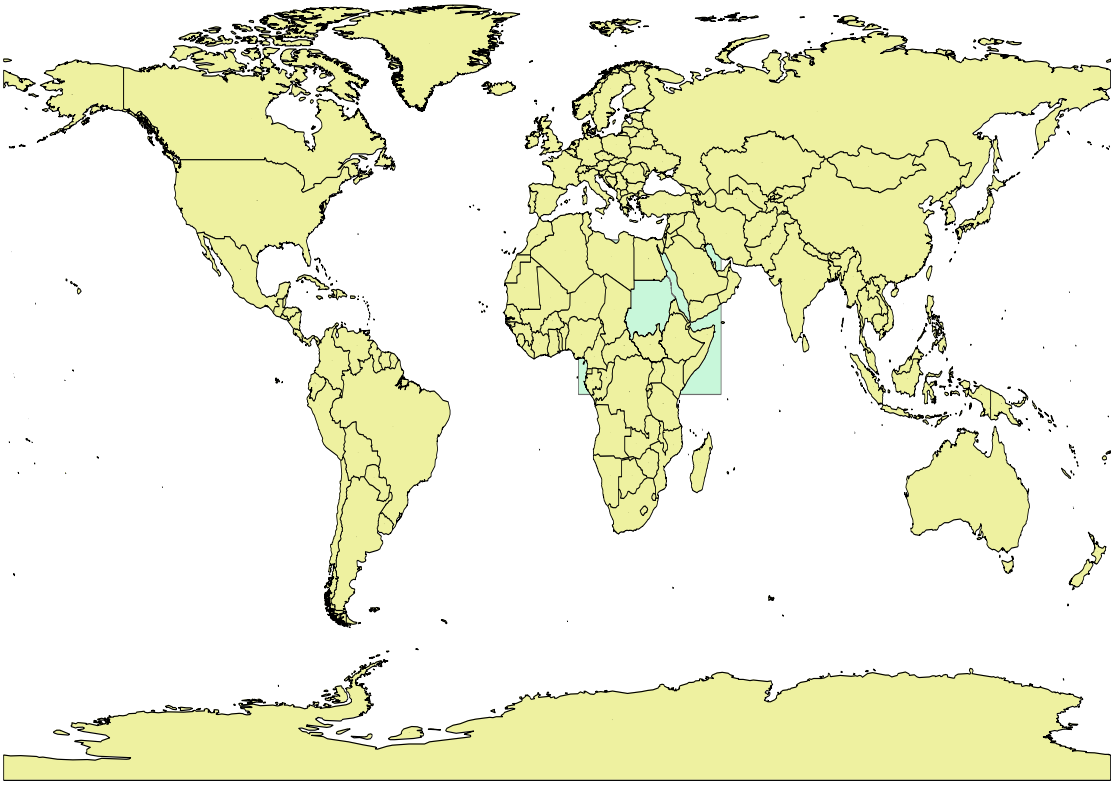
Sudan Country Report -2023

Implementation Status of UNGGIM National Geospatial Information Management

Thirteenth Session of the UN Committee of Experts, New York, 2-4 August 2023



Dr. Kamal Sami Sudan Survey Advisor

Dr.kamal.sami@gmail.com

UNGGIM 13 - 2023

Sudan Country Report 2023

Implementation Status of UNGGIM-National Geospatial Information Management

Thirteenth Session of the UN Committee of Experts, New York, 2-4 August 2023

1. Introduction

Sudan Survey Authority (SSA) is the focal coordinating agency in Sudan, for the implementation of UNGGIM geospatial Information management at the national and regional levels. As stated in our 2022 Sudan country report, SSA started with encouraging the Sudan government and the regional partners to empower the geospatial information for sustainable national and regional developments. Sudan started with planning for projects to implement the UGGIM global frames related to the national Global Geodetic Reference Frame (NGGRF) and National Integrated Geospatial Information Frame (IGIF). The Sudan Survey Authority, planned for the implementation of Sudan National Basemap System (SNBS) for Federal and State government entities. The SNBS has been designed and until now at the Implementation Stage for the establishment of Sudan National Basemap Center in SSA premises connecting the SSA Units such as Photogrammetric and satellite imagery, geodetic, GIS, and mapping departments, which are considered to be as the main geospatial data provider and SNBS geospatial data updating and quality control taking consideration of the national SDI and SDG initiatives. The SNBS shall be integrated with Sudan various entities, existing GIS and geospatial systems to form the National integrated Geospatial frame to be in line with UNGIM resolutions, plans, guidelines and strategies. Here SSA will take the role of prime SNBS implementer with the corporation of all its strategic Stakeholders and partners in Sudan and the region.

