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DOCUMENT

Statement of Work

Satellite-Enhanced Telemedicine and eHealth for sub-Saharan Africa (eHSA) Programme

Study on Interoperability

Prepared by
Reference TAFS-EST-SOW-002
Issue 1.0
Revision 1
Date of Issue 19/03/2012
Status Authorised
Document Type SOW
Distribution



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2 BACKGROUND

A well-conceived eHealth platform is the result of a design that deeply understands and considers various domains, including technical aspects, human factors, organisational roles and financial models. These domains form a complex environment with a high degree of interoperation amongst them. A successful eHealth platform has to acknowledge this situation, paying special attention to the implications of the underlying interoperability aspects.

2.1 Context and Purpose of this Document

The study on interoperability aspects described in this document will outline and analyse all the domains and their underlying interoperability aspects, as required to design, implement, and operate a pan-African eHealth platform. This will be used as the basis for identifying and designing opportunities to be considered when planning phase 2 of the eHSA programme.

2.1.1 Context and Rationale

The eHSA Programme is a key recommendation of the Telemedicine Task Force (TTF)¹, a group which was set up in June 2006 with a view to developing a complete picture of telemedicine opportunities in Sub-Saharan Africa and formulating recommendations for further implementation [RD-1], [RD-2]. Key elements of this effort are strong African ownership, contribution to Millennium Development Goals (MDGs) of the United Nations, and to counteract the workforce shortage in the region. The final goal of the eHSA Programme is to enable the development of a satellite-enhanced eHealth and telemedicine infrastructure for the benefit of the Sub-Saharan African region. This infrastructure shall be capable of delivering a variety of services for education, clinical services, surveillance and management to the Sub-Saharan citizens and health workers. This goal should be reached in full coherence with the strategic priorities of the socio-economic development of the Sub-Saharan African region [RD-3].

¹ The TTF was composed of representatives from: the African Union Commission (AUC), the New Partnership for Africa's Development (NEPAD), the African Development Bank (AfDB), the Communauté Economique et Monétaire de l'Afrique Centrale (CEMAC), the Organisation de Coordination pour la lutte contre les Endémies en Afrique Centrale (OCEAC), the East African Community (EAC), the Economic Community of West African States (ECOWAS), the Secretariat of the African, Caribbean and Pacific Group of States (ACP Sec), the World Health Organization (WHO), the European Commission (EC) and the European Space Agency (ESA).



2.1.2 Purpose of this Document

This Statement of Work (SoW) has been created in the context of the Delegation Agreement between the Luxembourg Agency for Development Cooperation (Lux-Dev) and the European Space Agency (ESA) for the implementation of the first phase of the Satellite-Enhanced Telemedicine and eHealth for Sub-Saharan Africa Programme (eHSA) funded by the EU-Africa Infrastructure Trust Fund (ITF) and the Government of Luxembourg.

2.2 ESA's involvement in eHealth

Over the last decade through several ESA programmes, space technologies have been successfully applied to a small number of health-related scenarios. For instance, in the ARTES programme, different projects have been initiated to explore and promote the different facets of telemedicine via satellite. The projects aimed at developing hardware, software, and content required by the specific telemedicine applications, and subsequently using the created system in a pilot utilisation phase with real users under real operational conditions. The new Integrated Application Programme is further reinforcing the link with the relevant health communities.

In spite of the potential benefits offered by space in supporting applications in the field of health ([RD-6]), until today the health sector has seen neither significant utilisation of space technologies nor systematic analyses of needs for space assets. Aside from cost considerations, this may be due to the health professionals' limited awareness of space capabilities on one side, and by limited understanding of user needs and regulatory issues by the space actors on the other side. Without a comprehensive understanding of the healthcare domain, the chances of a breakthrough in the utilisation of space assets are very limited. In this situation, contributing to paving the way for eHealth and telemedicine service penetrations in developing countries is a significant opportunity for promoting space infrastructure for societal benefit.

2.3 eHealth for Africa

eHealth and telemedicine development has brought hopes to developing countries and their most remote areas. Advanced technologies such as electronic medical records, decision support systems, diagnostic imaging and biosignals, mobile computing, and robot-assisted medical procedures have changed the hospitals and operating theatres around the Western world. Geographic distance has significantly lost impact on service provision.

However, the global society has not followed the industrial world and its broadband rush. As globalization moves on toward an information society without digital divide, hope and goal are that the gap between developed and developing countries will shrink. The MDGs have set out concrete, measurable objectives to support such development. Sub-Saharan Africa is one of the world's regions which need comprehensive action in order reach these goals [RD-7].



In this respect, it must be noted there are millions of people in sub-Saharan Africa living in areas where there is no short-to-medium term plan to invest in ICT infrastructures. These people are also likely to live in areas with a lack of health and transport infrastructure, making a trip to the closest hospital a time intensive and expensive journey. The availability of an appropriate ICT infrastructure can allow the sub-Saharan population the access to various services, including eHealth. Just to illustrate this situation, currently just over half of the sub-Saharan African population are covered by the mobile phone network which leaves about 350 million outside of the network coverage. This number will be expected to shrink as mobile networks grow, though this is likely to be at a decreasing rate on an aggregate level as the networks initially reach the most populated and easy-to-access areas first.

Sub-Saharan Africa has significant social and economic development potential but currently faces a number of barriers preventing them from playing a more significant role in the global economy. The serious health problems which are evident across the African continent are among the most critical of these barriers. The MDGs already acknowledge the importance of Health explicitly in three out of the eight specific goals: reduction of child mortality; improve maternal health and; combat HIV/AIDS, malaria and other diseases.

The poor health situation is reflected both in high concentrations of communicable diseases and the sparse average health outcomes across the populations, especially amongst disadvantaged groups such as rural dwellers, the poor, women, and children. In many places, there are insufficient human and financial resources to apply the required levels of healthcare needed to address these issues. This is often exacerbated in more remote areas where infrastructure has proven to be insufficient in providing the health-care services required; therefore raising significant barriers to delivery.

Addressing the needs of these areas and populations requires both providers of appropriate medical services and products, and also the means of effectively delivering the requested services to all communities in need; whether they are near or far.

In this context, ICT offers significant opportunities and the potential for world-wide advancement in health and healthcare. eHealth, i.e. the use of ICT for clinical, educational and administrative purposes within the health sector, both locally and at a distance, is a key enabler for supporting health systems and delivery of healthcare ([RD-4]).

As a precursor activity, and in response to the actions described in [RD-2], a demonstration project funded by European Commission and delegated to ESA² is currently running in order to demonstrate the feasibility of satellite technology to extend the reach of eHealth and to contribute to regional efforts to overcome health workforce shortages.

