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

Study on Sustainability, Liability and Business Aspects

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1   REFERENCE DOCUMENTS

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2   BACKGROUND

Sustainability is a key aspect to be thoroughly assessed prior to any investment in any potential service. The case of eHealth in not an exception. The harsh and difficult sub-Saharan African (SSAf) environment adds even more complexity. As such, it is necessary to carefully evaluate the entire service provision chain to ensure that it is conducive – in its entirety – to the establishment of credible business opportunities that can lead to sustainable eHealth services.

2.1   The eHSA Programme

The Satellite-Enhanced Telemedicine and eHealth for Sub-Saharan Africa (eHSA) Programme is a six-year programme. This programme comprises four horizontal studies and four thematic areas. Figure 1 shows the overall programme structure.
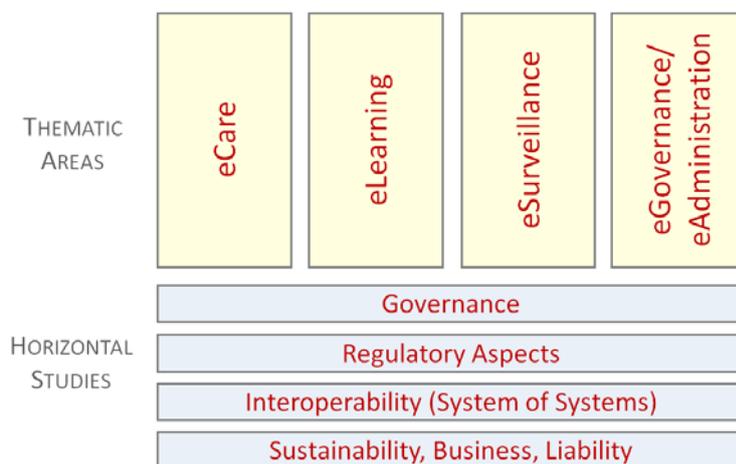
Figure 1: Overall Structure of the eHSA Programme

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.
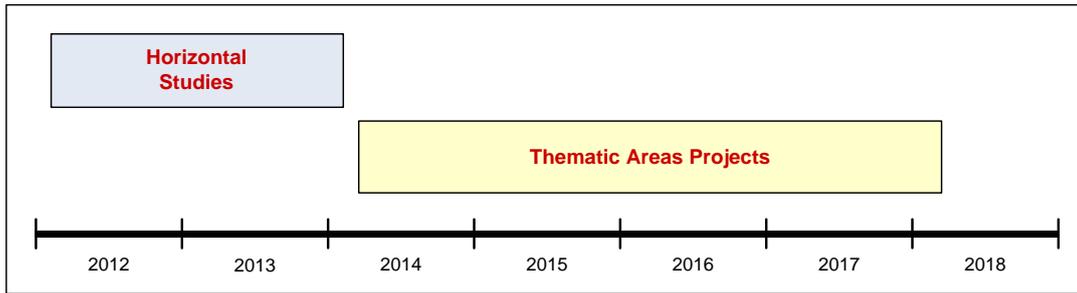
Figure 2: eHSA Programme Timeline

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, and sustainability (which is specifically covered by this SoW).

Coordination is of importance to ensure coherence amongst the four horizontal studies. This coordination will be enabled via ESA.

2.2 Context and Purpose of this Document

The study on sustainability, liability, and business aspects described in this document will analyse the aforementioned sustainability of eHealth services in the sub-Saharan African environment. This is necessary to ensure that any services conceived around the eHSA programme are grounded in reality and can become independent of it.

2.2.1 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

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[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).

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].

2.2.2   *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.

2.3   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-5]), 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.

2.4   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 which still has to work towards reducing the 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.

In this respect, it must be noted that 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 ESA[2] 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.

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

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3 GENERAL ASPECTS OF THE SUSTAINABILITY, LIABILITY AND BUSINESS STUDY

3.1 Introduction

The long-term sustainability of eHealth services is very difficult to achieve, particularly in SSAf. Often, programmes or services are created using donations, grants, and other funding mechanisms that are a) often not expecting to see returns on their investment, and b) not constant sources of funding (eg. one-time donations). This frequently leads to programmes or services that are established in a region, provide hope to a community, and flourish during the initial period of investment. However, failing the establishment of a sustainable funding mechanism, these programmes and services are often discontinued, leaving a population that may have become dependent upon a service without it. Furthermore, infrastructure is often abandoned and goes to waste.