Knowing that, the SSA has been working as surveying government entity in Sudan for more than 100 years, currently providing mapping and surveying services for the entire country, and now it has been directed, since 2020, by the Sudan Translational government to provide Geospatial Services to all government entities in Sudan. As Sudan Official Geospatial Partner, SSA has established strong and successful relationships with multiple agencies and entities throughout Sudan. Similarly, we maintain enduring relationships with multiple agencies and entities at regional and federal government levels as well as with private sector and academia.

SSA is always proud of its relationship with Sudan federal and State governments as well as the Department of Surveying Engineering in four Universities in Sudan. We would see the Sudan national Information Center as a key partner, both during and following SNBS implementation. Not only SSA will develop state-of-the art technical solutions, but will also implement them by building effective partnerships and encouraging positive collaborations that will ensure that geospatial standardization, and any associated UNGGIM operational recommendations, are taken up willingly at all levels of government across the Sudan.

One of the promising and step forward implementation for the UGGIM global frames is that our national renowned expert staffs are well aware about their role to implement the SNBS and in the near future to establish Sudan geodetic network, to develop Sudan geoid and CORS network which forms a part of the critical national infrastructure of the Sudan for geospatial sustainable provision. SSA is acknowledged as a national mapping agency and is recognized for its technical leadership and competence in all aspects of surveying and mapping. Our directors and senior staff maintain an international collaboration and influence geospatial policy and standards to be in line with UN-GGIM. This significant step by the government of adopting the SNBS to be at the forefront of geospatial development in the country, has provided an opportunity for SSA to use their skill and expertise to drive a collective and unified approach to promoting interoperability for the geospatial industry and to collaborate with all other 17 sustainable development goals. So, SSA has evidenced that it is confident to deliver a truly successful geospatial information outcomes to meet Sudan and the Sudanese NSDI ambitions.

2. SUDAN Survey Authority

SUDAN Survey Authority (SSA) is the national surveying and mapping authority for Sudan, it is a national leading geospatial data and technology organization. SSA is responsible for maintaining the master map – the nation's fundamental geospatial reference base. The Sudan government, the general-public, and businesses have relied and to be relied on Sudan Survey Authority as a legal and regulatory body for accurate and up-to-date geospatial information since 1998 and the years to come. Currently Sudan Survey Authority has set the standard for data capture, data management and planning for innovative services, shaping the geospatial industry and helping Sudan government to become one of a leading digital nation.

The Sudan Survey Act, as well, illustrated that, Sudan Survey Authority being responsible for the creation of geodetic network, aerial photography, processing and mapping, and planning for the design of national CORS network which can form a part of the critical national infrastructure of the Sudan and as well to be part of the Unified African Reference frame (AFREF).

3. SSA Existing and Future services

1. Geospatial services: Geospatial Technology, is generally identified and usually used for visualization, measurement, and analysis of features or phenomena that occur on the earth. Geospatial technology is a combination of three (GNSS, GIS, RS) different technologies that are all associated to mapping features. Services provided by SSA covers design, development, and implementation of Geospatial system that are required for short- and long-term objectives as per Federal and states government requirements.

2. The services offered including but not limited to: Establishing Reference Station, Data Collection, Raster/Vector Data Processing, Internet/Intranet Deployment, GIS applications, Satellite Image Processing, Remote Sensing (RS) application Development, Digital Terrain Modelling (DTM), Data Publishing and Documentation, Database Management Systems and Design, GPR Services, UAVs data acquisition and processing and geoid modelling.

3. Surveying & Mapping: Accurate surveys and mapping techniques have vital role in development and planning of Sudan engineering projects. SSA provides complete range of services in engineering surveying and Mapping areas.

