PROMOTING EUROPE-WESTERN AFRICA COOPERATION TO BUILD AND PROMOTE A NEW CENTRE OF EXCELLENCE FOSTERING MID-ATLANTIC INCLUSIVE BLUE AND GREEN GROWTH

CAVIC

CABO VERDE INNOVATION CENTRE FOR GREEN AND BLUE GROWTH

*A proposal in the context of the "**K4P Alliances – Knowledge for People, the Planet and Prosperity through Partnerships**", in terms of a network of regional Centres of Excellence in the Global South to be promoted by the Global Europe Programming*

WORKING DOCUMENT

Version: December 5th, 2022

Table of Contents

1. OBJECTIVES

1.1 OVERALL GOALS

Promoting the sustainable growth of Western Sub-Saharan Africa together with **innovation activities for blue and green growth in the Mid Atlantic** should attract our main attention in coming years. It should promote local socio-economic development through leveraging ***digital resources*** throughout the region, together with the **Regional Fiber backbones and Satellite connectivity** in the context of the recent development of the **Secure EurAfrica Gateway Cable**.

To accelerate achieving this goal, a new centre of excellence focused on advanced information and Earth Observation (EO) systems for blue and green growth in Sub-Saharan Western Africa, hereafter called "**CAVIC – CABO VERDE INNOVATION CENTER FOR GREEN AND BLUE GROWTH**[1]", will introduce tools and services, leveraging the opportunity for open "data ecologies" to service local and regional stakeholder needs, as well as to create new skilled jobs in Cabo Verde and Sub-Saharan Western Africa.

The Center is intended to promote an inclusive and green transition in the emerging digital age, using new space EO systems in order to promote ***Sustainable and Healthy Territories*** through research and innovative social practices, together with the creation of new jobs and initiatives that encourage the ecological transition of the economy and society and the understanding of the dynamics emerging in sub-Saharan Africa, giving full priority to "Human Agency"[2].

The overall operation and the new centre will be promoted under the revisited cooperation programs established by the European Commission, through DG INTPA (i.e., "Global Europe programming"), to foster the Western Sub-Saharan Africa economies and will be oriented to **foster the digital economy and society flagship and related selected services for economic activities in the mid-Atlantic region**, together with the sustainable use and economic valorisation of natural resources in Cabo Verde archipelago and Sub-Saharan Western Africa.

[1] Tentative title, to be confirmed

[2] See, for example, UNDP 2022, https://hdr.undp.org/content/human-development-report-2021-22?gclid=EAIaIQobChMI9Jy97_rp-gIV8_LjBx3W4Q3JEAAYASABEgKHevD_BwE; and UNDP 2019, https://hdr.undp.org/content/human-development-report-2019?utm_source=EN&utm_medium=GSR&utm_content=US_UNDP_PaidSearch_Brand_English&utm_campaign=CENTRAL&c_src=CENTRAL&c_src2=GSR&gclid=EAIaIQobChMItY7il_vp-gIVjP7jBx0_6AB0EAAYASAAEgJKGvD_BwE .

1.2 PROPOSED DELIVERABLES

Main **expected deliverables** include the following:

- Development and implementation of digital systems oriented to promote the **modernization of public administration**, together with **energy sustainability, sustainable and healthy urban expansion, sustainable use of land and the blue economy**, namely in conjunction with the sustainable development of the **agro-food sector;**
- Development and implementation of **advanced EO systems integrated with information acquisition and processing systems** (i.e., "Digital Planet"). The Center's activity will include the development and application of new forms of "Responsible Artificial Intelligence" (i.e., "Responsible AI"), as well as the digital planning of territories and social and economic activities through "digital twins";
- **Monitoring and analysis of complex urban landscapes** in Sub-Saharan Western Africa, including urban expansion processes, making use of high-resolution EO systems, together with the development of ***social cartographies*** and the implementation of community-based participatory innovation;
- **Monitoring and protection of coastal areas, maritime surveillance and monitoring of maritime traffic, as well as the monitoring of the biodiversity of the ocean**. Activities will consider the development of "**digital twins" of the ocean** to model and promote new activities under the scope of the blue economy, including the valorisation of "blue carbon";
- Development of an **open access digital library of natural products**, as well as in the economic and social valorisation of biological assets. In addition, activities will consider the development of **"digital twins" of agro-forestry structures and mountains**, together with the **mapping of the potential for carbon fixation and sequestration** and the potential valorisation of Western Africa in emerging carbon markets;
- **Dynamic mapping of sustainable energy systems** to foster the optimized use of solar and wind renewable sources of energy, together with distributed systems of energy production in Sub-Saharan Western Africa;
- Development of **innovation policies, capacity building and actions/initiatives** oriented to develop four main areas in Western Sub-Saharan Africa through the use of advanced digital systems: i) **sustainable and healthy urban expansion**; ii) the **blue economy;** iii) the **agro-forestry sector and the bioeconomy** through the economic and social valorisation of biological assets; and iv) **sustainable energy**.
- Compliance with **European cybersecurity standards and the 5G Toolbox,** aiming to become part of the **cybersecurity preparedness facility of Cabo Verde;**

1.3 MAIN PROPOSED ACTION LINES IN THE SHORT TERM

Emphasis will be on the following actions in the short term:

- Deployment of dedicated equipment in existing **Data Centre for Earth Observation and related scientific, technological and innovation activities for blue and green growth**, pooling exiting ***digital resources*** in Cabo Verde and in Sub-Saharan Western Africa, in close cooperation with main public and private regional actors in the area of green economy. The Data Centre will also be tailored to address local needs and ensure highest possible energy efficiency of operations;
- An effective **international network and international connectivity pathway**, including the **EurAfrica Gateway**), through the engagement of the **Atlantic International Research Centre, AIR Centre**, and its main role as coordinator of a European funded CSA under the mission "*EU Mission Restore our Ocean and Waters by 2030*" (with EC´s Horizon Europe funding for 2023-2027). The new Centre will become fully integrated in the AIR Centre network;
- Fostering a **Digital connectivity infrastructure**, including international connectivity (the EurAfrica Gateway), the Regional Fiber backbones and Satellite connectivity, together with **Secure EurAfrica Gateway Cable**. The new Centre will comply with **European cybersecurity standards and the 5G Toolbox**, aiming to become part of the ***cybersecurity preparedness facility of Cabo Verde***;
- **Strengthening regional cohesion and networks in Western Sub-Saharan Africa** in the area of **urban expansion, environmental monitoring, natural resources management and support to fisheries**, through remote sensing services using geospatial technologies to provide decision support and planning tools for sustainable social and economic development. This will include a close **articulation with existing services in Western Africa**, including in Senegal, Ghana and Nigeria, as well as with inter-governmental organizations, such as the ***Sub-Regional Fisheries Commission*** (SRFC);
- Further reinforcing **Cabo Verde's ambition on becoming a Digital Hub** in Western Sub-Saharan Africa and increasing digital connectivity for underserved countries, leveraging capabilities to create social impact and bring value to industry (SMEs, start-ups) and society at large. Through an investment opportunity in the Amilcar Cabral submarine cable, connecting Cabo Verde to the underserved countries of Guinea, Guinea-Bissau, Liberia, Sierra Leone and The Gambia increasing their resilience and connecting them to EllaLink. Evaluated with the ongoing feasibility study by ECOWAS to identify operating model, model for implementation and corresponding funding requirements.
- Full integration in the "**K4P Alliances – Knowledge for People, the Planet and Prosperity through Partnerships**", in terms of a network of regional Centres of Excellence and

"Collaborative Laboratories" in the Global South, with relevance in Sub-Saharan Africa and Latin America.

1.4 Potential Benefits in mid and long-term

Mutual benefits are expected for both Western Sub-Saharan Africa and the EU, as synergies will be enabled, and new knowledge together in-situ data sharing channels will be opened. This will be further scalable through the integration of the new Centre in the existing AIR Centre network in close articulation with the "**K4P Alliances – Knowledge for People, the Planet and Prosperity through Partnerships**", with particular relevance in Sub-Saharan Africa and, further, to other connected centres of excellence and Copernicus centres, in Latin America and other parts of the world.

It should be emphasized that **satellite Earth Observation is important for society and economy** for several reasons. First, satellite data adequality integrated in advanced information systems can be used to **monitor and protect coastal areas, maritime traffic and the biodiversity of the ocean**, as well as to create the "**digital twin" of the ocean** to model and promote new activities under the scope of the blue economy. For example, satellite data can be used to indirectly track the movements of fish stocks, identify areas of Illegal fishing, and monitor the health of coral reefs. This information can be used to improve the management of fisheries and to support the sustainable development of the blue economy.