It is therefore imperative for the success of eHSA that sustainable funding instruments and mechanisms are identified early in the programme. Securing this financial sustainability will be a trying task that will be on-going throughout the duration of the programme – and is going to depend largely on strong engagement with appropriate stakeholders. It is important to recognize that there are many aspects that will affect the business case for and financial sustainability of eHSA, including political, linguistic, technological, geographic, economic, and societal.

In conformance with [RD-2] the horizontal eHSA Programme Study on Sustainability, Liability, and Business Aspects shall:

1. Analyse factors and constraints affecting the transition of eHealth services in SSAf from projects into sustainable services.

2. Develop economic models supporting long-term sustainability of satellite-enhanced eHealth infrastructure, and eHSA services; these shall include identification of business cases and (co-)funding sources.

3. Propose criteria for the identification and assessment of satellite-enhanced eHealth opportunities in SSAf.

4. Demonstrate the business case for space assets supporting eHSA services.

3.2 General Requirements

The study shall meet the following general requirements:

- Identification of promising cases of eHealth services and their environments, to be considered in phase 2 of the eHSA programme, paying specific attention to related business aspects and potential liability considerations.

- Exploitation of recent relevant work conducted earlier by other programmes and initiatives (e.g. [RD-3], [RD-6]) 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-6]).

- Creation of models and designs shall 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.

- Utilisation of state-of-the-art modelling methods and tools, such as UML[3], BPML[4], GIS[5], 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 shall be carried out being aware of its implications for the entire eHSA Programme, in particular for the next phase.

3.3   General Benefits

The successful completion of this study and implementation of its findings is envisioned to help services established under the eHSA programme achieve financial independence and sustainability. This will ensure continuity of services to populations who become dependent upon them, and geographical expansion of these to a pan-African scale.

While the Governance, Regulatory, and Interoperability studies will make recommendations for service deployment, these will need to be taken in the context of the study described herein. This bears great strategic importance, because the success of deployed services in a given region is likely to attract interest of other regions, thereby propagating the service. Conversely, an economically unstable programme in one region is unlikely to be given a chance to prove itself elsewhere.

The study is seen as crucial for ensuring that developed services will see attractive figures for Return on Investment (ROI), thereby attracting investment in the programme.

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[3] UML: Unified Modelling Language

[4] BPML: Business Process Modelling Language

[5] GIS: Geographic Information System

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4   WORK DESCRIPTION

The main objective of the eHSA study on sustainability, liability, and business aspects is to ensure the long-term provision of the intended eHealth services, based on the a reliably maintained and continuously developed eHealth platform. Sustainability is deeply related to a) developing partnerships amongst all stakeholders involved in the service provision and ensuring their endorsement; b) building a convincing governance and economic framework fostering development as well as business opportunities. In addition, it is important to demonstrate attractive ROIs in order to build the required capacity and to start providing the services.

To achieve these goals, the following objectives have been defined:

1. Compile initiatives that have succeeded or failed to become sustainable and analyse their findings for the benefit of the eHSA programme.

2. Propose a transition strategy into sustainable operations of the infrastructure and services generated by means of the eHSA programme, including partnerships, business models, and liability schemes.

3. Identify opportunities in SSAf where the proposed strategy could be applied in the short-to-medium term and define a roadmap for each of them, describing the actions necessary to successfully transition into an operational mode.

The activities of this study shall be performed following an approach covering three major steps, defined in the following subsections 4.2 to 4.4 on the basis of the general requirements presented in section 3. The overall study logic is illustrated in Figure 3. Each of the steps is estimated to require similar amounts of working time.