2.4 The eHSA Programme

The Satellite-Enhanced Telemedicine and eHealth for Sub-Saharan Africa (eHSA) Programme is a six-year programme with an overall budget of 36 MEuro. This programme

² More information at: http://iap.esa.int/news/SAHEL_News_21022011

comprises four horizontal studies and four thematic areas. Figure 1 shows the overall programme structure.

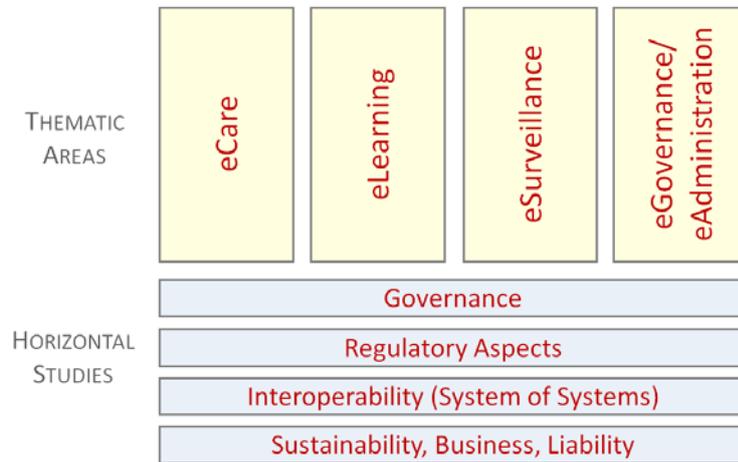


Figure 1: Overall Structure of the eHSA Programme

The programme has been designed to meet the challenges and to exploit the opportunities described in the previous section. The programme focuses on activities towards implementation of sustainable services on a scalable infrastructure. Prior to service implementation projects in thematic areas, four horizontal studies will be conducted. A rough indication of the possible timeline is shown in Figure 2.

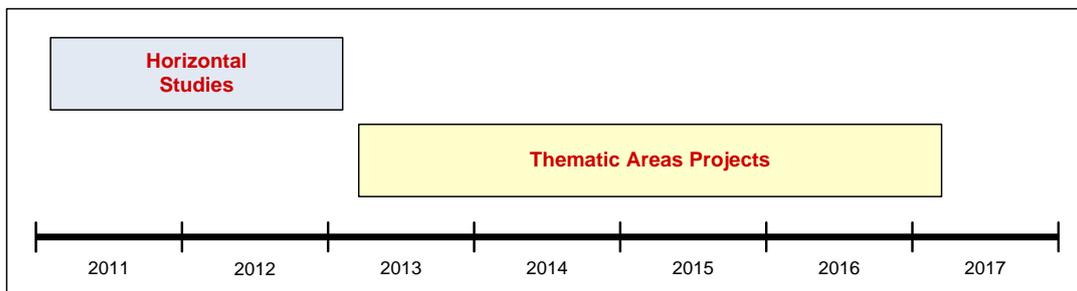


Figure 2: eHSA Programme Timeline

The four horizontal studies are cross-thematic and considered a mandatory precondition of success for the eHSA Programme. They address key issues critical to the implementation of any eHealth and telemedicine service. They will provide the backbone of the programme and emphasize sustainability of infrastructure and services as the major goal, involving the three other aspects as critical success factors. The infrastructure will also be open for services beyond eHealth, and in this way contribute to the knowledge economy of the region.

Each horizontal study is expected to be conducted with a budget of 1 MEuro. The subjects to be investigated are: governance, regulatory aspects, interoperability (which are specifically covered by this SoW), and sustainability.



As coordination is of crucial importance in order to grant the necessary inputs to the different studies, the SoW corresponding to each of the four studies defines specific elements facilitating this coordination that will be enabled via ESA.

3 GENERAL ASPECTS OF THE INTEROPERABILITY STUDY

3.1 Introduction

For the provision of eHealth services, it is important to note that the systems, units and forces are not just technical, but also human. In this context, the nature of interoperability widens, automatically covering political, organisational, social, financial, and other aspects. Focusing on sub-Saharan Africa, this becomes a major and ubiquitous challenge. In order to implement eHealth services, it is important not only to make systems work and communicate (existing ones and new ones), but also to ensure the transmitted contents have a common semantic understood by all involved stakeholders. Furthermore, organizations – such as health service providers, healthcare professionals, authorities, health insurance schemes, etc. – must share responsibilities and workflows, and countries and regions must interoperate on a political level. For example, a major constraint in the development of new health services originates in differences between the health and economy sectors in many countries, often showing a lack of synergy.

Taking into account all these considerations, it is clear the development of a cost-effective technical solution or service is not enough. A thorough understanding of all the surrounding environment together with the way it should interoperate with the proposed solution is mandatory; this is necessary not only the operation of the systems and the provision of the services, but also to ensure their acceptance.

In conformance with [RD-2] the horizontal eHSA Programme Study on Interoperability Aspects shall:

1. Investigate all domains and their underlying interoperability aspects linked to the design, implementation and operation of eHealth platforms and services.
2. Design a scalable, modular, and African-owned platform supporting a complete pan-African provision of eHealth services in consonance with the sub-Saharan African situation.
3. Identify areas where the implementation of such a platform could be started with high anticipated impact and sustainability.
4. Suggest an implementation roadmap for the designed eHealth platform covering the whole of sub-Saharan Africa. Take into account all the technical and non-technical interoperability aspects.

3.2 General Requirements

The study must meet the following general requirements:

- The study shall pave the way to the identification of promising cases of eHealth services and their environments, to be considered in phase 2 of the eHSA programme.
- The study must exploit recent relevant work conducted earlier by other programmes and initiatives (e.g. [RD-3], [RD-8], [RD-11], [RD-12], [RD-15]) as well as local partnerships to gain a deep understanding of the entire situation
- All efforts in the study must be undertaken in full coherence with the health and eHealth political agendas of the sub-Saharan African countries, Regional Economic Communities (RECs), and the African Union's relevant policies ([RD-4], [RD-8], [RD-9], [RD-10]).
- Models and designs created in the study must explicitly support the key elements of the eHSA programme: strong African ownership, contribution to the United Nations Millennium Development Goals, and counteracting the health workforce crisis.
- State-of-the-art modelling methods and tools have to be used, such as UML³, BPML⁴, GIS⁵, or others. All models and designs of any kind created during the study (structures, processes, databases etc.) have to be delivered (in addition to the technical reports) in the source format of the modelling tools.

The study must be carried out in full awareness of its outstanding importance, which is considered very critical to the entire eHSA Programme.

3.3 General Benefits

In order to achieve its objectives, it is important that this study provides an overview of all the domains necessary to effectively design and implement eHealth platforms and their associated services. This basis is essential to understanding the situation on sub-Saharan Africa, leading to a sustainable, modular, scalable, and African-owned solution.