Second, satellite data adequality integrated in advanced information systems can help us better understand and manage our **natural resources** if adequality integrated with in-situ data and advanced information systems. For example, satellite data can be used to build "**digital twins" of Agro-forestry structures and mountains**, which will allow to monitor natural products and to foster sustainable agricultural production and help farmers optimize their use of water and fertilizer. This can lead to better crop monitoring for diseases and fungal outbreaks, better management of fertiliser use and control of agricultural waste run-off, and overall increased crop yields, thereby bolstering the **food security and resilience** of the continent.

Finally, satellite data can be used to **monitor and mitigate the effects of climate change** through the effective use of "**digital twins" of complex urban laboratory and wetlands, as well as the ocean and other landscapes,** that are co-designed with key entities and potential users. For example, satellite data can be used to track land use changes and the expansion of deserts and the effects of drought and floods. This information can be used to support the development of adaptation and mitigation strategies.

The use of advanced information systems integrating EO data, together with the development of "digital twins" is essential for the development of sustainable urban expansion and blue economy activities in the mid-Atlantic and the geographic situation of Cabo Verde is particularly suitable to establish a new Centre of excellence with this goal. EO data can be used to create maps of the seafloor, to identify areas of high biological productivity in all the Gulf of Guinea and Macaronesia, and to identify suitable sites for aquaculture, for marine biodiversity protection areas, and no-take fishing zones. This information is essential for the planning of sustainable fisheries and aquaculture activities. EO data can also be used to assess and monitor coastal erosion as well as to assess and monitor environmental impacts of blue economy activities.

Such activities are complementary to the actions planned under the GMES & Africa programme. Indeed, it is expected that CAVIC will catalyse the partnership with members of the GMES & Africa consortium and the African Space Agency, beyond the European Space Agency.

1.5 CAVIC´s Logical Framework of Implementation

The implementation of CAVIC will require a logical framework for continuous measurement the ***impact, outcomes, and outputs***. Therefore, it is proposed the following dynamic pathway:

Impact:

- Promoting the **sustainable growth of Sub-Saharan Western Africa**, together with **innovation activities for blue and green growth** in the Mid Atlantic through **leveraging *digital resources* and remote sensing services using geospatial technologies** to provide decision support and planning tools for sustainable social and economic development throughout the region. It considers Cabo Verde as a **secure Mid Atlantic Data-Hub using EO systems** for Sustainable and Healthy territories, blue economy, agroforestry and sustainable energy, with mutual benefits for both the EU and Sub-Saharan Western Africa.

Outcomes:

- **Modernization of public administration**, together with the adoption of forms of **energy sustainability, sustainable and healthy urban expansion, sustainable use of land and the blue economy**, namely in conjunction with the sustainable development of the **agro-food sector;**
- **Improved planning of urban landscapes in continuous expansion in Sub-Saharan Western Africa;**
- **Monitoring and protection of coastal areas**, **maritime surveillance and monitoring of maritime traffic**, as well as the monitoring of the biodiversity of the ocean;

- Economic and social valorisation of **biological assets** and the support tools for the development of local **bio economie;**
- **Optimized use of solar and wind renewable sources of energy**, together with distributed systems of energy production in Sub-Saharan Western Africa.

Outputs:

- **New digital products** integrating forms of "**Responsible Artificial Intelligence**" (i.e., "Responsible AI"), with entire **compliance with European cybersecurity standards** and established partnerships with Sub-Saharan Western African and European organisations;
- **New digital planning systems and tools** of territories and social and economic activities through "digital twins" and it includes:
    - **Digital twins of complex urban landscapes in Sub-Saharan Western Africa**, in increasing expansion, including social cartographies and the development of digital tools and planning to help eradicating poverty through the remote monitoring of the most vulnerable urban zones;
    - **Digital twins of the ocean and wetlands in Western Sub-Saharan Africa** to model and promote new activities under the scope of the blue economy;
    - **Digital twins of agro-forestry structures and mountains in Sub-Saharan Western Africa**, including the planning of carbon fixation and sequestration, as well as the necessary tools to access financial assets through carbon markets;
    - **Dynamic mapping of sustainable energy systems in Sub-Saharan Western Africa**;
    - An **open access digital library of natural products in Sub-Saharan Western Africa**;
- Dedicated capacity building program for **Sub-Saharan Western Africa**, including professional and specialized training actions.

As a potential example of the expected impact of CAVIC, Figure 1 illustrates the planned evolution of the number of digital applications regrading "green and blue growth" expected to be developed during the implementation and operation of CAVIC, as well as the expected number of EU cybersecurity standards applied, from 2023 to 2027.

To facilitate a fast and effective starting for the operation of CAVIC, the AIR Centre will promote in early 2023 a Copernicus uptake action for the maritime sector in Cabo Verde, stimulating Blue Economy Growth, and open to all current and prospective partners of the K4P network, and articulating it with the actions of the GMES & Africa programme.

This action will be exploiting the Earth Observation program of Copernicus, that provides global data in a sustainable and reliable way and will concern the use of Copernicus data across the maritime sector,

focusing on Ports and Harbours, Aquaculture and Fisheries. Further, this action will promote the engagement of stakeholders in Cabo Verde and from Europe and will be articulated with the Copernicus Marine Environment Monitoring Service (CMEMS) showcasing how Earth Observation systems can support in the development of up-take opportunities and use-cases solving real market needs within the Blue Economy growth.

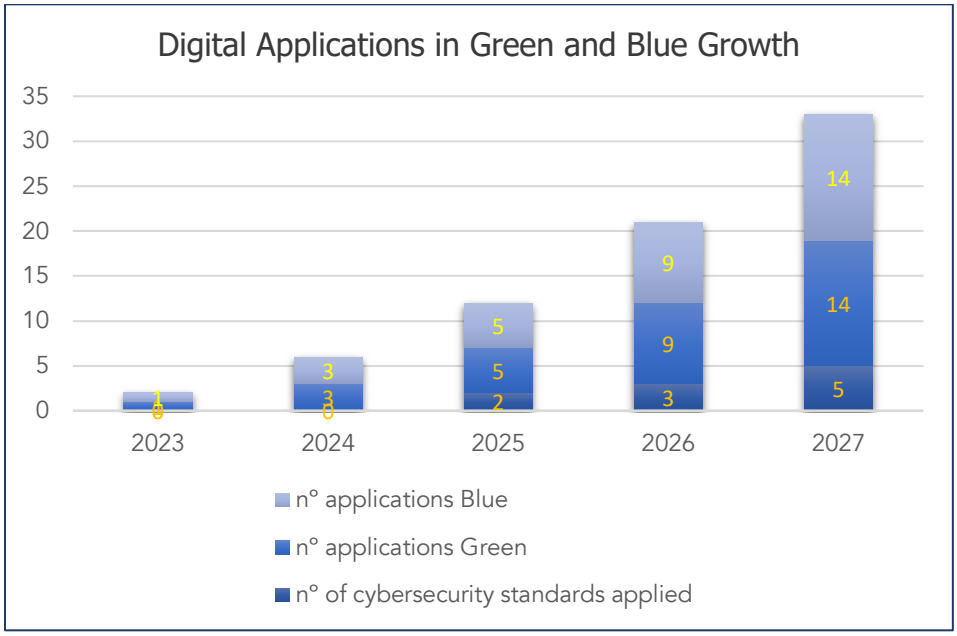


Figure 1 – *Evolution of the number of digital applications regarding Green and Blue Growth, as well, expected number of cybersecurity standards*

In addition, Figure 2 illustrates the Data Centre estimated external data usage in 5 to 10 years (as measured in terabytes), including the expected type of usage (workstation, in-house databases, IoT and auto-queries).

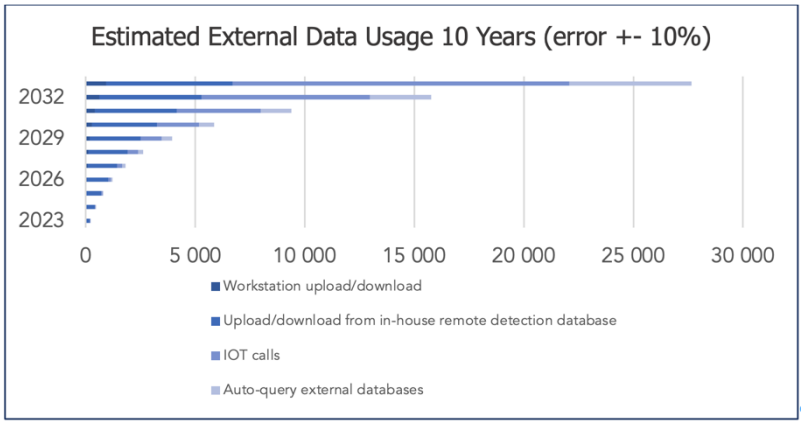


Figure 2 – *Data Centre estimated external data usage in 5 to 10 years in terabytes, (including the expected type of usage (workstation, in-house databases, IoT and auto-queries)*

The overall forecast for the initial 5 years of operation of CAVIC show that a total of 300 direct and indirect jobs will be created.