The contractor shall undertake a programme of work lasting no more than 12 months for the execution of the activity.
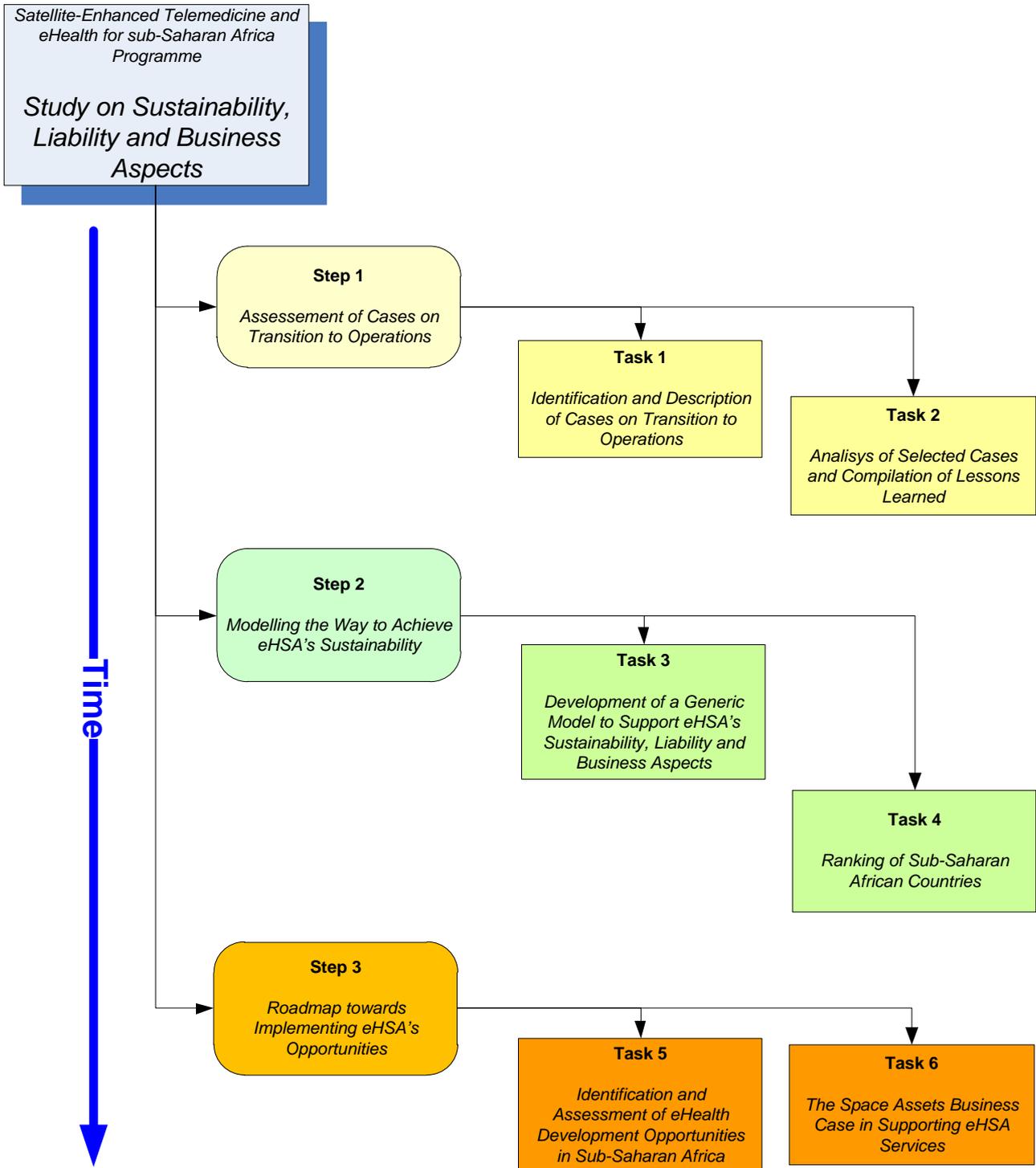
Figure 3: Sustainability, Liability and Business Aspects Study Logic

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.

Sustainability

There is no universally agreed definition of "sustainability". The Oxford dictionary refers to it as "the ability to be maintained at a certain rate or level". The Food and Agriculture Organisation (FAO) acknowledges that "Sustainability concerns one of the most fundamental questions for technical cooperation: will the benefits and results achieved through the project be maintained and enhanced by the ultimate end-users and their community, based on their own commitment and resources, after the termination of the external assistance? The question entails a complex analysis of aspects related to this broad concept, including the acceptability and use to be made of project outputs and results by the intended groups targeted their capacity to maintain the results, and the institutional and policy environments to enable them to do so."