Additionally, the analysis of the sub-Saharan scenario will help identify the most promising countries or geographical areas where fertilisation projects framed on the second phase of the eHSA programme can begin. These projects will be the first actions towards a complete pan-African eHealth platform and its associated services.

³ UML: Unified Modelling Language

⁴ BPML: Business Process Modelling Language

⁵ GIS: Geographic Information System



This study on Interoperability aspects in sub-Saharan Africa essential not only to the eHSA programme objectives, but also to any initiative attempting to create sustainable eHealth services in the entire region.

4 WORK DESCRIPTION

The main scope of the eHSA Interoperability Study is to comprehensively investigate the interoperability-related requirements of all domains linked to design, implementation and operation of a pan-African eHealth platform and its associated services. The study will have to come out with a modular reference model demonstrating scalability, sustainability and African ownership that can be tailored to the specific conditions of each country / geographical area, and from there, to grow and finally reach a pan-African scale. To achieve this goal, the following objectives have been defined:

1. Identify all domains linked to the design, implementation, and operation of an eHealth platform and supported services. Analyse them and the interoperability aspects underneath. Focus on the categories of services considered within the eHSA programme (Appendix B). Define an interoperability framework and design a general reference eHealth platform providing eHealth services.
2. Using the defined framework, analyse the sub-Saharan situation, and identify the countries / geographical areas with a high degree of readiness where a potential implementation of a pan-African eHealth platform and supported services may begin. Refine the reference eHealth platform and provide a complete in-depth design for these “seed areas” of the future eHSA pan-African eHealth platform.
3. Provide an implementation roadmap for the identified seed areas that can later be used as a baseline for defining eHSA phase 2 projects. For countries that are not ready, provide advice on general strategies towards achieving a minimum degree of maturity, thereby enabling the implementation of infrastructure and services necessary to connect the pan-African eHealth platform, later.

The activities of this study shall be performed following an approach covering two major steps, defined in the following subsections 4.2 and 4.3 on the basis of the general requirements presented in section 3.

The contractor shall undertake a programme of work lasting no more than 12 months for the execution of the activity.

The overall study logic is divided into two steps as illustrated in Figure 3. Each of the steps is estimated to require similar amounts of working time.

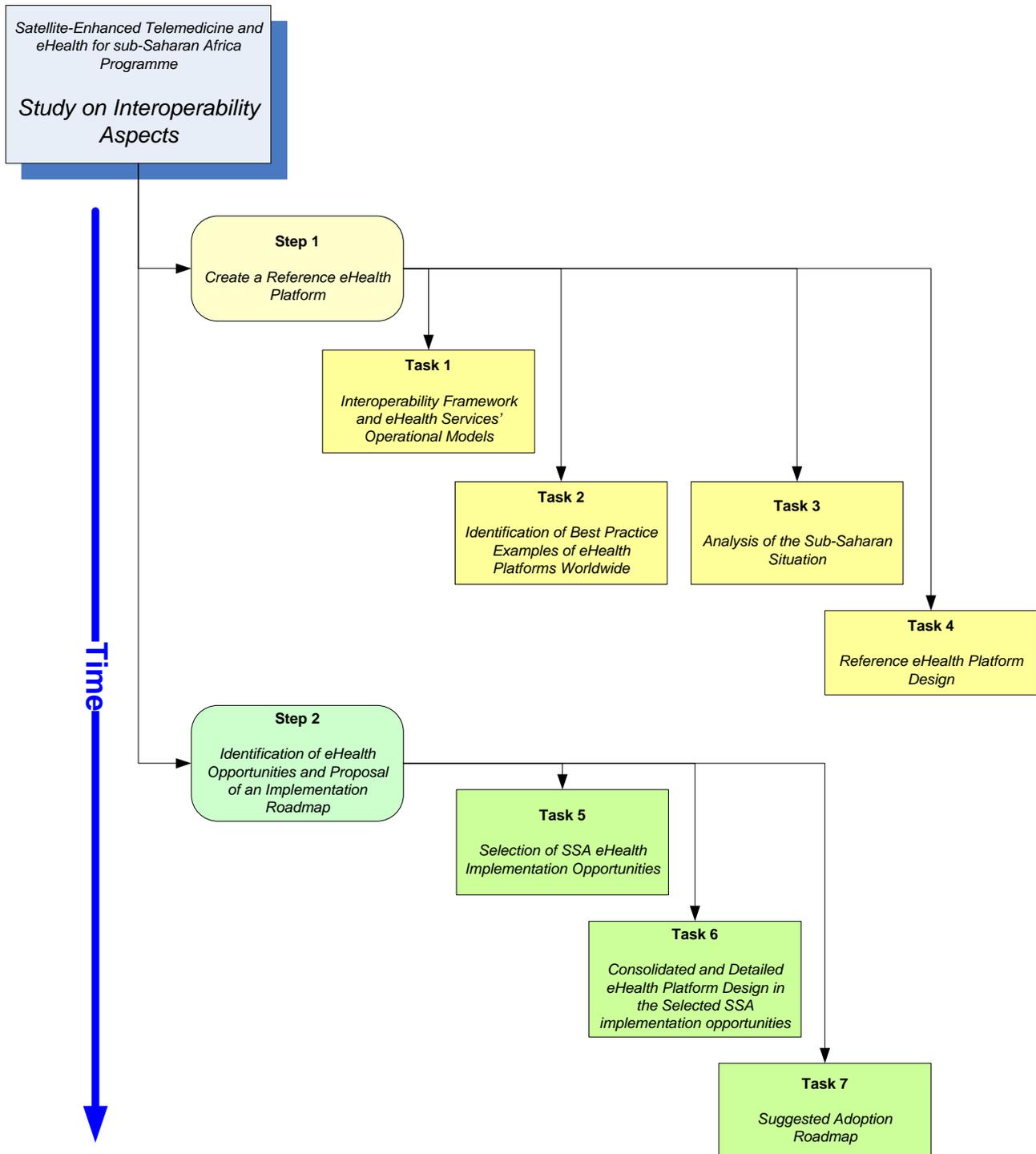


Figure 3: Interoperability Aspects Study Logic

4.1 Terms and Conventions

The present Statement of Work (SoW) contains a list of reference terms in Section 6.2. For convenience, the following terms and conventions are anticipated.



Interoperability in the context of eHealth is defined as “the ability of systems, units or forces to provide services and to accept services from other systems, units, or forces and to use the services so exchanged to enable them to operate effectively together [RD-11]”. In the context of eHealth, systems and units are more than technical components. They also involve people and their interrelations with and without those systems. In this context, interoperability covers technical aspects, but also others such as political (e.g. national healthcare agendas, international relations, etc.), organisational (e.g. management of the supply chain, infrastructure / personnel sharing, etc.), social (e.g. generation of externalities, attitude of the population towards new services, etc.) and financial (e.g. required investments, funding mechanisms, etc.).

