 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 GIM 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/or 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 addressed would have the greatest impact on capacity development outcomes at the different levels described above.

From empirical evidence and first-hand experience UNDP 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 (non-exhaustive) issues in geospatial information capacity to these in the matrix below:

Table 5: Core issues in GI 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].	▪ ICT policy frameworks & legislation ▪ Data producers, custodians& 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.	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 US Federal Geographic Data Committee in 1990 ▪ Leadership demonstrated by Google in democratising 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.	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)

Core Issue	Description	Geospatial information Issues
		▪ Geospatial information products and services (e.g., metadata, spatial data directories, atlases, on-line cadastral-based services, community resource centres) ▪ Geospatial information management toolkits ▪ Planning & decision support tools
Accountability	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. 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.	▪ 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 (including capturing and utilization of ▪ Open engagement with 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.)

The three levels of capacity and the core issues taken together break from the piece-meal, 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 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/or 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. GIM must therefore be addressed through the development of SDI which, by definition, requires buy-in from a diverse group of stakeholders. These stakeholders include GIM experts/technicians, users of geospatial information, and policy-makers/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), 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 AU/NEPAD Capacity Development Strategic Framework (CDSF) 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 CDSF is founded on six cornerstones which inherently identify broad groups of actors to be involved in all capacity development activities, as shown in table 6 below:

Table 6: Suggested GI Capacity Development Targets Based on the NEPAD CDSF

Cornerstone	**Description**	**Suggested GI CD 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 policy makers 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/projects within and across levels aligned to key sustainability principles, to promote development results.	Planners Policy-makers Mid-level development managers Technical support staff

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 identify their specific interests, opportunities, and incentives for investing in the development of their own capacities. Governments and the currently established leadership in geospatial

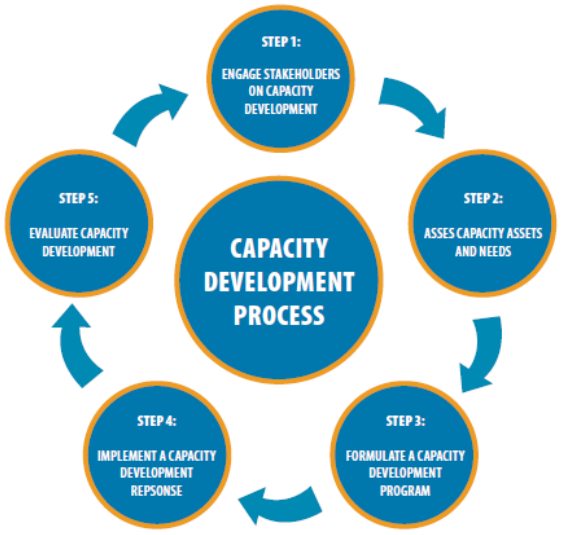
information activities have a responsibility to bring this about; once opportunities and incentives are identified it is most likely that the interest groups will put in place appropriate mechanisms to sustain their interest, including developing their own self-serving strategies.

A multi-stakeholder approach helps to overcome the coordination problems, creates momentum on a broad front rather than in a piecemeal fashion, and ensures harmonised processes including interoperability of data and systems. In this regard, capacity development in GIM can benefit from the experience of ICT capacity builders, who have seen success in overcoming issues related to the 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 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 optimisation 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, organisational, 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 the youth and women 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 would be 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 will also provide a critical feedback mechanism that will help GIM leaders identify the most productive uses of geospatial information (ranging from which data to disseminate to the structures of SDI).

Interventions must also focus on strengthening linkages between education and training organizations on the one hand, 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 capacity development in geospatial information, by facilitating the transfer of knowledge, resources among individuals and among 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 the effort of such organizations.

Change and Change Readiness

Introducing information systems often requires, and causes changes. Societies that have understood, developed, or/and adapted policies, legislation, systems, and business processes to this reality, have, and continue to, benefit from 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 SDI. 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 (e.g., NEPAD, the Kenya Open Government Data Portal, among others). The experience in North America and numerous European countries demonstrates the potential for geospatial information and SDI 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/or 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, and there are many examples of highly trained skilled individuals who are unable to function at their full potential because the organisational 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, open-minded and positive attitudes in using the related technology, that gives information and knowledge its strategic importance, 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 the entire society is 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.

This implies that the whole society needs to be capacitated in order to bring about change. This requires that the capacity development strategy for geospatial information should not only address technician and policy makers, 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.