In the frame of this study, sustainability will be understood in this study as the capability of the foreseen eHealth services and their supporting infrastructure to:

- *develop partnerships amongst all stakeholders involved in the service provision chain, ensuring their acceptance and endorsement;*

- *build a convincing economic framework that can raise the necessary funding, foster the operation and maintenance of the intended services and infrastructures together with their continuous development, and promote new business opportunities;*

Liability

Liabilities are also an important aspect to be considered in any service provision, potentially impacting its long-term sustainability. In the financial environment, liability is defined as "a claim against the assets or legal obligations of a person or organisation, arising out of past or current transactions or actions". In the legal environment, liability is the "responsibility for the consequences of one's acts or omissions, enforceable by civil remedy (damages) or criminal punishment".

Both aspects presented, the legal and the financial, will have to be considered in this study when assessing liabilities associated to the foreseen eHealth services.

Operational scenario

In this study, the operational scenario shall be understood as the situation concerning the service provision where:

- *there is a Service Level Agreement (SLA) governing the relationship between the service provider and the stakeholder(s);*

- *the service provider can develop his business plan, relying just on the cash flow generated by means of the service provision to the customers. These include the procurement of all necessary resources; either material or financial, related to the service provision, as well as all commitments towards the stakeholder(s) as reflected in the SLA.*

4.2 Step 1: Assessment of Cases on Transition to Operations

Mission:

Identify and assess relevant cases of services that attempted to achieve sustainability, and compile lessons learned relevant to eHSA's transition to operations.

Objectives:

- Identification of worldwide cases of initiatives that succeeded / failed to provide sustainable operational services.

- Analysis of the identified cases and extract lessons learned that are relevant to the eHSA programme.

Rationale:

Achieving sustainability is a complex process requiring the involvement of numerous stakeholders, getting proper funding, being compliant with existing frameworks, convincing and protecting users and customers via and added-value proposition, and understanding market dynamics. In this respect, the eHSA programme transition to operations can benefit from the experiences and findings of other initiatives.

Approach:

To maximise the sustainability potential of eHSA services in the long term, it is important to understand all aspects that can influence them over time. One way to compile and understand them is to identify and analyse previous or on-going initiatives. These can be related to Health and eHealth, but also to other areas of the economic activity worldwide, not just in sub-Saharan Africa.

The analysis of these initiatives can show different approaches to achieving sustainability and a provide a number of lessons learned, including reasons for their success or failure, that can be useful to create an appropriate transition to operations framework for the eHSA programme.

The exact scope of the work will be described later in Tasks 1 and 2 (sections 5.1.1 and 5.1.2).

Expected Outputs:

- List of example cases, detailed analysed.

- Compilation of useful lessons learned supporting the eHSA programme on sustainability, liability, and business aspects.

4.3   Step 2: Modelling the Way to Achieve eHSA's Sustainability

Mission:

Develop a generic model describing the possible transition to operations of the eHSA programme outputs and identify the most promising sub-Saharan African countries in which to start.

Objectives:

- Definition and consolidattion of a generic model illustrating all the necessary steps towards a successful transition to operations of the eHSA outputs.

- Assessment of the   situation in SSAf in terms of readiness for the provision of sustainable eHealth services.

Rationale:

Designing a strategy to ensure the long-term sustainability of the eHealth services developed under the eHSA programme should follow a top-down approach. A generic model covering all the necessary steps for a successful transition to operations can later be extended and customised for specific opportunities.

Approach:

The generic model of successful transition to operations of the developed eHSA services shall take into account the four categories of services considered (eCare, eLearning, eSurveillance, eAdministration/eGovernance), the nature of the   SSAf scenario, the capabilities of space technologies to support these services, and the lessons learned during the execution of Step 1 (section 4.2) of this study. The model shall include indicators to evaluate the readiness of each country in SSAf for the provision of sustainable eHealth services.

The proposed model, being generic, will require further development and strengthening to ensure a useful tool for the purposes of the eHSA programme. It is proposed to develop a full ranking of the sub-Saharan countries and regions specified by the model. The findings of this action will be useful in evolving the proposed model and achieving the objectives of Step 3.

The exact scope of the work will be described later in Tasks 3 and 4 (sections 5.2.1 and 5.2.2).

Expected Outputs:

- A generic model reflecting the transition of the eHSA programme outputs into operations.

- A ranking of the different sub-Saharan countries in terms of readiness to provide sustainable operational eHealth services.