In this SoW and for convenience, an *eHealth Platform* will be understood as the system of systems (hardware and software) together with the procedures, protocols (access, authentication, distribution, etc.) and the data necessary to support the provision of eHealth services.

4.2 Step 1: Current Status of eHealth Platforms and Their Implementation

Mission:

Propose a reference eHealth platform able to provide eHealth services in sub-Saharan Africa addressing all necessary levels affecting the provision of eHealth services and their interoperability.

Objectives:

- Define an interoperability framework for the operational provision of eHealth services. This framework shall cover technical, political, organisational, social and financial aspects. Based on this framework, recommend operational models for each of the four categories of services considered within the eHSA programme (eCare, eLearning, eSurveillance, eAdministration/eGovernance).
- Perform a worldwide review of eHealth platforms and their status and identify best practice examples based on the interoperability framework and the operational provision of eHealth services.
- Describe in full detail the situation in sub-Saharan Africa regarding the implementation and operation of platforms supporting eHealth services, as well as all the associated interoperability aspects (political, organisational, social and financial). This description shall be carried out not only within national boundaries, but shall also investigate trans-border relationships.
- Propose a reference eHealth platform supporting the provision of the four categories of services considered within the eHSA programme (eCare, eLearning, eSurveillance, eAdministration/eGovernance) and identify all interoperability aspects associated to that reference eHealth platform.

Rationale:

An eHealth platform supporting the provision of eHealth services is a complex system of systems with many interoperability issues involved (technical, organisational, political and financial) that are mandatory to identify and understand. Practically, this understanding shall be based on a thorough review of the global and the sub-Saharan status, the identification of best practice cases and the conditions imposed by the existing situation. All the information obtained shall be described in the form of an eHealth reference platform model that can later be used to analyse the readiness of the sub-Saharan region to adopt eHealth services.

Approach:

The design of a platform able to support the provision of eHealth services can only be done with a thorough understanding what these services require and imply. To this end, it is necessary:

- To define an interoperability framework based on typical cases of health service delivery, education and training, health surveillance, administration and governance; this framework shall address interoperability on different levels, mainly technical, organizational, social, financial and political. The framework shall also take into account other relevant aspects such as management, stakeholders involved, basic infrastructure and systems and services required.
- To design operational models covering each of the four categories of services considered (eCare, eLearning, eSurveillance, eAdministration/eGovernance) and based on the defined interoperability framework.

Before using the framework and operational models, their suitability has to be validated. To do so, the identification and analysis of best practice examples worldwide is proposed. The choice of these examples shall be properly justified, shall cover all the intended categories of eHealth services and shall provide clear insights in all the interoperability aspects associated with the operational provision of eHealth services and how to evaluate them.

This identification of best practice examples must be complemented with a detailed analysis and assessment of the sub-Saharan situation, including:

- All the aspects considered in the interoperability framework and the operational models defined for eHealth services.
- Possible services and infrastructure that can be accessed and used during a possible implementation phase, starting from basic needs (i.e., electricity, water, etc.) to more advanced ones (telecommunications, transport, theft protection, etc.); The potential of satellite communications to provide access to eHealth services in areas with low or without any connectivity shall also be considered.



- Existing sub-Saharan eHealth platforms and services (if any) that could also be beneficial, especially in understanding the relationships between all the layers addressed in the interoperability framework, and in refining evaluation criteria.

The information obtained shall be used to define a reference eHealth platform model for the sub-Saharan scenario, having the interoperability framework and the operational models of eHealth services as its backbone. This reference eHealth platform model shall be constructed and consolidated using the results obtained from the global and sub-Saharan analyses done. This reference eHealth platform model shall be validated by putting the already identified examples in its context and evaluating them using the criteria already identified. This reference eHealth platform model will later be the basis for specific implementations and operations of eHealth services in sub-Saharan Africa, and as such, shall allow high modularity and scalability.

The exact scope of the work will be described later in Tasks 1-4.

Expected Outputs:

- A justified and detailed interoperability framework.
- Detailed operational models of eHealth services (eCare, eLearning, eSurveillance, eAdministration/eGovernance) put in the context of the interoperability framework.
- Justified examples of eHealth platforms (representing at least 8 countries worldwide), analysing their interoperability aspects and the services they provide.
- A fully detailed analysis of the situation regarding eHealth platforms in the entire sub-Saharan Africa, addressing all the interoperability levels.
- A reference eHealth platform model based on the interoperability framework, the operational service models, the assessment of the worldwide best practice examples and the sub-Saharan situation.
- An instantiation of the identified eHealth service examples in the context of the reference eHealth platform model.

4.3 Step 2: Identification of eHealth Opportunities and Proposal of an Implementation Roadmap

Mission:

Design eHealth platforms as subsets of a pan-African eHealth platform and provide their associated implementation roadmap focusing on the most promising sub-Saharan implementation opportunities.



Objectives:

- Provide a ranking of the different sub-Saharan countries and areas on all levels considered within the interoperability framework, based on the information obtained during the Step 1. Identify the countries and regions that are ready to begin implementation of a pan-African eHealth platform and the associated services in the short-to-medium term.
- Design subsets of the whole eHealth platform and their associated services tailored to the previously identified countries and regions, starting from the reference eHealth platform defined. These subsets shall cover all levels considered in the interoperability framework and relevant information previously collected. Designs shall maximise the utilisation of existing resources / services where possible and ensure a strong African ownership of resources and results.
- Suggest an implementation roadmap for the designed subsets of the pan-African eHealth platform and services, starting with the highest readiness countries and regions. For those not ready yet, suggest a general strategy to maximise the chances of providing eHealth services in the future.

Rationale:

The implementation of the eHealth platform providing services in sub-Saharan Africa shall be done in a step-wise approach starting with areas demonstrating a sufficiently high degree of readiness. Any solution provided shall be modular and scalable enough to grow in the future at all interoperability levels. It shall also be compatible with existing processes, systems and services and must ensure a strong African ownership of resources and results.

Approach:

An eHealth platform supporting the provision of services covering the entire sub-Saharan region is an extremely complex and ambitious task, which cannot be fully addressed in this study. Therefore, the proposed approach is to start building subsets of the platform in selected promising countries and regions, expecting them to grow in the future towards complete coverage of sub-Saharan Africa. Therefore, it is necessary to select those starting areas via a full ranking of the sub-Saharan countries and regions in terms of readiness to accept eHealth. This ranking shall be based on the findings of Step 1, using the interoperability framework defined to justify a set of quantifiable criteria.

Once the identification is done, the aforementioned subsets of the pan-African eHealth platform shall be designed, supporting the provision of the four categories of services considered, to the maximum possible extent. These subsets shall be cost-effective, modular, scalable and sustainable, taking into account all previous interoperability considerations, strong African ownership of resources, maximum re-utilisation of existing infrastructure and assets, strategies to overcome existing gaps, as well as acceptance by the population, the governments and other stakeholders. There should be at least one sub-



platform (able to support each of the four services) for each of the main regional economic communities of sub-Saharan Africa.