The following table provides a brief description of the logical framework for the implementation of CAVIC, which is to be continually assessed and gradually updated over the years.

	Intervention Logic	Indicators and contributions to SDGs	Targets Reference Year	Sources and means of verification
Overall Objective: Impact	Sustainable growth of Sub-Saharan Western Africa, with Cabo Verde as a secure Mid Atlantic Data-Hub using EO systems for Sustainable and Healthy territories, blue economy, agroforestry and sustainable energy, with mutual benefits for both the EU and Sub-Saharan Western Africa	*1.1 Indicator: (tb defined) SDG(s): 5, 8, 10, 13, 14, 15, 17.*	*(tentative date) December 2023*	*(tb defined)*
Specific Objectives/ Outcomes	Oc1. Modernization of public administration Oc2. Improved planning of urban landscapes Oc3. Monitoring and protection of coastal areas, maritime surveillance, and monitoring of maritime traffic Oc4. Economic and social valorisation of biological assets and local bio economies. Oc5. Optimized use of solar and wind renewable sources of energy	*(tb defined) Measure the change in factors determining the outcome(s)*	*(tb defined) intended value of the indicators*	*(tb defined) sources of information and methods used to collect and report*
Outputs	Otp 1. New digital products integrating responsible AI, with compliance with European cybersecurity standards Otp 2. Digital twins of complex urban landscape Otp 3. Digital twins of the ocean and wetlands Otp 4. Digital twins of agro-forestry structures and mountains, with tools to access financial assets through carbon markets; Otp 5. Dynamic mapping of sustainable energy systems Otp 6. An open access digital library of natural products Otp 7. Dedicated capacity building program, including professional and specialized training actions	*(tbd) Measure the degree of delivery of the outputs*	*(tbd) idem as above for corresponding indicators*	*(tbd) idem as above for corresponding indicators*

Table. 1 *–Logical framework for the implemented of CAVIC: description of impacts, outcomes and outputs*

2. General Context: Western Sub-Saharan Africa

In a context affected above all by sudden changes in association with climate change and population growth in Sub-Saharan Africa in the coming decades[3], the aim of the proposed Centre is to stimulate initiatives oriented towards sustainable growth that allow articulating the development of the most vulnerable populations in Sub-Saharan Western Africa.

The following important highlights should be considered:

- The conditions towards the sustainable economic, social and environmental development of West Africa have been discussed in recent years by ECOWAS and the establishment of ECREEE has a specialized agency with headquarters in Cabo Verde has been an important step to help improving access to modern, reliable and affordable energy services, energy security and reduction of negative environmental externalities of the energy system.
- Most Western Sub-Saharan Africa regions, including Cabo Verde, have a long history of drought, and recently has been in a 20-year period of below-normal rainfall. This has made it difficult to grow crops, and most people rely on imported food. Governments are working on strategies to improve the agricultural sector, including diversifying crop types and investing in new production processes and efficient water irrigation systems. Small dams can also help by providing water for farmers, but there is still a risk of dry spells. Almost all farms are family-owned, with average plots size being 1.2 Ha. This makes it difficult to achieve economies of scale. For example, the majority of farm parcels in Cabo Verde are in Santiago Island (59%), livestock is practiced in 85.3% of farms, while the dry farming is practiced in 73.4% of these parcels.
- The construction of several small dams led to a considerable increase in the amount of water available for irrigation in the recent years. The management of hydrographic basins carried out in an integrated way in the different river basins. Agriculture, livestock, and fishing are still the main economic activities in rural areas, but many people are moving to urban areas for work. This results in an abandonment of agriculture. Investments in new technologies, like agriculture in greenhouses and hydroponic units have the potential to invert this tendency. Also, regional and local governments are trying to change the way rural areas are developed, from the traditional way to a more modern way that is based on business agriculture. This will help to produce better quality products that can be sold in markets that require them.
- Sustainable agriculture practices are critical to increase production and productivity, farm incomes, and enhance adaptation and resilience against climate change and variability. Innovations in agricultural practices, the use of renewable energy, the development of agro-

[3] https://www.un.org/en/global-issues/population,

forest-pastoral systems, and the strengthening of research and development is crucial. Organic farming and the production of bio-food are also a challenge to be considered. Diversification of agriculture and increased use of drought-resistant crops, water harvesting and supplemental irrigation techniques, and drip irrigation for more effective use of irrigation water can help to ensure water for populations, food production, ecosystems, and the tourist industry.

- Groundwater is one of the most important natural resources and its use is increasing, which is reducing its quantity. Salinization and contamination of coastal aquifers are some of the most worrying problems in the management of groundwater resources, as they are considered strategic reservoirs. Climate change is happening more quickly than before, resulting in increased social, environmental, economic and political vulnerability, as well as new risks and opportunities. The decrease in annual precipitation (-20 to -10%), combined with up to 2.5° C rise in temperature, will expose a large proportion of the rural population to food insecurity and drastically affect the economy.
- Western Sub-Saharan Africa regions are extremely vulnerable to food shortages due to climate changes and external market fluctuations. In the past few years, more than 80% of cereals (corn, rice, wheat) are imported from abroad, both in the form of food aid and commercial imports. The weight of commercial imports has been increasing as food aid decreases. According to the FAO, in 2017 about 13% of the population in most of the Western Sub-Saharan Africa regions was undernourished. For example, Cabo Verde data from 2005 indicates that 20% of rural families were in a state of food insecurity, with 13% being moderately food insecure and 7% severely food insecure.
- In the specific case of Cabo Verde, land surface of protected areas was 733,57Km^2 in 2015, representing 18.19% of the entire land surface of Cabo Verde. Mountain ecosystems are among the most sensitive and vulnerable to climate change. Cabo Verde ratified the United Nations Convention to Combat Desertification in October 1994. The Convention is a Program of Action to Combat Desertification that focuses on land preservation. Cabo Verde's efforts to combat desertification are expanding the forested areas and implementing erosion control measures.
- Most of Western Sub-Saharan Africa regions and countries have implemented forms of a "*Youth Start-up program*" for young people aged 18-35, with higher education or vocational training. The programs build on incentives to offer young people new job opportunities and to develop their own business with training activities, financing of projects on advantageous conditions, follow-up on project implementation and incubation of companies. Additionally, several distinct programs of microfinance institutions have geared seeds of local entrepreneurship, competitiveness, and sustainability within the microfinance sectors, with special impact in Senegal and Ghana. They have created relevant conditions to open access to financial products and services for segments of the populations excluded from the formal financial system, as well as micro and small businesses.

- The National Strategy for Disaster Risk Reduction covers the period 2017-2030, in line with the time horizon of the Sendai Framework for Disaster Risk Reduction 2015-2030 and the African and ECOWAS Action Plans for Disaster Risk Reduction which covers all types of risks arising from both natural and man-made hazards, including risks related to climate change. The strategy provides an effective framework to manage risk, prevent disasters, minimize damage and associated losses, and avoid creating new risks, through the establishment of institutional mechanisms and capacity building for planning and implementing disaster risk reduction for building the nation's resilience.
- Urban centres lacking access to adequate infrastructure and basic services are more likely to be impacted by natural disasters. Basic services include safe drinking water, proper sanitation and drainage, and health care access. This is increasingly pertinent as it relates to the threats that arise from, or are exacerbated by, the impacts of climate change. Cities are increasingly exposed to both water scarcity and intense flooding due to extreme changes in weather patterns across the globe. In coastal areas, cities must consider the impact of rising sea levels as well. The World Bank's 2013 Open Data for Resilience Initiative suggests that by 2050, the urban population exposed to cyclones will increase from 310 million to 680 million . In Dakar, the World Bank estimates the value of "flood-vulnerable" assets at around €40 billion, double Senegal's GDP. There are other coastal countries in SSA whose cities are deemed high impact risk from climate variability. The chart below indicates the countries that have a significant percentage of their population residing in elevation below 5 meters. Subsets of urban centres across the developing world deemed "*development deficit*" are at increased risk of disaster impact. These areas, also referred to as informal settlements or "slums," are often reliant on non-existent or incompetent risk-reduction services.