4.4 Step 3: Roadmap towards Implementing eHSA's Opportunities

Mission:

Identify and assess eHealth development opportunities in sub-Saharan Africa (including the capacity building necessities) and suggest a roadmap for their realisation.

Objectives:

- Identification of opportunities in sub-Saharan Africa for the provision of sustainable eHealth services, customise the generic transition to operations strategy accordingly (Step 2, section 4.3), and suggest an appropriate roadmap towards long-term sustainability.

- Assessment of the role of space technologies in supporting the provision of sustainable eHealth services in sub-Saharan Africa.

Rationale:

The generic strategy developed during Step 2 (section 4.3) shall be customised according to the specific circumstances of the identified scenarios to provide satellite-enhanced eHeath services. This customisation will lead to the definition of a roadmap to develop the opportunity, including the capacity building requirements. Space assets are part of the development, and as such, the potential they offer in developing long-term sustainable services needs to be addressed.

Approach:

Based on the model and the ranking performed during Step 2 (section 4.3), a number of opportunities for the development of long-term sustainable eHealth services shall be identified. Each identified opportunity will require the extension and customisation of the

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proposed model. This model will yield an implementation roadmap specific for each opportunity.

The roadmap will not be achieved unless certain capacities will be built. Space assets are part of this capacity. It is necessary to investigate the added value and the business opportunities space can bring into the development of eHealth services, consistent with the eHSA programme approach.

The exact scope of the work will be described later in Tasks 5 and 6 (sections 5.3.1 and 5.3.2).

Expected Outputs:

- List of eHealth development opportunities, with their assessment and roadmap towards their implementation.

- Assessment of the required Space-based technologies and services in terms of eHealth service enabling and provision, and business opportunities.

5   RELEVANT TASKS

5.1   Step 1: Assessment of Cases on Transition to Operations

Step 1 of the study is dedicated to the identification and assessment of relevant cases that have tried (successfully or not) to achieve sustainability. Different approaches have to be identified and duly analysed.

5.1.1   Task 1: Identification and Description of Cases on Transition to Operations

The contractor shall:

- Identify cases of initiatives / developments / projects that have succeeded or failed in their attempts to achieve an operational service provision scenario.

- For each case, describe in full detail the whole process followed to reach the operational service provision scenario.

Requirements:

1. A minimum of 15 cases shall be identified; the cases to be further investigated shall be agreed with ESA. They should not necessarily be restricted to the domain of Health / eHealth, but may also address other areas (e.g. ICT).

2. The contractor shall define a methodology to identify successful /unsuccessful cases based on indicators related to sustainability, liability, and business provision. The methodology and the indicators shall be discussed and agreed with ESA.

3. The selection shall be representative of the various situations that can exist in sub-Saharan Africa influencing the transition to operations (e.g., monopoly / liberalised markets, political support, degree of standardisation, status of infrastructure (water, electricity), general level of education, etc.); the selected cases should not be necessarily restricted to sub-Saharan Africa, but also other countries / regions of the world.

4. The description of the selected cases shall cover:

   o An understanding of the initial situation, prior to the beginning of the activity.

   o Purpose and scope of the initiative / development / project put in place, along with the achieved results and the rationale for pursuing an operational approach.

   o Pre-operational situation (if any) where the services are provided, but still dependent on mechanisms / structures put in place to support / govern them

(e.g., subsidies, funding mechanisms that sponsored the original initiative / development / project, etc.).

o Operational situation (if any) where the services are provided in a fully sustainable way, i.e., independent of any support structure

o The steps taken to move from one situation to the other, the timeline foreseen and the timeline followed in reality.

o The foreseen and final business models as well as their evolution where applicable; they shall include the funding strategies foreseen or used and the return of the investment (if any).

o The stakeholders involved on each situation, including their roles and positioning on each step.

o The potentially existing liabilities across the service provision chain.

o The externalities generated, if any.

5. The cases shall be presented in a structured manner.

Outputs (See section 6):

- A list of selected cases illustrating different successful / unsuccessful transitions to operations (Contribution to TN-1).

- A detailed description of each case (Contribution to TN-1).

5.1.2 Task 2: Analysis of Selected Cases and Compilation of Lessons Learned

For each of the cases described in Task 1 (section 5.1.1), the contractor shall :

- Analyse the strengths and weaknesses of the chosen approaches in the context of a successful transition to operational service provision.