The final task shall be to propose a roadmap addressing the implementation and operation of the designed eHealth platform subsets and their associated services, starting from the most promising countries and regions identified. This roadmap shall include all the necessary steps and actors covering all (interoperability) levels including: stakeholders to be involved, the strategy to be followed, the infrastructure required, any agreement / permission required to deploy and operate any system or service, value chains, etc. In those cases where the current situation does not allow the deployment of a solution, suggest a general approach to find out the minimum prerequisites needed to build the related subset of the platform.

The exact scope of the work will be described later in Tasks 5-7.

Expected Outputs:

- A complete ranking of the sub-Saharan countries and regions indicating those with a higher degree of readiness to start with the implementation.
- Full design of the subsets of the eHealth platform and services in those countries and geographical regions identified.
- A roadmap describing in full detail the implementation and the transition to operations of the designed eHealth platforms and services.
- A general strategy dedicated to achieving the minimum prerequisites necessary to consider any implementation of eHealth services in those countries / areas not ready yet.

5 RELEVANT TASKS

5.1 Step 1: Current Status of eHealth Platforms and Their Implementation

Step 1 of the study is dedicated to proposing a reference eHealth platform able to support all categories of eHealth services considered (eLearning, eCare, eSurveillance eAdministration/eGovernance) in sub-Saharan Africa. A deep assessment of all interoperability levels is mandatory.

5.1.1 Task 1: Interoperability Framework and eHealth Services' Operational models

The bidder shall:

- Create an interoperability framework describing all of the levels involved in the provision of eHealth services and their interoperability. The framework shall cover technical, political, organisational, social and financial levels.
- Build operational models covering the four categories of eHealth services (eCare, eLearning, eSurveillance, eAdministration/eGovernance), using the interoperability framework already defined.
- Validate the completeness of the proposed framework and operational models and propose evaluation criteria for the performance/success of eHealth services.

Requirements:

1. Identify a list of interoperability requirements for each of the four eHSA service categories (eLearning, eCare, e Surveillance, eAdministration/eGovernance) for an eHSA platform to be deployed in SSA.
2. Identify the processes/tasks needed to fulfil these requirements. Each process/task identified shall include a summary of the resources necessary for its completion and a timeline, which shall identify the critical path.
3. Identify the stakeholders needed to execute the identified processes/tasks:
 - Identified stakeholders shall be able to address all requirements pertaining to the technical, organizational and societal/political requirements, at all levels of healthcare and all geographic levels.
 - Allocations of all major tasks/processes shall be justified.
4. Create operational models of each of the four service categories allocating each task/process identified to one/many of the identified stakeholders. Allocations of all tasks / processes shall be justified.



5. Based on the operational models of the eHSA service categories, define success criteria and KPIs (Key Performance Indicators) for the later evaluation of eHealth platform elements.
6. Based on a set of indicators, define instruments for measuring the degree of interoperability – overall, and on each of the levels (technical, organizational, societal/political).

Outputs (See section 6):

- A justified and detailed interoperability framework (Contribution to TN-1).
- Detailed operational models of eHealth services (eCare, eLearning, eSurveillance, eAdministration/eGovernance) in the context of the interoperability framework (Contribution to TN-1).
- Evaluation criteria regarding the performance of future eHealth services (Contribution to TN-1).
- An instrument for measuring the degree of interoperability (Contribution to TN-1).
- An instantiation of the framework and the operational services using a software tool (ED-1).

5.1.2 Task 2: Global Best Practice Identification of eHealth Platforms

The bidder shall:

- Review the current state of the art regarding eHealth platforms and services provided worldwide, and based on the outcomes of Task 1, identify best practice examples.
- Analyse these examples and identify how the different levels addressed within the interoperability framework have been considered.
- Compile lessons learned from the implementation of these examples and validate the suitability of the outcomes of Task 1, revising them if necessary.

Requirements:

1. Best practice examples shall be identified by applying the interoperability assessment instrument defined in Task 1 to at least 8 countries and regions' current eHealth platforms extracted from published evidence.
2. The best practice examples shall cover all four categories of eHSA services.
3. The bidder shall provide an annotated bibliography of all resources surveyed when compiling the list of best practices.



4. The bidder shall ensure that the interoperability framework and the operational service models defined in Task 1 are sufficiently broad to cover the best practice examples. Particularly, compliance shall be considered in the context of information concerning healthcare standards, data management, storage, access and security.
5. The bidder shall include organizational, political, societal, and economic best practices.

Outputs (See section 6):

- Justified best practice examples of eHealth platforms (representing at least 8 countries worldwide), analysing their interoperability aspects and the services they provide (Contribution to TN-2).
- Bibliography including detailed comments on the evaluation (Contribution to TN-2).
- Extended interoperability framework and operational service models defined in Task 1, where necessary (Update of TN-1 and ED-1).
- Best practice examples instantiated using the software and the modelling done for Task 1 (ED-2).

5.1.3 Task 3: Sub-Saharan Situation

The bidder shall describe the full sub-Saharan landscape considering all levels included in the interoperability framework and the operational service models defined in Task 1. In particular:

- Analyse the full extent of the sub-Saharan situation, focusing on all the relevant aspects identified in Tasks 1 and 2. This analysis should not be restricted to national situations, but shall consider trans-border conditions.
- Refine and extend evaluation criteria obtained during Tasks 1 and 2 for eHSA resource availability.
- Quantify the connectivity of sub-Saharan Africa at the local/district/national/regional levels. For each geographical area, assess the potential role and relevance of ICT infrastructure (including Satellite Communications) presently and in the anticipated mid- to long-term. Define suitable indicators for this assessment.
- Evaluate availability of resources (technical, organisational, political, societal, and financial) in sub-Saharan Africa for future eHealth platforms.

Requirements:

1. Produce a complete list of necessary resources for the deployment of an eHealth platform in SSA.
2. Identify and describe existing eHealth services in sub-Saharan Africa, with a focus on interoperability between these services and those to be created as part of the eHSA programme.
3. Identify and describe relevant health programmes that could interoperate with an eHSA programme.
4. Define quantitative and qualitative evaluation and scoring criteria, and a scoring system for the evaluation of availability and usability of these resources.
5. Evaluate the national availability and usability of the resources defined in this task.
6. Evaluate the sub-national availability and usability of the resources defined in this task for regions where significant national variation exists with respect to the resources.
7. Provide a justified level of confidence for all outputs of this task.
8. Produce a database containing all the findings of this task.