4. Services offered: Geodetic Surveys, Aerial & LIDAR Survey, Lidar Bathymetry & Hydrographic Surveying, Map Updating, Land, Boundary and Cadastral Surveys, Topographic & Contour Surveys, Site Development Surveys, Route Location Surveys, Construction Surveys, Cartographic Surveys, Satellite imagery Processing, Digital Terrain Modelling (DTM), Digitization and Scanning (Raster-to-Vector Conversions), Geodetic Control Points.

5. 3D As built for Corridor mapping, including Roadway and Rail, Transportation, Pipelines and Electric Transmission Lines, 3D Asset Inventory Mapping, Digital Terrain Models, etc.

6. Feasibility studies related to potential network layouts, site selection and potential seismic systems, Supply and system installation, Network operation (data transmission, data processing and archiving), Training, Network servicing, maintenance and long-term support and water harvesting maps.

7. Marine Data Services: Bathymetry and seabed data collection, Acquisition, processing and production of mapping and bathymetric charts derived from: Coastal margins and shallow water environment data using classical bathymetric data acquisition technology. On-shore coastal zone mapping using airborne LiDAR. Provision of hydrographic solutions, planning and management of sea surveys; capacity and capability building and development; marine mapping & charting and GIS consultancy and associated professional services.

8. Marine survey services:

    - Detailed surveys of the seabed and coastal zone are a critical prerequisite for safe navigation,
    - Nautical charting
    - Coastal zone and marine environment management
    - Disaster prevention and recovery strategies
    - Cost-effective design of marine civil engineering
    - Structures and informing environmental assessments
    - Planning seismic transition zone surveys and infrastructure landfalls.

4. Sudan National Basemap System

One of the primary objectives of SNBS is to implement an enhanced information management system that will dramatically improve the level of support for the activities in the SSA and the Sudan geospatial community, by providing solutions that enable the effective and efficient collection, editing, storing and delivery of geospatial data and information.

After a thorough investigation, SSA has planned and outlined the requirements of the IT system and its components and any upgrades and additions to the current IT infrastructure as required for delivery of the geospatial information, management system to an acceptable level of confidentiality, availability and performance. SSA project team shall undertakes and to revise the previous needs assessment to capture requirements for SSA Departments and Units business processes. It is recognised that this plan will be influenced by the base map and spatial data provision, in addition to the following:

(1) Hardware, Servers and End-user Computers, Physical Security.
(2) Networks and Telecommunications: Local Area Network and Internet addressing
(3) Observations on the Current Infrastructure and data volumes.
(4) Database: database architecture, merging and database solutions.
(5) Application Development: this relates to enabling the business processes to be modelled through the development of an open-source custom software applications.
(6) Software Licensing: SSA will indicates the Operating System licensing implications of the planned system. In particular, an explanation shall be given of the requirements for Access Licenses resulting from system Implementation, stating versions and preferred licensing model, with the description of the licensing structure to be purchased as part of the final system.

For sustainable implementation SSA shall apply a quality control systems and approach to include testing, formal system and user acceptance testing. Then SSA Basemap centre team shall train identified trainers and ensure lead users are trained to support the system at a departmental level with sufficient supervision at all stages of the implementation. Post implementation support shall be planned and offered in a structured and logical manner. Propagation of the use of the new system will be a dedicated task and shall address this with a plan for how to involve the staff.

Based on the investigations, and the understanding of SSA conditions, we can conclude that, thorough user needs assessments should be performed within SSA organization structure for full implementation of SNBS in all departments.

5. Previous SNBS Major Activities for System Design and Future Operations

The previous main SNBS project activities and deliverables can be summarized as below, in which the six Activities have been sub-divided into sub-tasks as follows