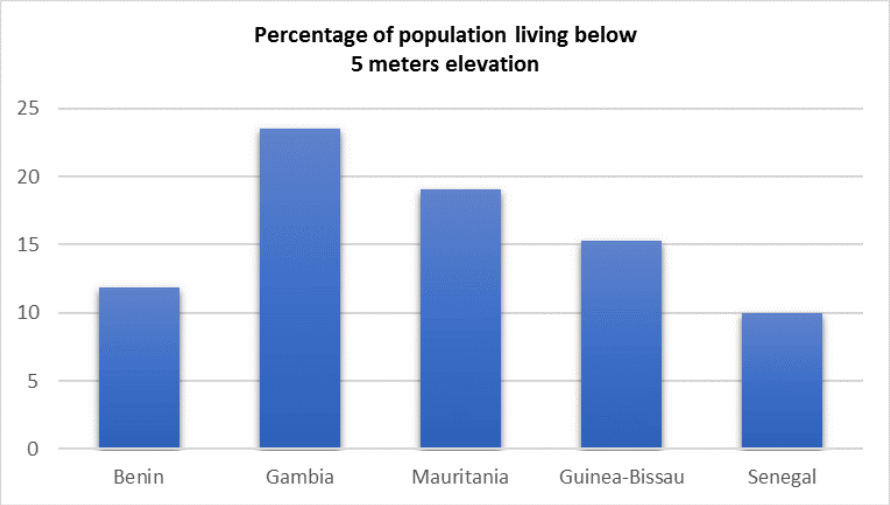


***Figure 3**. Countries that have a significant percentage of their population residing in elevation below 5 meters, with emphasis for Western Sub-Saharan Africa regions (The Gambia, Guinea-Bissau, Benin, Senegal).*
Source: World Bank 2010 indicators: "Sub-Saharan Africa."

- There is a great potential of renewable resources in most Western Sub-Saharan Africa regions, such as wind and solar power, can help reduce electricity and water costs, increase energy security and competitiveness, and diversify the economy. Local meteorological and geophysical models with higher resolution and accuracy are needed, as current ones are insufficient.
- Most of Western Sub-Saharan Africa governments, including that of Cabo Verde, have developed action plans to promote digital and innovation platforms. To help achieving this goal, the new Centre needs to focus on innovation and connect with global research and digital technology production centres and networks.
- Regarding Western Sub-Saharan Africa, it should be noted that Cabo Verde EEZ is a major asset and an essential part of the regional identity, beyond that of Cabo Verde itself. The zone, which extends 200 nautical miles from the coast and currently covers 740,000 km², could reach 1 million km² if the continental shelf is extended to 350 nautical miles. This would give Cabo Verde and the overall Western Sub-Saharan Africa an immense heritage that should be leveraged. More sustainable fisheries management needs be achieved by eliminating destructive practices by controlling and monitoring illegal, unreported and unregulated fishing. Furthermore, investment in the fisheries sector should be promoted, as well as knowledge and sustainable exploitation of the living resources of the sea, mariculture and aquaculture. Currently the World Bank is supporting investment in an aquaculture station at IMAR (a research centre in Mindelo, São Vicente Island), and a legal framework is under development and private investment in several explorations is underway. Identification of new fishing banks (often far away from coast) and

monitoring of existing ones is needed, and new fishing techniques should be explored. With more than 4´000 fishing vessels, often below 9m, the fleet needs to be modernised towards semi-industrial and larger vessels. There is also an effort and programs of the government to train and attract younger generations to blue economy. Finally, the country lacks oceanographic local scale information and means to characterise its coasts (e.g. research vessels are needed), although here are ongoing efforts and projects.

- Western Sub-Saharan African regions, including Cabo Verde, have a high dependence on port activities (international and inter/island connectivity) and a continuous modernization of the ports with operational and environmental standards is needed to ensure efficiency, efficacy and low environmental impacts.
- Western Sub-Saharan African regions include more than one hundred *Marine Protected Areas*, distributed over different regions, including Cabo Verde (about forty protected areas). Many of these areas already have management tools, specifically management plans, eco-tourism plans, business plans and monitoring plans. However, biodiversity in the region is difficult to assess due to the absence of dedicated EO systems oriented towards a *Biodiversity Observatory* and reliable statistical information.
- It is also important to highlight that Climate change may have a huge impact on Western Sub-Saharan African regions, in particular on rainfall, drought, fish catches, and the rise in sea level:
    - Changes in marine species distribution and composition will have negative effects on the country's food security.
    - For example, simulations carried out by Lam et al. (2012) indicate that the reduction in fish catches in the Cabo Verde EEZ could be 6% or 22%, depending on the emission scenario.
    - The decrease in fish catches is expected to have negative impacts on prices, export earnings, and income from fisheries agreements.

Regarding the specific case of Cabo Verde, we note that in 2020, the country entered recession due to the economic impact of COVID-19. The collapse of tourism flows from Europe, which represent 25% of its GDP, has dramatically stalled economic activity and government revenue. GDP fell by 14,8%, public debt has peaked to 151%, and official unemployment has reached 20%.

To grasp the full dimension of the current crisis we must recall that Cabo Verde is known for its remarkable economic and social achievements, despite the almost absolute lack of natural resources, including water or arable land. Cabo Verde also faces many of the vulnerabilities of a SIDS, including those arising from climate change, challenges in international and inter/island connectivity, expensive energy, small and scattered administration, and an economy very dependent on international fluctuations.

The current situation and its social impact pose a threat to the country's economic stability and performance. It is, however, also an opportunity for the country to respond to the structural challenges of its growth model and undertake significant reforms and investments that will help shift its development vision towards an inclusive green economy. In some specific areas, the country is already on the right track, but hampered by lack of finance and its high debt burden. In other areas, firm transformational initiatives are needed to develop and diversify sustainably key sectors of the country's economy and promote further convergence with EU norms and standards.

3. Stakeholders and Sub-Saharan Western Africa Regional Network

3.1 Vision

A Centre of excellence focused on advanced information and EO systems for blue and green growth in Cabo Verde to serve Western Sub-Saharan Africa and the mid-Atlantic regions must consider the full engagement of main regional actors/entities in close international relationships.

The goal should encompass the massive use of digital systems to foster a transformational shift towards inclusive green growth economic model, forming a working/operational model potentially scalable to other regions and aiming to promote the close collaboration with local actors, involving "*Living Labs*" and co-creation mechanisms, as well as interface, intermediation, and outreach activities.

The orientation should be clearly on creating healthy jobs and markets, together with capacity building at institutional and individual levels.
To achieve this overall goal, the following issues have been considered in the design of CAVIC:

- An effective **international network and international connectivity pathway**, including the **EurAfrica Gateway**), through the engagement of the **Atlantic International Research Centre, AIR Centre**, and its main role as coordinator of a European funded CSA under the mission "*EU Mission Restore our Ocean and Waters by 2030*" (with EC´s Horizon Europe funding for 2023-2027). The new Centre will become fully integrated in the AIR Centre network;

- Fostering a **Digital connectivity infrastructure**, including international connectivity (the EurAfrica Gateway), the Regional Fiber backbones and Satellite connectivity, together with **Secure EurAfrica Gateway Cable**; The new Centre will comply with **European cybersecurity standards and the 5G Toolbox**, aiming to become part of the **cybersecurity preparedness facility of Cabo Verde**;
- **Strengthening regional cohesion and networks in Western Sub-Saharan Africa**, including a close **articulation with exiting services in Western Africa**, including in Senegal, Ghana and Nigeria, as well as with inter-governmental organizations, such as the ***Sub-Regional Fisheries Commission*** (SRFC);
- **Leveraging the digital capacity at NOSI,** a Data Centre and digital service provider in Cabo Verde, with relevant relationships with other digital providers in Western Sub-Saharan Africa, and with relevant experience in establishing European links.

It should be noted that the new Centre will explore the experience of the **Atlantic International Research Centre – AIR Centre**, including its "Earth Observation Laboratory" (in the Terceira Island of Azores) and related activities in Brazil (e.g., Rio Janeiro, Ceará) and Africa (e.g., South Africa and Nigeria), to help strengthening regional cohesion and networks in Western Sub-Saharan Africa, including a close articulation with existing services in Western Africa, including in Senegal, Ghana and Nigeria.

3.2 Main Promoters of CAVIC: Design phase (2022)

The following table lists the main partner institutions in Cabo Verde and elsewhere that have agreed to partner with the ***Atlantic International Research Centre – AIR Centre*** to promote the design, installation, and immediate growth of this new Centre.