Outputs (See section 6):

- A fully detailed description of the situation in the entire sub-Saharan Africa addressing all the aspects associated with eHealth platforms and interoperability (TN-3).
- A database with querying and reporting capabilities for all the findings of this task (ED-3).

5.1.4 Task 4: Reference eHealth Platform Design

Based on the outputs of previous tasks, the bidder shall design a reference eHealth platform model for the provision of eHealth services in SSA. This reference design shall comprise all aspects considered in the interoperability framework and shall be able to support all operational models defined. The design model shall easily be extendable to a full implementation model of the eHealth platform and services when considering specific cases.

The bidder shall:

- Create the functional design of an eHealth platform.
- Provide a top-level architectural design for the reference eHealth platform.
- Provide a funding model for the reference eHealth platform.



- Evaluate the reference eHealth platform design against the set of criteria defined in Task 1.
- Use modelling software to provide an operational design of the reference eHealth platform.

Requirements:

1. The functional design of the eHealth platform shall comply with medical standards for data storage, management, business logic, security, and healthcare provision; as well as ITU regulations, and relevant legislations.
2. The eHealth platform design model shall take into account the general frameworks defined (Tasks 1 and 2) and the particularities of the sub-Saharan region (Task 3).
3. The design model shall ensure modularity and scalability of all its subsequent implementations.
4. The functional, architectural and operational designs shall be accompanied by a statement of assumptions, restrictions, constraints, and gaps.
5. The funding model shall be covering the platform's implementation and sustainable operation.
6. In the evaluation of the reference eHealth platform model, the bidder shall identify weaknesses and risks of failure, and how to address those when using the model to create implementations.
7. Additionally, the operational design shall include all platform aspects (ie. the network, network services, basic services for security, logging, etc. – independently of specific eHealth services. It shall also include representative examples from eHealth services introduced in Task 1.

Outputs (See section 6):

- Reference eHealth platform model, addressing the platform and all the associated interoperability aspects, comprising the functional, architectural and operational designs (Contribution to TN-4).
- Funding model for the implementation and operational phases of the eHealth platform (Contribution to TN-4).
- Evaluation of the reference eHealth platform model using the criteria already defined, including a risk analysis (Contribution to TN-4).
- Electronic version of the created models, in addition to the paper versions (Contribution to ED-1).

ESA's approval is required to proceed with the tasks associated to step 2 of the study.

5.2 Step 2: Identification of eHealth Opportunities and Proposal of an Implementation Roadmap

Step 2 of the study is dedicated, first, to identifying scenarios where eHSA phase 2 projects can be deployed, maximising their benefits from an interoperability perspective; second, to designing and providing an implementation roadmap for the eHealth platforms and their associated services in those scenarios.

5.2.1 Task 5: Selection of Sub-Saharan eHealth implementation opportunities

The bidder shall use all of the outcomes of Step 1 as starting point to:

- Define a methodology for ranking interoperability readiness on local, district, country, and regional levels wherever possible, considering all interoperability levels. Specific attention shall be paid to the degree of inclusion that can be reached by bridging connectivity gaps via Satcom.
- Rank the different sub-Saharan regions / countries / districts considering all interoperability levels and the four categories of eHealth services.
- Identify at least 30 eHealth implementation opportunities covering different geographic sub-Saharan areas and services.

The ranking shall reveal the most appropriate eHealth implementation opportunities and services to be implemented during phase 2 of the eHSA programme from the point of view of all the categories considered in the interoperability framework.

Requirements:

1. The proposed ranking methodology shall be fully described and justified.
2. The review shall cover all the interoperability levels related to the implementation and operation of the envisaged eHealth platform and its associated services.
3. The whole of sub-Saharan Africa shall be analysed. The analysis shall take into account different geographic levels (local, district, country, region) where applicable.
4. The review shall identify not only the opportunities, but also the most promising eHealth services to be provided in those opportunities, as well as the required basic operational services to run the platform.
5. The ranking shall address in a justified way:
 - a. The readiness of each geographical area for the implementation of eHealth platforms and adoption of eHealth services, considering all the levels



- included in the interoperability framework (Task 1). (This particularly includes the degree of inclusion of currently isolated populations that could be reached by bridging connectivity gaps via Satcom).
- b. Constraints to be faced, expected degree of risk in the implementation / operation of eHealth services and criticality.
 - c. The current initiatives under discussion affecting the different levels included in the interoperability framework, either on the political agenda, or in the process of being approved, including the accountability of relevant stakeholders to enforce these initiatives.
 - d. Funding sources and conditions to fund new infrastructure / services.
 - e. Other aspects proposed by the bidder to be discussed and agreed with ESA.
6. The chosen eHealth implementation opportunities should cover a certain, reasonable range of readiness levels (e.g. medium to high), and should be representative with respect to typical compositions of the final readiness score from the single indicators. The chosen opportunities should also include some where the impact of eHealth services is high and others where the impact of space technology is high.
 7. The contractor shall provide a justified level of confidence for each entry in the provided ranking and for the ranking as a whole.
 8. All examined candidates, not only the chosen ones, must be documented in full detail; the selection must thoroughly be justified.

Outputs (See section 6):

- A complete ranking of the sub-Saharan countries and districts according to their readiness in terms of the levels identified in the interoperability framework (Contribution to TN-5).
- A justified selection of scenarios and services to be addressed during phase 2 of the programme (Contribution to TN-5).
- A software tool reflecting the analysis allowing modifications / updates (ED-4).

5.2.2 Task 6: Consolidated eHealth Platform and Services Design for the Selected Sub-Saharan opportunities

Focusing on the selected opportunities (Task 5), design the eHealth platforms required to provide the identified services, attending to all levels identified in the interoperability framework (Task 1). This design shall take as starting point the reference eHealth platform model (Task 4) and the analysis of the sub-Saharan scenario performed (Task 3).

Based on the outputs of Task 5, the bidder shall:



- Provide an architectural design based on the reference eHealth platform model (Task 4) and considering the requirements / cases for the different eHealth services (Task 1).
- Provide an operational concept indicating, amongst others, the sequence of operations, data flow, operators and stakeholders involved; targeting all levels considered in the interoperability framework (Task 1).
- Define the service model and the service value chain for each scenario at all levels, ensuring the maximum participation of African stakeholders.
- Use a software tool to reflect all the design considerations.

Requirements:

1. The design shall use the reference eHealth platform model environment defined in Task 4.
2. In providing the architectural design, the bidder shall take into account:
 - a. The proposed design shall be modular and scalable. The design shall ensure the deployment of minimum service units able to grow and being interconnected to form a larger platform.
 - b. The design shall reuse as much of the existing infrastructure and services as possible. The design must ensure a strong African ownership of resources.
 - c. Cost-effective solutions shall be proposed to cover the expected gap between existing and required infrastructure, maximising African ownership of these resources.
 - d. Basic infrastructure access (electricity, sheltering), more complex services (access to networks, provision of telecommunication services, etc.) shall be considered as part of the design.
3. Address ancillary actions such as training, maintenance, etc.
4. In designing the platform, the bidder shall consider the basic network services, generic common services (e.g. life cycle management, transaction, logging, configuration), security services (e.g. confidentiality, integrity, audit, authentication, policy services, access management), and other eHealth-specific services (e.g. anonymisation, terminology).