- Identify reasons underlying the success / failure of the proposed approaches, and compile relevant lessons learned.

- Provide sustainability assessments of the provided operational services as well as their impact on national / regional economies.

Requirements:

1. The analysis methodology shall be defined and agreed with ESA.

2. The analysis shall be done in such way that all cases can be compared. A set of key performance indicators (KPIs) shall be extracted to assess each case and to compare

achievements and results; KPIs shall cover, for example, aspects such as addressable market, capacity to raise funding, influence on and support received by political / regulatory situation, competition, predicted vs. real time required to move to operations, predicted vs. real revenue/benefit increase or liability impact; the list shall be expanded and agreed with ESA.

3. The analysis shall cover the whole life cycle of the case, from the initial situation to the operational service provision (if any). It shall also include the funding scheme and potential return of investment.

4. Relevant lessons learned shall be extracted. The possible impact they could have on each of the cases shall be reasonably assessed for the cases identified in Task 1.

5. Based on the results of the analysis and the identified lessons learned, provide an assessment of the impact of each case on its national / regional economies. This assessment has to be undertaken in terms of economic, regulatory, organisational, and societal terms, and must consider liability aspects as well – even for unsuccessful cases.

Outputs (See section 6):

- Compilation of useful lessons learned to support the eHSA programme in terms of sustainability, liability, and business cases.

- Detailed methodology and key performance indicators assessing the transition to operations of the cases identified in Task 1 (Contribution to TN-2).

- Analysis of the cases identified in Task 1 (Contribution to TN-2).

- Compilation of useful lessons learned supporting the eHSA programme on sustainability, liability, and business aspects and their impact on Task 1 cases (Contribution to TN-2).

- Sustainability assessment based on all the previous findings (Contribution to TN-2).

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

5.2 Step 2: Modelling the Way to Achieve eHSA's Sustainability

Step 2 of the study is oriented towards the development of a generic model describing the steps towards sustainability of the intended satellite-enhanced eHealth services.

5.2.1 Task 3: Development of a Generic Model to Support eHSA's Sustainability, Liability and Business Aspects

Based on the findings of Step 1 (section 5.1), the contractor shall:

- Define a generic model illustrating all the necessary steps towards a successful transition to operations and sustainability of the eHSA generated outputs, paying attention in particular to business aspects and liability considerations.

- Define a set of indicators that can help assess the successful transition to operations and the sustainability of the proposed model, covering all the defined scenarios and transitions between them.

- Clearly describe the role played by and the added-value of Space technologies in the model.

Requirements:

1. The model reflecting the transition towards sustainable services to be defined shall cover the whole cycle: initial, pre-operational, and operational scenarios, as well as the transitions between phases . Appropriate instruments to support each transition shall be identified and modelled.

2. The potential role and added-value of space technologies shall cover the whole cycle of the transition towards sustainable services, and shall clearly describe the similarities and differences between different types of transitions. These will depend on the type of service and its operation.

3. The model shall cover the four categories of eHealth services considered within the eHSA programme: eCare, eLearning, eSurveillance and eAdministration/eGovernance.

4. The modelled scenarios and the presented transitions shall consider, as minimum, the following aspects:

   o Business model / Funding approaches (supporting subsidies, contributions from donors, customer fees, return on investment, etc.).

   o Legal / economic frameworks (competition, liability, etc.).

   o Governance structures, ownership, and partnership (public, private, public-private partnership (PPP), required stakeholders, etc.).

   o Overall approach considering all the mentioned aspects and indicative timelines (temporal dimension).

5. The set of indicators defined during Step 1 (section 5.1) shall be refined and/or expanded to appropriately represent sub-Saharan Africa and the role of space assets. These indicators shall be incorporated into the model.

6. The contractor shall provide qualitative validations on the developed model and indicators.

7. The contractor shall reflect all findings using an electronic modelling tool (refer to section 3.2) to allow continuous improvement and sustainability of the work to be carried out.

Outputs:

- A generic model reflecting the transition of the eHSA programme outputs into operations (TN-3).

- An instantiation of the model using an electronic tool (ED-1).

5.2.2   Task 4: Ranking of Sub-Saharan African Countries

Based on the model defined in Task 3 (section 5.2.1), the contractor shall:

- Assess the situation in SSAf in terms of readiness to provide sustainable eHealth services, ranking them.