*Table 2: List of initial **main CAVIC´s promoters at the design phase (2022)** and type of relationship with the AIR Centre (main CAVIC´s promoter)*

Institution	Mission	Country/ region of influence in Cabo verde	Established relationship
AIR Centre: Atlantic International Research Centre https://www.aircentre.org/	An international collaborative organization that promotes an integrative approach to space, climate, ocean and energy and data sciences in the Atlantic. The AIR Centre is driven by and supports emerging technological innovations and advances in data science. Its activities are oriented to attract the young generations and to foster local skilled job creation through "user-driven and open innovation platforms" that test new solutions and facilitate social appropriation of scientific knowledge.	Atlantic: The AIR Centre was launched in 2016 and formally created in 2018 as an international organization, registered in Portugal. It includes many African	Main promoter

	Collaborative action research should be transdisciplinary and involve start-ups, SMEs, large firms, engineering centres, research institutions and potential users throughout Atlantic regions.	countries and institutions (South Africa, Nigeria, Ghana, Benin, Angola, Cabo Verde). It has, well established relations in Western Africa	
NOSI: https://www.nosi.cv/	ICT Public company registered in Cabo Verde, with over 20 years' experience in digital governance, acting nationally and internationally. They develop solutions for digital transformation, for both private and public sectors, with the work of highly qualified personnel and through web-oriented, modern technologic platforms which are adaptable to the needs of each client.	Cabo Verde: Santiago Island; with established relations in Western Africa	Memorandum of Understanding (MoU) with AIR Centre and the "K4P alliances"
IMAR/OCM: Institute of the Sea /Ocean Science Centre of Mindelo https://www.imar.gov.cv/ https://www.oscm.cv/	The Institute of the Sea (IMAR) operates a main facility in Mindelo, and holds a joint facility with the GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany, through the Ocean Science Centre Mindelo (OSCM).	Cabo Verde: São Vicente Island (Mindelo); with established relations in Western Africa	Memorandum of Understanding (MoU) with AIR Centre and the "K4P alliances"
INIDA: National Institute for Agrarian Research and Development https://www.inida.gov.cv/	The National Institute for Agrarian Research and Development (INIDA) was created in 2006 and operates a main infrastructure in the Santiago Island. It is under the authority of the Ministry of Agriculture and Environment. INIDA is focused on research, experimentation and development of science, agriculture technologies and natural resources, as well as in disseminating scientific and technologic knowledge.	Cabo Verde: Santiago and Santo Antão Islands; with established relations in Western Africa	Memorandum of Understanding (MoU) with AIR Centre and the "K4P alliances"
UNI-CV: University of Cabo Verde https://www.unicv.edu.cv/en	The University of Cabo Verde (*Portuguese*: *Universidade de Cabo Verde, abbreviated "Uni-CVV")* is the only public university of Cabo Verde. The main campus is in Palmarejo, Praia, but there are also institutes in Mindelo, Assomada and São Jorge dos Órgãos. It has over 5000 students.	Cabo Verde: Santiago and São Vicente Islands; with established relations in Western Africa	Memorandum of Understanding (MoU) with AIR Centre and the "K4P alliances"

CIMO/IPB: Mountain Research Centre of the Polytechnic Institute of Bragança, Portugal https://cimo.ipb.pt	CIMO (Centro de Investigação de Montanha / Mountain Research Centre) was established in 2002 at the Instituto Politécnico de Bragança (IPB). Is an inter-disciplinary research unit focused on mountains research issues. CIMO aims to study and create value on natural resources and local products; develop sustainable systems from an economic, social, and environmental point of view and strengthen the link between research and the economic sectors in mountain regions in Portugal.	Portugal, with established relations in Western Africa	Memorandum of Understanding (MoU) with AIR Centre and the "K4P alliances"
MORE – Colab for Mountains Research, Portugal https://morecolab.pt/en/home/	MORE CoLAB focuses on the development and innovation in mountain territories using a global but inter-and multidisciplinary approach, targeting the primary sector (e.g., agriculture, forestry, natural resources), the industry (e.g., food and bio-based products and processes) and services (e.g., tourism) in an integrated territorial development and innovation mode, focusing on digital transition efforts (technology development and implementation).	Portugal, with established relations in Western Africa	Memorandum of Understanding (MoU) with AIR Centre and the "K4P alliances"
PLOCAN - Oceanic Platform of the Canary Islands, Spain https://www.plocan.eu/en/	The Oceanic Platform of the Canary Islands (PLOCAN) is a Research Infrastructure (RI) labelled by the ICTS (Unique Scientific and Technological Infrastructure) Spanish National Roadmap, co-funded by the Ministry of Science, Innovation and Universities of the Spanish government and the Canary Islands government and by the European Regional Development Fund (ERDF) under the Operational Programme of the Canary Islands. PLOCAN is a multipurpose technical-scientific service infrastructure that provides support for research, technological development, and innovation in the marine and maritime sectors, available to public and private users.	Spain, Canary Islands, with established relations in Western Africa	Memorandum of Understanding (MoU) with AIR Centre and the "K4P alliances"
INMG National Institute of Meteorology and Geophysics https://www.inmg.gov.cv/	National authority in the fields of meteorology, climatology and geophysics, geomagnetism and seismology, for aeronautical and maritime purposes. It exercises its powers throughout the national territory and in the air and sea space, subject to the jurisdiction of the State of Cabo Verde and, has its head in the city of Espargos, Sal Island, with delegations and services installed in various parts of the archipelago.	Cabo Verde: Santiago and São Vicente Islands with established relations in Western Africa	A future Memorandum of Understanding (MoU) with AIR Centre and the "K4P alliances" is under discussion

ENAPOR Cabo Verde Port Authority http://www.enapor.cv/en_US/page/empresa	National port authority, oriented to an integrated management of the entire logistics and maritime business chain, taking into account the simplification of processes in its different aspects: transportation, production, storage, distribution and other services of value added.	Cabo Verde: Santiago and São Vicente Islands with established relations in Western Africa	A future Memorandum of Understanding (MoU) with AIR Centre and the "K4P alliances" is under discussion

It is proposed that a first phase of the implementation of the new Centre **is focused on the island of Santiago, with future potential poles in São Vicente and Santo Antão**, as well with potential relationships with IMAR in Mindelo. This national network will certainly increase in the medium to long-term after consolidation of the new Centre in the mentioned regions.

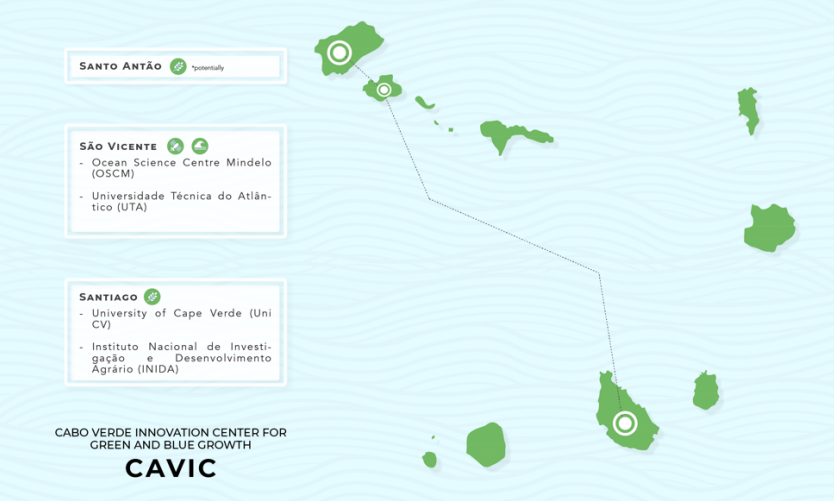


Figure 4 – *Draft plan for first phase of implementation of the new Centre in Cabo Verde islands, with the headquarters and main operation in Santiago and potential future poles in São Vicente and Santo Antão*

3.3 Stakeholders in Continental Western Sub-Saharan Africa

The following table lists the main partner institutions involved in the ***Atlantic International Research Centre – AIR Centre***, which will contribute for the CAVIC´s strategy to strengthening regional cohesion and networks in Continental Western Sub-Saharan Africa, including a close articulation with exiting services in Western Africa, particularly in Senegal, Ghana and Nigeria.

The table also lists potential future agreements of cooperation, including with inter-governmental organizations operating in Western Sub-Saharan Africa, such as the *Sub-Regional Fisheries Commission* (SRFC).