Outputs (See section 6):

- A complete design of eHealth platform subsets and services in the selected opportunities in the form of a detailed paper-based model with appropriate sub-models for each selected opportunities (TN-6).
- A thoroughly commented electronic version of the model (ED-5).



5.2.3 Task 7: Suggested Adoption Roadmap

The contractor shall:

- Suggest an adoption roadmap for the selected opportunities considered as promising where eHealth platforms and their associated services were designed (Task 6).
- For the rest of the opportunities identified in Task 5, suggest a strategy to achieve minimum prerequisites needed to support the adoption of eHealth services in each of the levels defined in the interoperability framework.

Requirements:

1. For the selected opportunities:
 - a. Identify actions to be taken and stakeholders to be addressed at all levels identified in the interoperability framework.
 - b. Assess the criticality of detected gaps, and propose strategies to overcome them, always in full compliance with regulations / agendas / plans applicable to the opportunity.
 - c. Identify and assess risks that can arise during the implementation / operation phases. Provide a logical sequence of actions to minimise these risks as well as mitigation strategies where possible.
 - d. Provide a justified methodology to evaluate the degree of success coming out of the implementation and operation of the selected eHealth services.
 - e. Provide a preliminary long-term plan on actions regarding scalability of the eHealth platform and services to cover neighbour areas / adopt new services
2. For the rest of sub-Saharan Africa:
 - a. Identify and analyse the major obstacles preventing a successful deployment of eHealth platforms and their associated services.
 - b. Suggest high-level strategies that should be taken to ensure the future development of eHealth platforms and their services.

Outputs (See section 6):

- A short-to-medium roadmap describing critically and in full detail the implementation and the transition to operations of the designed eHealth platforms and their associated services in the selected opportunities (Contribution to TN-7).
- A preliminary long-term plan dedicated to the possible expansion/scalability of the eHealth platform parts addressed, covering new services and neighbour regions (Contribution to TN-7).



- A justified methodology to assess the success of a deployed eHealth platform in a selected scenario (Contribution to TN-7).
- A general strategy dedicated to achieve the minimum prerequisites necessary to consider any implementation of eHealth services in those countries / areas not ready yet (Contribution to TN-7).

6 REQUIREMENTS FOR MANAGEMENT, REPORTING, MEETINGS AND DELIVERABLES

Applicable Management, Reporting, Meetings and Deliverables are included in the Contract.

The list of deliverables is reproduced here for convenience.

<i>Reference</i>	<i>Title</i>	<i>Type</i>
TN-1.	eHealth Interoperability Framework and Service Operational Models	Document
ED-1.	eHealth Interoperability Framework, Service, and Platform Models in Electronic Format(*)	Document / Software
TN-2.	Global Best Practice Examples of eHealth Platforms	Document
ED-2.	Global Best Practice Examples of eHealth Platforms in Electronic Format(*)	Document / Software
TN-3.	Description of the eHealth and interoperability situations in Sub-Saharan Africa	Document
ED-3.	Database of the eHealth and interoperability situations in Sub-Saharan Africa	Document / Software
TN-4.	Reference eHealth Platform Model	Document
TN-5.	Sub-Saharan Africa eHealth Implementation Opportunities	Document
ED-4.	Sub-Saharan Africa eHealth Implementation Opportunities in Electronic Format(*)	Document / Software
TN-6.	Consolidated eHealth Platform/Service Design	Document
ED-5.	Consolidated eHealth Platform/Service Design in Electronic Format(*)	Document / Software
TN-7.	eHSA Adoption Roadmap	Document

(*) Electronic format is referred to design files elaborated using electronic modelling tools or other software. The contractor shall deliver all software licenses acquired for doing this job.

Table 1: Deliverable List



<i>Title</i>	<i>Type</i>
Final Report	Document
Executive Summary	Document
Monthly Progress Reports	Document
Minutes of Meetings (kick-off, progress, review, final presentation)	Document
Project Web Page (PWP)	Document

Table 2: Reporting deliverable list

ACRONYMS AND TERMS

6.1 Acronyms

ACP Sec	Secretariat of the African, Caribbean and Pacific Group of States
AfDB	African Development Bank
AIDS	Acquired Immune Deficiency Syndrome
AIL	Action Item List
ARTES	Advanced Research in Telecommunications Systems
AU	African Union
AUC	African Union Commission
BPML	Business Process Modelling Language
CEMAC	Communauté Economique et Monétaire de l'Afrique Centrale
COMESA	Common Market for Eastern and Southern Africa
DOI	Digital Opportunity Index
eHSA	eHealth for Sub-Saharan Africa
EAC	East African Community
EC	European Commission
ECOWAS	Economic Community of West African States
ESA	European Space Agency
EU	European Union
GIS	Geographic Information System
HIV	Human Immunodeficiency Virus
IAP	Integrated Applications Programme
ICT	Information and Communication Technology
ITF	EU-Africa Infrastructure Trust Fund
ITU	International Telecommunication Union
LLU	Local Loop Unbundling
Lux-Dev	Luxembourg Agency for Development Cooperation
MDGs	Millennium Development Goals
NEPAD	New Partnership for Africa's Development



OCEAC	Organisation de Coordination pour la lutte contre les Endémies en Afrique Centrale
PR	Public Relations / Relationships
RD	Reference Document
REC	Regional Economic Community
SADC	Southern African Development Community
SoW	Statement of Work
SSA	Sub-Saharan Africa
TN	Technical Note
TTF	Telemedicine Task Force
UML	Unified Modelling Language
UN	United Nations
WHO	World Health Organisation

6.2 Glossary of Terms

Common Practice: An accepted usual or customary action or proceeding

eHealth: The cost-effective and secure use of information and communications technologies in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research.

Health & Safety: Health and Safety is a discipline, enshrined in primary legislation, concerned with preserving and protecting human and facility resources in the workplace. All employers are subject to the law and can be inspected.

Health Information System (HIS): A health information system includes the people, processes and technologies to collect, communicate, manage, analyze and present information for decision making. It represents sources of population based data like census, vital events registration, surveys, as well as facility based data like individual health records, health service records, and resource management records. An HIS may be referred to as a health management information system or HMIS and is also likely to be comprised of any number of subsystems.