ACTIVITIES	Scope of Work
ACTIVITY 1	**Conduct Inception Meetings**
1.1	Arrangement of series of meetings with SSA stakeholders' teams to introduce SNBS, clarify any points about the project scope, review the project management approach, and agree on project communications and reporting conventions to be followed. Inception sessions addressed mutual expectations regarding the project scope, schedule and the specific roles and responsibilities of both SSA and Stakeholders teams.
1.2	The topics addressed above and mutually agreed conclusions were documented to an "Inception Report" which has been reviewed and approved.
ACTIVITY 2	**Convene SNBS Working Group**
2.1	SSA with the support of the strategic stakeholders convened the Sudan government to support the project with the information and input from several key stakeholders
2.2	Several existing geospatial systems in use by different organizations covering different geographic areas in Sudan were addressed during the SNBS stakeholder assessment.
2.3	Initiation of formal engagement with the UN GGIM program to leverage the international experience of that program and to initiate a process of formal engagement.
2.4	SSA collaboration with the Stakeholders to identify the full range of potential stakeholders and to identify the potential contribution of each.
2.5	Preparation of a charter to be distributed to prospective members.
ACTIVITY 3	**Conduct Existing Situation Assessment**
3.1	The SSA Consultants have been responsible for conducting a thorough assessment of the existing situation related to geospatial matters in Sudan, i.e working closely with SSA stakeholder and Sudan geospatial community members.
3.2	Information collected from each stakeholder were systematically consolidated to a draft writeup for each involved entity. Each writeup has been submitted for review and approval by the respective entities prior to consolidating this information to the draft SNBS Program Situation Assessment Report.

3.3	SSA will submit the draft "SNBS Program Situation Assessment Report" to the Stakeholders for review and comment. Feedback from the stakeholders will be incorporated by the SSA project to a final draft version of the report. SSA shall consider the alignment with the UN GGIM program and international best practices.
ACTIVITY 4	**Conduct Requirements Analysis and Outline Options**
4.1	Further analysis of information gathered from the previous activities, the comparison of the existing situation against the UN GGIM program and international best practices, and the outlining of all the essential requirements that will need to be addressed to establish a modern, accurate, sustainable and accessible SNBS.
4.2	A key component of the requirements analysis has been to understand the requirements for geospatial infrastructure - instruments, technology, data, data repositories, analysis, human resources, products and services required to answer economic, societal and environmental questions in Sudan. The requirements analysis has also addressed all of the components that are outlined in Activity 5 below to prepare Sudan national Basemap System Program Design and outlining all of the components and issues that being addressed in the Program Design.
4.3	SSA consultants were prepared and submitted the first draft of SNBS Requirements Analysis report, then prepared the PPT summary that has been delivered to the stakeholders through many workshop in the previous years. This will be followed by the preparation of a final draft of the requirements analysis report.
ACTIVITY 5	**Preparation of SNBS Program Design**
5.1	SSA Consultants used the results of the previous activities for the preparation of a comprehensive design for the SNBS Program, as minimum to include the interrelated components given by SSA.
5.2	SSA Consultants described in detail their approach for defining each of the components and any other elements needed to accurately and completely describe all of the targets that will need to be in place for a modern, effectively functioning and sustainable SNBS.
5.3	This activity shall define the form and function of future SNBS Center of Excellence (SCoE) to support the initial development and ongoing maintenance of the SNBS. This will include both the Center itself as well as the formulation and the charter for a permanent SNBS Special Interest Group comprising representatives from all SSA key stakeholders to support the communications and coordination among the members.

5.4	SSA project team shall support geospatial education, training and capacity building within all the relevant stakeholder organizations. Facilitate communications and outreach among the SNBS stakeholders. Assist Sudan in identifying and/or refining their geospatial needs, and pathways to meet these needs in line with the National Spatial Data Infrastructure (NSDI), and continuously monitor for technological advances and innovations that can be applied to the SNBS.
5.5	SSA team shall indicate its approach to the functional charter and organizational design for the SCoE, define its organization chart and describe staff roles and responsibilities. The SSA team shall also describe its approach to the development of a functional charter for Geospatial Special Interest Group and what content is to be included.
5.6	**Policies, Standards and Conventions** The project Consultant will be responsible for identifying and defining the policy statements and standards that will be required to support the SNBS as a national program, as well as support its contribution to the regional and international levels. These statements and standards will be authored in a manner that can be added to the overall Sudan/NSDI policy and standards frameworks that are to be defined in the context of the future NSDI program design project, with special consideration to SSA existing polies and standards.
5.7	**Geospatial Infrastructure**. The SSA project team will define a detailed specifications for all elements of the integrated Sudan geospatial infrastructure. Knowing that the Existing Situation Assessment conducted in Activity 3 and the Requirements Analysis conducted in Activity 4 will guide the geospatial infrastructure needs to support the integrated Sudan SNBS.
5.8	Document the steps to developing and implementing a new National Sudan Reference System based on the most current realization of ITRF and in line with the African vision. The ITRF2008 reference system will be the future foundation of the Sudan NSDI and will need the systems, tools and transformation methodologies to translate all of Sudan spatial datasets to the new reference system. These processes also need to be specified in detail by the SSA project team.
5.9	Specifications of a National Geospatial Database based on internationally recognized data exchange formats, with provisions for storing and managing all geospatial records (historical and current) and data e.g. maps, geodetic mark information, geodetic observations, adjustments, coordinates, heights, geoids,