Table 3: *List of partner institutions in* ***Continental Western Sub-Saharan Africa*** *and type of relationship with the AIR Centre* (main CAVIC´s promoter)

Institution	Mission	Country	Established relationship
ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) **http://www.ecreee.org/**	ECREEE is a specialized agency which acts as an independent body but within the legal, administrative and financial framework of the ECOWAS rules and regulations. ECREEE aspires to contribute to the sustainable economic, social and environmental development of West Africa by improving access to modern, reliable and affordable energy services, energy security and reduction of negative environmental externalities of the energy system.	**Western Africa**	A future Memorandum of Understanding (MoU) with AIR Centre is to be planned The institutional structure of the Centre includes a Secretariat based in Praia, Cape Verde
Nigerian Institute for Oceanography and Marine Research, NIOMR https://www.niomr.gov.ng	National Fisheries and Oceanography centre of excellence using dedicated, world-class scientists to collect, analyse and provide scientific data and information for the development of scientific products necessary for sustainable exploitation of Nigeria's Marine resources and utilization, coastal and ocean environment for the benefit of our national community at large.	**Nigeria**	**Affiliation agreement with AIR Centre** Main contact: CEO NIOMR, Sule Abiodun
National Space Research and Development Agency, NASRDA	The main thrust of the Agency's activities is geared towards making space science and technology application an integral part of the overall strategies for sustainable national development.	**Nigeria**	**Full member of the Air Centre (Associated);** Main contact: Head of Climate Change and Modelling division, Asma Ibrahim

Centre and Centre for remote Sensing and Geographic Information Services, CERSGIS https://cersgis.org	Established in 1999 by the University of Ghana and the Environmental Protection Agency of Ghana (EPA). As a self-supporting organization, CERSGIS was mandated to provide GIS and Remote Sensing services using Geospatial technologies to provide decision support and planning tools for sustainable social and economic development to Government, NGOs, Research Institutions and the Private Sector. The Centre is located at the Department of Geography and Resource Development, University of Ghana, Legon.	**Ghana**	**Affiliation agreement with AIR Centre** Main contact: Executive Director, Foster Mensah
RCM, Regional Marine Centre - University of Ghana https://regionalmarinecentreug.blogspot.com	The Regional Marine Centre, at University of Ghana is implementing the GMES & Africa project on Marine and Coastal Areas Management for western Africa. This action is in partnership with seven state institution.	**Ghana, Accra**	**Memorandum of Understanding (MoU) with AIR Centre** Technical Lead: Kuame Adu Agyekum
The Benin Institute for Halieutic and Oceanographic Research, IRHOB, https://aquadocs.org/handle/1834/17778	Government organization established in 1988 (at that time known as National Oceanographic Committee) with the objective to contribute to rational management of living and non-living aquatic resources in Benin, based on the integration of scientific, economic and sociological advice (more information on the institute's mission, structure and activities can be found here: http://nodc-benin.odinafrica.org/2016-07-22-08-25-58/pr%C3%A9sentation-de-l-irhob.html). The library of the Benin Institute for Halieutic and Oceanographic Research (IRHOB) is a unit of the Technical and Scientific Information Department. Its mission is to monitor and promote access to aquatic, marine, and environmental science information.	**Benin**	**Memorandum of Understanding (MoU) with AIR Centre** Technical Lead: Director, Zacharie Sohou
Oceanographic Research Center of Dakar Thiaroye – CROD https://www.gfar.net/organizations/centre-de-recherches-oceanographiques-dakar-thiaroye And Sub-Regional Fisheries Commission (SRFC), http://spcsrp.org/en/	CROD belongs to the Sub-Regional Fisheries Commission (SRFC), an inter-governmental fisheries cooperation organization established by the Convention of 29 March 1985, amended on 14 July 1993 in Praia (Cabo Verde). It has 7 member States: Cabo Verde, The Gambia, Guinea, Guinea-Bissau, Mauritania, Senegal and Sierra Leone. Its headquarters are in Dakar, Senegal. SRFC is an institution with diversified expertise to enforce the mechanisms of sustainable governance of fisheries resources. It is in line with strengthening the regional cooperation to enhance the sustainable management of	**Senegal, Dakar**	**A future Memorandum of Understanding (MoU) with AIR Centre is under discussion**

	fisheries resources in maritime waters under the jurisdiction of member States.		
STEPRI Science and Technology Policy Research Institute (STEPRI) of the Council of Science and Industrial Research (CSIR)	The Vision of STEPRI is to become an international institution that facilitates the development, transfer, utilization and management of Science, Technology and Innovation (STI) tailored to meet the specific needs of Ghana and Africa	**Ghana**	**A future Memorandum of Understanding (MoU) with AIR Centre is under discussion**
The Centre de Suivi Écologique (CSE) https://www.greenclimate.fund/ae/cse	The Centre de Suivi Écologique (CSE) is a national entity located in Senegal whose core activities include environmental monitoring, natural resources management and conducting environmental impact assessment.	**Senegal, Dakar**	**A future Memorandum of Understanding (MoU) with AIR Centre is under discussion**

Regarding CAVIC´s goal of strengthening regional cohesion and networks in Continental Western Sub-Saharan Africa, the following main actions are considered in the design and installation of CAVIC:

a) Promoting the **cooperation with ECREE/ECOWAS oriented towards the sustainable economic, social and environmental development of West Africa** by improving access to modern, reliable and affordable energy services, energy security and reduction of negative environmental externalities of the energy system. The institutional structure of the Centre is based in Praia, Santiago Island, Cabo Verde;

b) **Promoting remote sensing and advanced EO systems to support the Sub-Regional Fisheries Commission (SRFC)**, which is an inter-governmental fisheries cooperation organization established by the Convention of 29 March 1985, amended on 14 July 1993 in Praia (Cabo Verde). It has 7 member States: Cabo Verde, The Gambia, Guinea, Guinea-Bissau, Mauritania, Senegal and Sierra Leone (see Figure 5). Its headquarters are in Dakar, Senegal. The SRFC is an institution with diversified expertise to enforce the mechanisms of sustainable governance of fisheries resources. It is in line with strengthening the regional cooperation to enhance the sustainable management of fisheries resources in maritime waters under the jurisdiction of member States.

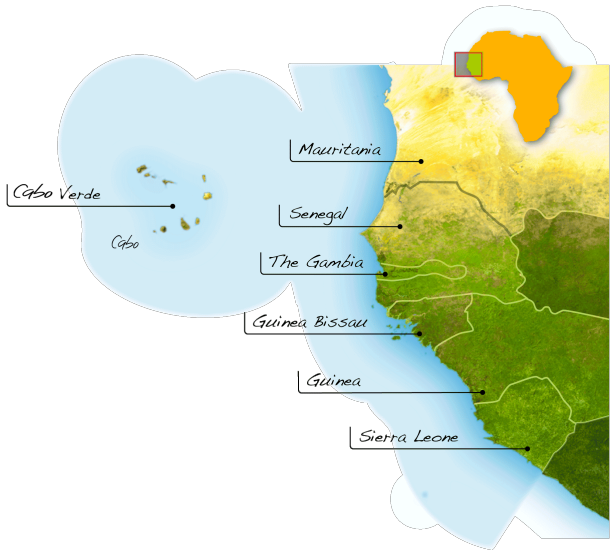


Figure 5. *Area of influence of the Sub-Regional Fisheries Commission (SRFC), involving Cabo Verde, The Gambia, Guinea, Guinea-Bissau, Mauritania, Senegal and Sierra Leone*

c) **Promoting remote sensing and advanced EO systems to support urban expansion in western Sub-Saharan Africa, particularly to address risks reduction strategies** in countries that have a significant percentage of their population residing in elevation below 5 meters, including The Gambia, Guinea-Bissau, Benin, Senegal.

d) **Partnering with Western African regions and countries to access the "Global Climate Fund – GCF"** in order to **promoting remote sensing and advanced Earth Observation systems to support the development of Western Africa (see at** https://www.greenclimate.fund/about/partners) . It should be note that CAVIC is planning to help GCF and national/regional authorities in Western Africa to unlocking projects that would not have happened without GCF financing or which would not have otherwise internalized rigorous climate considerations.

e) **Partnering with Western African regions and countries to access IEA, the International Energy Agency**, in order to promoting remote sensing and advanced EO systems to support the development of energy-related issues in Western Africa. The IEA is at the heart of global dialogue on energy, providing authoritative analysis, data, policy recommendations, and real-world solutions to help countries provide secure and sustainable energy for all (https://www.iea.org/about/mission).

3.4 INTERNATIONAL STAKEHOLDERS IN AFRICA AND WORLDWIDE

The following table lists the main institutions involved in existing and future potential strategic partnerships with the ***Atlantic International Research Centre – AIR Centre***, which will contribute for installation and growth of CAVIC and its future activities in Western Sub-Saharan Africa, including a close articulation with exiting services in Africa, particularly in South Africa and Tanzania.

The table also lists potential future agreements of cooperation, including with inter-governmental organizations operating in Africa, such as the recently created *Africa Space Agency*, with headquarters in Egypt, and "Digital Earth Africa", with headquarters in Pretoria.