Health System: According to WHO health systems consist of all organizations, people and actions whose primary intent is to promote, restore or maintain health . This includes efforts to influence determinants of health as well as more direct health-improving activities. A health system is therefore more than the pyramid of publicly owned facilities that deliver personal health services. Based on the functions defined in WHR 2000, the building blocks of health systems are:



infrastructure; medical technologies; health workforce; health financing; information systems and stewardship (leadership and governance).

Information and Communications Technology (ICT): Includes the computers, software, data-capture devices, wireless communication devices, and local and wide area networks that move information, and the people that are required to design, implement and support these systems.

Interoperability: The ability of systems, units or forces to provide services and to accept services from other systems, units, or forces and to use the services so exchanged to enable them to operate effectively together.

Law: The principles and regulations established by a government or other authority and applicable to a people, whether by legislation or by custom enforced by judicial decision.

Legal environment: It is the environment that is effected and controlled by the country's constitution and that consists of laws, rules and regulations and their interpretations.

Medical purposes: Medical purposes include preventive medicine, medical diagnosis, medical research, the provision of care and treatment and the management of healthcare services.

Operational model: A model of the operational interactions between the various user groups and an eHSA platform. An operational model is similar to “use cases” in software engineering.

Performance: A quantitative indication of the degree to which a framework, platform, or model meets the requirements initially defined for it.



APPENDIX A - SUB-SAHARAN AFRICA

In the scope of the present study, sub-Saharan Africa is defined as the geographical space covering the following 47 countries:

1. Angola	17. Gabon	33. Niger
2. Benin	18. Gambia	34. Nigeria
3. Botswana	19. Ghana	35. Rwanda
4. Burkina Faso	20. Guinea	36. Sao Tome and Principe
5. Burundi	21. Guinea-Bissau	37. Senegal
6. Cameroon	22. Ivory Coast	38. Seychelles
7. Cape Verde	23. Kenya	39. Sierra Leone
8. Central African Republic	24. Leshoto	40. Somalia
9. Chad	25. Liberia	41. South Sudan
10. Comoros	26. Madagascar	42. Sudan
11. Congo	27. Malawi	43. Swaziland
12. Democratic Republic of Congo	28. Mali	44. Tanzania
13. Djibouti	29. Mauritania	45. Togo
14. Equatorial Guinea	31. Mauritius	46. Uganda
15. Eritrea	31. Mozambique	47. Zambia
16. Ethiopia	32. Namibia	48. Zimbabwe

Table 3: List of sub-Saharan African Countries



Figure 4: Sub-Saharan Africa (yellow). Source: ESA.



APPENDIX B - EHEALTH SERVICE CLASSIFICATION, CHARACTERISTICS AND EXAMPLES

Based on the four eHealth application areas considered in the eHSA programme, i.e., eCare, eLearning, eSurveillance and eGovernance/eAdministration, the following examples are given as typical representatives of eHealth service classes with largely varying conditions and requirements regarding governance, regulation, interoperability, and sustainability ([RD-6]).

eCare

Basic requirements for services:

- Sensitive contractual relationship between patient and health service provider.
- Storage and transmissions of protected health information.
- (Typically) Strict regulations regarding, e.g., data privacy and security, health professionals licensing, etc.
- High to highest demand for service availability (up to 24/7) and service quality.
- For emergency and remote actor applications, real-time QoS connectivity.
- (eHSA specific) Strong African ownership of service.
- (eHSA specific) Seamless incursion of remote populations via satellite communications.

Typical examples of services:

- Electronically supported self-help.
- Self-management of a chronic disease with telemedicine support.
- Tlediagnosis in various specialties (e.g. radiology, dermatology, cardiology, pathology).
- Remote professional consultation and sharing of data amongst professionals, especially the provision of remote second opinions.
- Access to specialized care.
- Electronic prescription of medicines.
- Interventions assisted by an expert via telepresence (typically by videoconferencing).
- Interventions performed via actor (robot) over distance by a remote expert (e.g. telesurgery).



- Telemonitoring of vital parameters and health-related actions, especially in patients at risk.
- Telemedicine for emergency, trauma, and catastrophes.
- Access to and maintenance of electronic health records.
- Specific prevention programmes enhanced and monitored through ICT (with registration of participant).

eLearning

Basic requirements for services

- Quality of content must be assured (evidence, didactic).
- Content must be adapted to the local needs (language, culture).
- Interaction between learner and eLearning application must be intuitive.
- Specific security requirements for Internet-based exams.
- (eHSA-specific) Sufficient portion of content from African content providers.
- (eHSA-specific) eLearning services must be suitable for remote training of health workers in isolated areas via satellite communication, e.g. compliant with educational regulations.

Typical examples of services

- Certified training programs for healthcare professionals.
- Remote patient learning for preventative care and disease management.
- Remote access to high-quality health information including current literature.
- Scientific databases used by healthcare professionals for CME (continuous medical education) and research.

eSurveillance

Basic requirements for services

- Requires effective and efficient health data collection.
- Data must be anonymised and aggregated, including its geographic origin.



- Remote sensing data can be incorporated in the analysis, fusing them with health data collected by health workers and patients.
- Quality assurance on the anonymised data, regarding e.g. correctness and sufficient completeness, is mandatory.
- State-of-the-art data analysis and visualization in Geographic Information Systems (GIS).
- Early Warning Systems (EWS) detecting critical situations and triggering alarms based on collected and data and/or earth observation data (depending on the underlying model).
- (eHSA-specific) Balanced ownership of service from global (e.g. Earth observation data acquisition) to local level (disease and health staff data acquisition and reporting).
- (eHSA-specific) eSurveillance services (e.g. GIS, EWS) must also serve remote areas via satellite connectivity.

Typical examples of services

- Public health and disease reporting.
- Electronic health statistics analysis.
- Real-time epidemiological analysis.
- Early warning systems (EWS) based on collected health & remote sensing data.
- Management of consequences to health of natural and man-made disasters.
- Geographic information systems (GIS) for presentation/visualization of data and analysis results, of different types serving different purposes, such as crisis management, general forecasts of environmental conditions for the public, or resource planning and political decision making.

eAdministration / eGovernance

Basic requirements for services

- Sensitive contractual and regulatory relationships between health service providers, health insurers, public authorities, and patients.
- Storage and transmission of protected health and financial information.
- Typically, strict regulations, e.g. regarding data transmission intervals and data formats, as well as data privacy and security (access control).
- Moderate demand for service availability.



- High demand for service reliability and accountability.
- (eHSA-specific) Preferably total African ownership of services.
- (eHSA-specific) eGovernance/ eAdministration services must support the inclusion of remote areas with scattered populations (high potential of improvement) via satellite communication.

Typical examples of services

- Billing and administrative data management to support the healthcare process.
- Aggregation and reporting of administrative data including quality indicators and clinical outcomes.
- Health information management systems to support informed decision making through access to comprehensive information.
- Services with clear impact and manageable complexity supporting advocacy for eHealth technology.