	datums and transformations, various entities layers and records etc. Also, online tools to provide access to geospatial information required by industry.
5.10	SSA confirms his consideration to Education, Training and Capacity Building, as required, to the SNBS program design and to include a training and capacity building component to ensure that the relevant federal and State-level stakeholders have the competency to effectively participate in the development, implementation, management and maintenance of the SNBS. The Project team is also required to develop a high-level research and development program to support the science that underpins the SNBS and consider how the Sudan can contribute to the GGIM in a meaningful way. This may include infrastructure for research as well as support for research institutions.
5.11	**Communications and Outreach**. The SSA project team shall design a communications and outreach program to ensure that the SNBS can be effectively communicated to the Sudan leadership, decision makers, financiers and all stakeholder entities. To this end, a Geospatial Strategy for the Sudan can be proposed based on the learnings from the Activities in this document.
5.12	SSA understands that, the Business Model needs to consider avenues for funding the implementation of the SNBS Program as well as the ongoing operational costs without placing a huge direct financial burden on users that would in effect defeat the purpose of developing the SNBS. SSA will develop a Business Model that details the current and future operating environment, business model and data policy that will support the implementation of the SNBS Program.
ACTIVITY 6	**Prepare Implementation Plan and Operational Model**
6.1	The SSA project team will define a detailed implementation plan, addressing the steps need to be taken to implement all the components of the SNBS Program Design.
6.2	The implementation plan will be outlined below.

Table (1): Main SNBS project activities

6. Implications on SNBS Implementation

The SNBS Center team will make sure that, the data which will be collected and (or used by more than one department, can be used effectively, to achieve the goals of SNBS implementation and facilitate a well-informed decision-making process in SSA. To achieve the SNBS tasks, coordination and corporation among SSA departments and related agencies are highly required. From the previous investigations, that include, formation of data standards to support data integration and exchange of information, the following recommendations has been taken into consideration:

i. Management perspective on SNBS implementation;

ii. Multi-participant SNBS and data sharing benefits;

iii. The SNBS development process;

iv. Qualified and experienced staff is a key success element in SNBS implementation;

v. The roles of national standards in SNBS to facilitates the integration of geospatial data sets and information between government departments.

7. Implications of the Findings on SNBS Implementation

The successful implementation of geographic information in SNBS system is a function of management and institutional capabilities rather than of technology, SSA higher authorities are needed to play active roles in such implementation

Successful SNBS implementation, therefore, includes successfully dealing with characteristics of organisational culture, the dynamics of people interacting in teams, change processes, and the impacts of introducing new technology and big data. The primary goals of SNBS implementation are to make information readily available to decision makers, geospatial producers and users and to provide tools to facilitate integrated management and analysis of the data.

The Information and data sharing among government departments is a corner stone for a successful SNBS implementation. The benefits of data sharing are many, but the most noticeable ones include the following:

(1) access to more data; and reduced data capture expense;

(2) improved interface between systems; and shared programs;

(3) reduced data storage requirements;

(4) avoidance of inconsistent data; and

(5) Ease of access.

8. SNBS Implementation Terms

Sudan Survey Authority (SSA) is established with the mandates as being a prime Sudan government Consultant for geomatics and geospatial activities related. Based on this, SSA should submit technical proposals related to SNBS implementation, including, the preparation and establishment of SNBS Center in SSA according to the directives, objectives and technical procedures adopted.

The implementation of SNBS is important to guide the Sudan government efforts for sustainable development in terms of the provision of electronic services related to geospatial infrastructure and its usages in the country, associated with the processes of data sharing, data exchange and geospatial data integration for sustainable development goals.