***Table 4**: List of major **international partner institutions with relevant activities in Africa** and type of relationship with the AIR center (main CAVIC´s promoter)*

Institution	Mission	Country/ region of influence	Established relationship
European Space Agency (ESA)	The European Space Agency is an intergovernmental organization of 22 member states dedicated to the exploration of space. Established in 1975 and headquartered in Paris, ESA has a worldwide staff of about 2,200 in 2018 and an annual budget of about €7.2 billion in 2022. ESA, Europe and Africa have been working together in the field of Earth observation for a number of years now, particularly thanks to the EU's Copernicus programme – the biggest environmental monitoring programme in the world. Through Copernicus, satellite data from the family of Copernicus Sentinels, developed and built by ESA, are made available through key services. The free and open access to data and services has allowed African institutions to develop applications to monitor water quality in lakes, prepare adaptation measures for agriculture and to monitor biodiversity, for example. The GMES & Africa Initiative lead by the African Union Commission has been instrumental to establish Earth observation services across the African continent.	**Europe and Africa**	**The AIR Centre Earth Observation Lab in Azores has been established as an "ESA Lab".** AIR Centre and ESRIN/ESA are cooperating in a joint assessment for the installation of CAVIC in 2022/2023. A future Memorandum of Understanding (MoU) between ESA/ESRIN and the AIR Centre will be under discussion for subsequent implementation
GMES & Africa https://au.int/GMESAfrica/	The Maputo Declaration of October 2006 provided the necessity for the EU-Africa partnership to confirm the commitment to avail European infrastructure and facilities, under the Copernicus programme to Africa, Caribbean, and Pacific (ACP) countries. This commitment led to the launch of GMES & Africa	**Africa**	A future Memorandum of Understanding (MoU) with AIR Centre for the operation in the Global South is under discussion

	process in Lisbon, Portugal, on 7th December 2007 during the 2nd EU-Africa Summit. In the context of this Lisbon process, the European and African Union Commissions established a Coordination Team tasked to develop an Action Plan for the GMES & Africa and an EU-Africa Space Troika to oversee the overall evolution of this initiative. The EU-Africa Space summit, of May 2022 in Lisbon, strengthened the EU-Africa partnership in Earth Observation		
SANSA - South Africa Space Agency https://www.sansa.org.za/	SANSA was created in 2010 to promote the use of space and strengthen cooperation in space-related activities while fostering research in space science, advancing scientific engineering through developing human capital, and supporting industrial development in space technologies. Much of this work involves monitoring the Earth and our surrounding environment, and using the collected data to ensure that navigation, communication technology and weather forecasting services function as intended. SANSA's Head Office in Pretoria oversees SANSA operations and management the Earth Observation programme (currently based in Hartebeesthoek); the Space Operations programme (formerly the Satellite Application Centre, located in Hartebeesthoek); and the Space Science programme (former Hermanus Magnetic Observatory, located in Hermanus); as well as a newly-established Space Engineering programme situated alongside the Head Office.	**South Africa, Pretoria**	**Memorandum of Understanding (MoU) with AIR Centre;** Technical Lead: Stewart Bernard
Africa Space Agency https://au.int/sites/default/files/treaties/36198-treaty-statute_african_space_agency_e.pdf	Recently formed, aiming to promote and coordinate the implementation of the African Space Policy and Strategy and to conduct activities that exploit space technologies and applications for sustainable development and improve of the welfare of african citizens.	**Headquarters in Egypt**	Future Memorandum of Understanding (MoU) with AIR Centre under discussion
Digital Earth Africa https://www.digitalearthafrica.org/	Newly formed African network, with special influence in South Africa, Rwanda, Tanzania. Digital Earth Africa exists to improve the lives of people across the African continent by translating Earth observations into insights that will support sustainable development. Digital Earth Africa has partnered with South African National Space Agency to establish a Program Management Office situated in South Africa, Gauteng, Pretoria	**African network, based in Pretoria**, at SANSA (South Africa Space Agency)	Future Memorandum of Understanding (MoU) with AIR Centre under discussion

Global Climate Fund – GCF, https://www.greenclimate.fund/about/partners	GCF relies on its expanding network of partners to deliver results across the spectrum of climate action to promote low-carbon and climate-resilient paths. These partners span multilateral and national banks, international financial institutions, development finance institutions, UN agencies, conservation organisations, equity funds, government agencies, regional institutions and more. These diverse partnerships enable GCF to build on knowledge and experiences to drive systemic change that achieves climate ambitions.	**Africa**	CAVIC plans to work with GCF works through a partnerships approach and to serve as a bridge for developing countries in navigating a complex climate financing landscape. Within this partnership network, CAVIC will help GCF and national/regional authorities in Western Africa to unlocking projects that would not have happened without GCF financing or which would not have otherwise internalized rigorous climate considerations.
AfricaLICS https://africalics.org/ The African Network for Economics of Learning, Innovation and Competence Building Systems.	African Network, with special influence currently in Ethiopia, Tanzania and Ghana AfricaLics connects scholars working within the areas of innovation and development with specific focus on these issues for African countries. It provides networking opportunities and increase access to education to enhance economic and socially sustainable development in Africa: conferences, PhD academies, visiting fellows programme for PhD students and post-doctoral researchers and dedicated online networking platforms.	**African Network**, with rotating headquarters	Future Memorandum of Understanding (MoU) with AIR Centre under discussion
AFRILabs https://afrilabs.com/	African Network, with special influence currently in South Africa, Ethiopia, Tanzania and Ghana AfriLabs is a network organisation supporting Innovation Centres across African countries since 2011, founded upon the mission of building a community around the rapidly emerging technology hubs in Africa. The Mission is to support innovation hubs and their communities to raise high potential entrepreneurs that will stimulate economic growth and social development in Africa. We achieve this through capacity building, financing, networking, policy advocacy, and providing insightful, reliable data.	**South Africa, Ethiopia, Tanzania and Ghana**	Future Memorandum of Understanding (MoU) with AIR Centre under discussion

INSAF – Institute for Sustainable Africa http://www.instforsustainafrica.org/	an independent multi-disciplinary independent think tank and research organisation	**Zimbabwe**	Future Memorandum of Understanding (MoU) with AIR Centre under discussion
ACTS African Centre for Technology Studies, Kenya (ACTS)	The Mission is to strengthen the capacity and policies of African countries and institutions to harness science, technology and innovation for sustainable development	**Kenya**	Future Memorandum of Understanding (MoU) with AIR Centre under discussion
STIPRO Science, Technology and Innovation Policy Research organization (STIPRO)	An independent think tank in Tanzania, founded in 2001 with the major objective to produce knowledge for evidence informed science, technology and innovation policies	**Tanzania**	Future Memorandum of Understanding (MoU) with AIR Centre under discussion
Tanzania Data Lab https://dlab.or.tz/ Inlui: DATA ZETU https://datazetu.dlab.or.tz/	dLab has executed data and innovation projects locally, regionally, and globally on data and innovation ecosystem building, data capacity building, data driven innovations, and data science products and services. The countries covered by dLab include: Tanzania, Kenya, Uganda, Rwanda, Democratic Republic of Congo, Ethiopia, Egypt, Ghana, South Africa, Zimbabwe, and Kosovo. Registered in February 2018, dLab NGO is a progression of the three successful interconnected projects named, Tanzania Data Lab (dLab), Data Zetu and Data for Local Impact Innovation Challenge (DLIIC). The three projects which ran between 2016 and 2018 served as anchors for the Data Collaborative for Local Impact (DCLI) program and were funded by the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) and implemented by the Millennium Challenge Corporation (MCC). Data Zetu aims to empower communities to make better, more evidence-based decisions to improve their lives.	**Tanzania** **Kilimanjaro** **Mzizima** **Serengeti**	Future Memorandum of Understanding (MoU) with AIR Centre under discussion
AKDN – Aga Khan Development Network https://the.akdn/en/home	AKDN is dedicated to improving the quality of life of those in need, mainly in Asia and Africa, irrespective of their origin, faith, or gender. Its approach aims to help communities and individuals become self-reliant. In Western Africa, operations include programmes here cover agriculture, health, education, infrastructure and civil society capacity building, in a holistic approach to social development.	**African network**, with special influence in Tanzania and Ethiopia	Future Memorandum of Understanding (MoU) with AIR Centre under discussion

4. WORK PLAN FOR THE NEW CENTRE OF EXCELLENCE FOR WESTERN SUB-SAHARAN AFRICA

4.1 RATIONAL FOR THE INSTALLATION OF THE NEW CENTRE

The program considers **an "inclusive" perspective of science and science-society relations**, together with new arrangements of social organization that encourage "**ecologies of knowledge**" and a holistic view of knowledge. It requires understanding the context of the social appropriation of knowledge and a transformative vision, together with active forms of citizenship.