- Strengthen the model developed under Task 3 (section 5.2.1) based on the findings of the ranking.

Requirements:

1. The ranking of the countries shall cover the whole sub-Saharan Africa.

2. The ranking shall reflect each country's readiness to provide eHSA services in of the categories considered: eCare, eLearning, eSurveillance and eAdministration/eGovernance.

3. As part of the ranking, the added-value (if any) of space technologies shall be reflected.

4. Define a methodology to perform the requested ranking. The methodology shall leverage the indicators defined during Task 3 (section 5.2.1). The methodology shall be discussed and agreed with ESA.

5. Compile all necessary data required to perform the ranking. The contractor shall discuss strategies to overcome missing data with ESA.

6. The contractor shall provide qualitative validations for each entry in the provided ranking, and for the ranking as a whole.

7. Produce a database containing all the findings of this task.

8. Based on the findings of the ranking, consolidate the model and indicators proposed during Task 3 (section 5.2.1).

Outputs (See section 6):

- Ranking methodology for the countries of sub-Saharan countries in terms of readiness to provide sustainable eHealth services (Contribution to TN-4).

- The ranking of the different sub-Saharan countries, including the confidence in the results (Contribution to TN-4).

- A database with querying and reporting capabilities for all the findings of this task (ED-2).

- A consolidated model reflecting the transition to operations of the eHSA's programme outputs (revised TN-3).

- A new instantiation of the model using an electronic tool (revised ED-1).

ESA's approval is required to proceed with the tasks associated to step 3 of the study.

5.3 Step 3: Roadmap towards Implementing eHSA's Opportunities

Based on the model and the ranking performed during Step 2 (section 5.2), the contractor shall identify a number of eHealth service development opportunities and provide a customised transition to operations roadmap. The role and added-value of space assets shall be investigated.

5.3.1 Task 5: Identification and Assessment of eHealth Development Opportunities in Sub-Saharan Africa

Based on the outputs of Step 2 (section 5.2), the contractor shall:

- Identify opportunities in sub-Saharan Africa where the provision of eHealth services can be sustained.

- Describe and assess the sustainability potential of the identified opportunities, including the whole process to be followed to reach the operational service provision scenario.

- Suggest a transition to operations roadmap for each of the identified opportunities.

Requirements:

1. A minimum of 30 opportunities shall be identified and assessed. These opportunities shall be discussed and agreed with ESA.

2. The opportunities shall cover the four service categories considered within the eHSA programme: eCare, eLearning, eSurveillance and eAdministration/eGovernance. Each opportunity should cover one or more service categories.

3. The assessment shall cover all identified stages as well as the transitions between them in full detail. At minimum, this includes stakeholders, funding, governance, liabilities, business plans, return on investment, and foreseen externalities. The sustainability potential shall be duly justified.

4. Tailored instruments, either institutional or of any other nature, shall be devised and modelled to ensure the long-term sustainability of the identified opportunities (e.g. to enlarge the customer base).

5. The model developed during Step 2 (section 5.2) shall be extended / customised / tailored to reflect the assessment of each identified case.

6. The contractor shall carefully identify risks that can arise during the whole transition to operations process; avoidance / mitigation strategies towards these risks shall be provided.

7. The contractor shall propose a methodology to evaluate the success in the transition to operations process. The contractor shall also propose another methodology to later assess the sustainability success.

8. The contractor shall reflect the level of confidence in the performed assessment.

9. The findings shall be instantiated using an electronic modelling tool (refer to section 3.2) to allow for its continuous refinement and improvement.

Outputs (See section 6):

- List of opportunities (Contribution to TN-5).

- Full description and assessment on each opportunity (Contribution to TN-5).

- Extended/customised/tailored models for each of the identified opportunities (Contribution to TN-5).

- Suggested transition to operations roadmaps (Contribution to TN-5)

- Electronic versions of the extended/customised/tailored models (ED-3).

5.3.2 Task 6: The Business Case of Space in Support of eHealth Services in sub-Saharan Africa

Based on all the previous work, the contractor shall:

- Describe and quantify the market and business opportunities the eHSA programme outputs can provide to satellite operators and service providers.

- Propose an approach to build and sustainably exploit all the required space-based capacity and services needed to support eHSA eHealth services.

- Suggest a roadmap for sustainably building and commercially exploiting the required space-based capacity.