The Sudan Survey Authority (SSA) constituted from the following Departments, which are responsible for all geomatics works and implementation of SNBS in the Federal and State levels. The SSA targeted Departments in this project are:

1. Sudan National Basemap Center (SNBC)
2. Photogrammetry and remote sensing.
3. Geodesy and Land Surveying
4. Geographical Information System
5. Sudan Survey work Regulation

9. SNBS Implementation Terms and Scope of Work

First Stage

a. Review SNBS previous work including designs, data models and system frame.
b. Establishment of the SNBS center
c. SNBS installation and operation in the Center and SSA Departments
d. Training and capacity buildings for the system managers and operating staff
e. Situation assessment study to the existing geospatial data in SSA and its Departments.
f. SSA needs assessment with the consideration of international best practices.
g. Documents preparation for all SSA geospatial standards, specifications, SNBS targeted data and the Departments conditions for geospatial data security and disseminations.

Second Stage:

a. Preparation of SSA Department Data models
b. Preparation of SSA Department Databases and layers.
c. Establishment and operating SSA system in all its Departments.
d. Business process reengineering for SSA departments.
e. Advanced training and capacity building for SSA staff.

Third Stage:

This stage aims checking for maintaining the technical assurance and quality control for the established SNBS in:

a. Fu fullness of Geospatial data specifications.
b. Data model conformance

Fourth Stage:

a. Establishment of the system operating environment and installation of the primary server and the network infrastructure and the connectivity with SSA Departments.
b. Preparation of user cases specifications in accordance with the policies adopted.
c. Preparation of SSA structure and SSA business processes, roles and responsibilities.
d.

10. Technical processes for SNBS Implementation

These technical approaches shall be in accordance with the required work load to execute the implementation process and to attain the stated objectives. These can be summarized as follows:

1. Project work basic Directives
2. Project Work Plan
3. Project Final Products and deliverables
4. Timeline of Project Activities Execution
5. Project Team
6. Technical support and Quality control and on job and educational training.
7. Communication Plan
8. Hardware, software and System Specification
9. Project execution cost

11. Sudan Council of Ministers Directives

In accordance with the Sudan Council of Ministers, SNBS approval and the unlimited support given by the Ministries of Finance and their endorsement for the necessity of good preparation and excellent design, execution and SNBS implementations at Federal and State levels in Sudan, SSA acknowledge the importance of SNBS implementation, with clear scope of work and services as well as the consideration of the big challenges that may face the implementation processes. Based on this, SSA and the SNBS Center team shall depend on the following main directives throughout the project execution:

1. SSA Scope of Work Basic Directives
2. SSA Work's objectives and Deterministic.
3. SSA survey act and the regulations governing SSA works
4. SSA works requirements and specifications
5. SSA departments' nature of work and the relevant originations participating in updating geospatial data and information for the SNBS.
6. Basic objectives of SNBS to meet national and international requirement.
7. The previous and required technical efforts.
8. Inception report deliverables
9. Extracted User cases from the inception report from which the scenarios and policies shall be built in the conceptual model and for completing the attributes in the physical model.
10. The group of data and concepts extracted from the conceptual model in the previous SNBS stages and in this project at the analysis stage.
11. The data structure design during the preparation of the logical model.
12. SSA decision maker's requirements and the end users as given in the inception report.
13. The requirements and basics specifications for the preparation of SSA GIS and digital maps.
14. Technical risks and project time duration
15. Consideration of previous national, regional and international experiences.

12. Hardware and software required for the SNBS operation:

The SNBS should be implemented in an integrated environment, with the capability of data exchange and data sharing for decision makers and system users to access the geospatial data and information according to the SNBS adopted standards and directives. The establishment of such an environment requires specialized hardware and software that capable for the sustainability of the system processes, management, security, privacy and data accessibility.

Table ( ), list the main components of the hardware and software that should be used to attain the required level of SNBS implementation, here in SSA and its Department.

No.	Category	Component	Nos	Remarks
1	Hardware	GIS Server	1	SNBS implementation for multiusers
2		Database Server	2	Data retrieval, management and storages.
3		Web Server	1	Provision of SNBS web-services
4		External Storage	2	Data archive and storing
5		PC's	many	For users implementations
6		Network Components	many	Components of the personal computers network environment
7	Software			Distributed GIS Environment
8		ArcGIS Server Enterprise		Data Repository & Multiuser Geodatabases
		ArcSDE		ArcGIS Developing Environment
9		ArcSDK		Web Servicing
10		ArcIMS		GIS Server Clients
11		ArcGIS Desktop		Dbase Management System
		SQL Server Enterprise		ArcGIS Server Integrated Environment
12		Microsoft Visual Studio		Computational Base Environment
13		.NET Framework		ArcGIS Professional Applications
		ArcGIS Server Extensions		
14				

Table (2) List of required Hardware and software for SNBS Implementation

13.	**SNBS Studies, design and development Stages:**
1	Study and analysis for SSA existing Situation
2	SSA Needs Analysis
3	Design of SNBS Services Design
4	SNBS Development
5	SSA Analysis of Data collection and data quality
6	SNBS Establishment and quality control
7	Issuing and announcement
8	SNBS directives for its implementation in SSA
9	Project stage 1: Establishment and implementation of SNBS
10	Project stage 2: Preparation of the data model and database layers of SSA Departments
11	**Training and Knowledge Transfer.**
12	Documentation of Project deliverables
13	Preparation of Service Level Agreements (SLA) with the SSA stakeholders

Table (3) Project Execution Time schedule in SSA

14. SSA Main Stakeholders and Partners

The SSA stakeholders shall include Sudan geospatial community, all federal and local governments' entities, private and public sectors organizations. SSA has met and coordinated with the following entities for the implementation of the Sudan National Basemap. SSA has already signed memorandum of understanding with all States ministries of infrastructures and some federal ministries.

No.	Government Federal Entities		Government States Entities
1	Ministry of Defense	16	Khartoum State Ministries and Localities Ministry of Planning Ministry of Infrastructure
2	Ministry of Finance and Economic Planning	17	White Nile State Ministries and Localities
3	Ministry of Interior Buildings Security Custom Department	18	Blue Nile Region and States
4	Ministry of Justice	19	Darfur Region and States
5	Ministry of Mining Geological Research Authority	20	Al Jazeera State
6	Ministry of Council of Ministers	21	Northern State
7	Ministry of Irrigation	22	North Kordofan State
8	Ministry of Higher Education	23	West Kordofan State
9	Ministry of Transportation	24	South Kordofan State
10	Ministry of Health	25	Sinnar State
11	Ministry of Energy Oil Information Center	26	Nile River State
12	Civil Aviation Authority	27	Al Gadarif State
13	National Information Center	28	Kassala State
14	National Statistics Authority	29	Red Sea State
15	General Intelligence Authority		* Electric Distribution Company

Table (4): SSA Main Stakeholders

15. Associated Strategic Projects:

Project. A1: Unification of Sudan Geospatial Reference System

Project.1: Establishment of Sudan Geodetic Control Network

1	List and review the existing entities geodetic networks and their ground control points locations
2	2 Sudan Geodetic Network Design and Selection of the location of geodetic Control Points
3	**3** Monumentation of Geodetic Control Stations
4	**4** Field Survey Observation, data processing and quality assurance
	5 Adjustment of Sudan Geodetic Control Network
	6 Establishment of one International/regional Station

	Project.2: Extension and Densification of Sudan Vertical Control Network
1	Selection of Benchmarks locations, Design of levelling loops and Benchmarks monumentation.
2	Levelling and processing and adjustment of the levelling network
	Project.3: Determination of Sudan Gravimetric Geoid Model
1	Sudan gravimetric Network Design
2	Gravity observations, processing and gravity reductions
3	Gravimetric Geoid Computation
4	Gravimetric Geoid fitting
	Project.4: establishment of Sudan Vertical Datum
1	Selection of tide gauge's locations in the red sea
2	Tide measurements at the selected gauge points
3	Establishment of Sudan Vertical datum
4	Connecting Existing Sudan Benchmarks with the Sudan Vertical datum point

A2. SSA Projects for Administrative Boundaries and Red Sea shore

No	Projects to be Executed
1	SSA Roadmap for National Geospatial Information Management Implementation
2	Administrative Boundaries Demarcation for the Sudan Regions, States and Localities
3	Maps Preparation of Red Sea hydrographic charts and Sea shores
4	River Nile bathymetric Surveys and the preparation of River Depths and River Sides Maps
5	Preparation of national Federal and States Atlases