Requirements:

1. The market and business analysis shall start with the list of eHSA opportunities identified during Task 5 (section 5.3.1).

2. The proposed approach shall be fully coherent with the eHSA programme approach: provision of sustainable services, strong African ownership, re-utilisation of existing resources, service access from remote locations, and creation of business opportunities to stimulate local economies. This shall always be done in full alignment with the policies and regulations of the sub-Saharan countries.

3. Public, private, and PPP schemes to govern / provide the required space-based services shall be assessed.

4. The different steps and transitions required to set-up sustainable space-based services supporting the provision of the eHSA services shall be illustrated by means of a model, which shall complement developed during Tasks 3, 4 and 5 (sections 5.2.1, 5.2.2 and 5.3.1), and covering the same aspects.

5. The model shall be instantiated using and electronic modelling tool (refer to section 3.2).

6. The contractor shall carefully identify risks related to the whole process. Risk avoidance / mitigation strategies shall be provided.

7. The contractor shall propose an evaluation methodology for the sustainable implementation of space-based services supporting eHSA services.

8. The contractor shall provide qualitative validations of the market and business analyses done.

Outputs (See section 6):

- Market and business assessment of Space-based technologies and services (Contribution to TN-6).

- Space capacity building and service provision model (Contribution to TN-6).

- Suggested roadmap for the commercial provision of the required space-based services (Contribution to TN-6)

- Electronic versions of the space capacity building and service provision model (ED-4).

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.

Reference	Title	Type
TN-1.	Reference Cases on Transition to Operations	Document
TN-2.	Analysis of Reference Cases and Lessons Learned	Document
TN-3.	Generic Model on the Transition to Operations of eHSA Generated Services	Document
ED-1.	Generic Model on the Transition to Operations of eHSA Generated Services in Electronic Format (*)	Document / Software
TN-4.	Ranking of Sub-Saharan African Countries in Terms of Readiness to Provide Sustainable eHealth Services.	Document
ED-2	Database Containing the Ranking of Countries	Document / Software
TN-5.	Sub-Saharan Africa eHealth Opportunities Assessment and Transition to Operations Roadmap	Document
ED-3.	Sub-Saharan Africa eHealth Opportunities Transition to Operations Models in Electronic Format(*)	Document / Software
TN-6.	Business Case of Space in Support of eHealth Services in sub-Saharan Africa	Document
ED-4.	Space-Based Service Provision and Roadmap towards Sustainability Model in Electronic Format(*)	Document / Software

(*) 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

Title	Type
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

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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 Promotion 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
PPP	Public-Private Partnership
PR	Public Relations / Relationships
RD	Reference Document
REC	Regional Economic Community
SADC	Southern African Development Community
SoW	Statement of Work
SSAf	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

Business Case: Decision-making tool used to determine the effects a particular decision will have on profitability. Business case typically shows how the decision will alter cash flows over a period of time, and how costs and revenue will change, paying specific attention to the internal rate of return (Business Dictionary).

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.

Liability: In the financial environment, "a claim against the assets or legal obligations of a person or organisation, arising out of past or current transactions or actions"; in the legal environment, "responsibility for the consequences of one's acts or omissions, enforceable by civil remedy (damages) or criminal punishment".

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.

Operational scenario: In the eHSA programme, situation concerning the service provision where i) there is a Service Level Agreement (SLA) governing the relationship between the service provider and the stakeholder(s) and; ii) the service provider can develop his business plan, relying just on the cash flow generated by means of the service provision to the customers. These include the procurement of all necessary resources; either material or financial, related to the service provision, as well as all commitments towards the stakeholder(s) as reflected in the SLA.

Opportunity: In the eHSA programme, an opportunity is a specific combination of geographical, temporal, technical, political, regulatory, economic and social

circumstances adequate to start an eHSA demonstration project with reasonable good chances to become a sustainable service later on.

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

Sustainability: in the eHSA programme, capability of the foreseen eHealth services and their supporting infrastructure to i) develop partnerships amongst all stakeholders involved in the service provision chain, ensuring their acceptance and endorsement and; ii) build a convincing economic framework that can raise the necessary funding, foster the operation and maintenance of the intended services and infrastructures together with their continuous development, and promote new business opportunities;

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-5]).

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.

- Telediagnosis 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.

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- 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.

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