The focus is on "**data ecologies**", including new satellite-based data, together with the necessary knowledge and innovation to **improve land use management, healthy environments** and the multi-dimensional and interlinked SDGs that shaped the four main pillars of the 2030 agenda:

- **People**: promotion of the right to security and healthy conditions, through the humanitarian, social and economic valorisation of the concept of "One Health", with experimentation on planetary health and ***sustainable and healthy territories***, as well as **healthy diets** and **health determinants** such as education, food security, healthy jobs, housing, racism and xenophobia that affect the most vulnerable populations. Also noteworthy is the understanding of the impact of the social footprint on the planet in different socio-economic development scenarios.
- **Planet**: guaranteeing the minimization of emissions through reduced use of fossil fuels, and the capture and conversion of CO_2 in complex rural and coastal landscapes in association with land use change and management, soil monitoring, water management and carbon observation, together with the stepwise experimentation and development of smart regulatory regimes towards the effective implementation of carbon markets.
- **Prosperity**: sustainable land, water, and soil management (e.g., biomes and biodiversity in tropical areas, as well as inland forests) and coastal areas (e.g., mangroves in tropical areas, and saltmarshes elsewhere), together with the social and economic valorisation of biological assets (e.g., natural products) and the development of regional bioeconomy's (i.e., blue/green economies), included the reconversion of some of the current economic activities if necessary.
- **Partnerships**: establishing an international network of "Collaborative Laboratories", as effective *centres of excellence* in close collaboration with local actors, involving interface and intermediation activities with the public and private sectors, aimed at creating jobs and markets, together with capacity building at institutional and individual levels.

The rationale of the program relies on the fact that the **climate crisis** is probably the biggest challenge humanity is facing. Its effects in the field of health led the World Health Organization, WHO, to declare that "the climate crisis threatens to annihilate the progress of the last 50 years in global health and poverty reduction and to further widen the inequalities in health that exist between and within different populations" and to recognize that "climate change is the greatest global threat to human health and the Paris Agreement is potentially the most impactful health agreement of the 21st century" (WHO, 2021). In turn, there is no sustainable development without guaranteeing the rights of all people, which requires considering the connection between the "ecological footprint" indicators and those associated with the "social footprint" (i.e., poverty, inequality, violation of basic rights).

For this change to happen, we need to understand better "**Human Agency**" and our emerging **collective behaviours**, particularly in the Global South, in a way to guarantee the sustainability of the populations, simultaneously with their right to become developed. And this requires the governance of complex and massive amounts of data and their synergies (i.e., "**data ecologies**"), including new satellite-based data, together with the necessary knowledge and innovation to improve land use management through carbon mapping. Large amounts of data that require new technological tools such as cloud computing, data analysis, artificial intelligence, and machine learning for handling, processing, understanding and exploitation, together with new *in situ* information systems and the knowledge and innovation needed to improve land use management and the development of sustainable and healthy territories.

4.2 MAIN THEMATIC CHALLENGES

Western Sub-Saharan Africa faces many of the vulnerabilities arising from climate change, together with unique opportunities associated with population growth, which will drive the installation and growth of the new Centre.

The aim is to stimulate initiatives oriented towards sustainable growth that allow articulating the development of the most vulnerable populations in Western Sub-Saharan Africa and achieving the goal of carbon neutrality, or "net zero", by 2050, through pilot projects that are sustainable in the long-term in association with forms of cooperation that stimulate research and innovation activities with the active participation of local communities.

The pilot projects and their sustainability will be implemented through forms of institutional innovation, stimulating an Centre of excellence and collaborative institutional frameworks promoting "data ecologies" though the integration of advanced forms of **Earth Observation and related scientific, technological and innovation activities for blue and green growth**, **remote sensing and in situ data** to

understand the present and looking into the future, in close articulation with other data collection systems and local actors.

CAVIC will take the form of an "Collaborative Laboratory" involving interface and intermediation activities with the public and private sectors, as well as civil society organizations to emphasize the following actions:

- A **Data Center including Earth Observation satellite data** aimed at scientific, technological and innovation activities that facilitate and promote **energy sustainability, sustainable urban expansion, sustainable management of soils and the agri-food sector**, as well as the growth of the **blue economy** in Western Sub-Saharan Africa, in full compliance with (European) cybersecurity standards;
- Foster a **digital connectivity infrastructure**, including international connectivity, regional fiber backbones and satellite connectivity, with **very low latency and new direct data transfer routes between Europe and** Western Sub-Saharan Africa, with the aim of becoming part local cybersecurity readiness facilities and potential regional cybersecurity hubs, including enhancing the connections made possible by the EurAfrica Gateway Cable;
- **Integrate international networks at regional level in** Africa, as well as intercontinental ones, that are effective for international connectivity and sustainable growth of Western Sub-Saharan Africa.

The new Centre will launch a series of new concrete actions and will explore new outputs over time and in a stepwise process, including an integrated thinking across disciplines and unprecedented interconnectivity, including:

- Promoting relevant **institutional innovations** in a way to consider **distributed, plural and collaborative institutional frameworks**;
- **Building new data ecologies with advanced observation methods**, including satellite-data, coupled with advanced in-situ data collection and processing systems, together with adequate user interfaces and **far front technical tools of analysis**; and
- Fostering **new knowledge** and **capacity building**.

The Centre must therefore include in its programming:

- Develop research and innovation activities aimed at ensuring the **modernization of public administration and the economy and companies**, through the implementation of advanced information acquisition and processing systems, integrated with EO systems, including new forms of ***Responsible Artificial Intelligence*** and the digital planning of territories and social and economic activities through "digital twins", promoting the "Digital Planet";
- Attract, welcome and **support young researchers and innovators** from around the world to carry out innovative activities oriented towards the sustainable growth of Western Sub-Saharan Africa,

including the development and implementation of responsible systems for the modernization of public administration, together with energy sustainability, sustainable and healthy urban expansion, sustainable management of land use and the blue economy, namely in conjunction with the sustainable development of the agro-food sector. The activities to be developed must follow the global demographic dynamics in an increasingly digital era and supported by advanced EO systems, integrated with information acquisition and processing systems;

- Stimulate the **development of postgraduate training and specialization programs** on the development and implementation of advanced satellite EO systems, integrated with information acquisition and processing systems, including Artificial Intelligence and digital planning of territories and activities social and economic;
- Promote **transdisciplinary dialogue and research and innovation studies and activities in** Western Sub-Saharan Africa;
- **Integrate and participate in international networks**, including the **Atlantic International Research Center – AIR Centre** and the "K4P Alliances - Knowledge for People, the Planet and Prosperity through Partnerships" initiative, fostering relations with these initiatives, among others;
- **Actively integrate and participate in African innovation networks**, particularly in Western Sub-Saharan Africa, as described in this document.

4.3 Sample Potential Intervention topics

Sustainable and healthy territories, Renewable energy, sustainable food systems and water, and the blue economy are fundamental pillars of all Western Sub-Saharan African countries and regions. These sectors are of the highest potential for sustainable and inclusive growth in the region and their performance require advanced information systems. They are also sectors with an strong potential to generate formal employment and provide opportunities for the development of inclusive labour policies. Considering both the current context of Cabo Verde and all other Western Sub-Saharan African countries and regions, the following paragraphs highlights sample examples of "intervention topics" for the new Centre.

Intervention Topic 1: Improve fishing fleets in Western Sub-Saharan Africa

Problem Statement:

a) The fishing fleets are still insufficiently developed to explore marine resources and the region is vulnerable to food shortages and external market fluctuations;
b) Absence of reliable "Biodiversity observatory" and reliable statistical information to foster the necessary protection of biodiversity;

c) For the specific case of Cabo Verde, the continuous development of tourism needs to keep developing the convergence with EU safety standards

Proposed Goals:

a) Improve the capacity to manage and monitor marine resources and vessels, by supporting the sustained growth of the fishing and aquaculture effort;
b) Improve safety and efficiency of fishing fleets, by improving the industry income by up to 10% by reducing the amount of lost fishing gear;
c) Engage regional biodiversity groups with international standards and practices;
d) For Cabo Verde, improve the safety and efficiency of the touristic fleet.

Proposed Actions:

a) Develop a low-cost logging location system for both boats and buoys of fishing gears (LoRa technology), in a way to help monitoring and characterising the fishing effort and consequently the effective and efficient management (including spatial planning) of both the fleet, time-to-market, and marine resources. The system shall significantly reduce the number of events of lost fishing gear, thus reducing ghost fishing, while increasing the recovery rate of lost equipment and therefore reducing marine litter in the ocean. These measures shall increase fisherman's income by up to 10%.
b) The system above shall be complemented with the development of proof-of-concept services based on EO and developed with local stakeholders (including technology takers). These provide increased safety through better communications and targeted weather and sea information; and near-real-time information regarding fish markets for market transparency and the optimisation of income and resources. Adoption of new fishing gear shall be considered if relevant in coordination with national initiatives. Use of EO based data for coastal water bathymetry shall be considered, either using satellites or drones.
c) In addition, the proposed system will assist with the elimination of destructive practices by monitoring illegal, unreported and unregulated fishing.
d) Create one local MBON nucleus (Marine Biodiversity Observation Network) to cooperate with other international organisations, in coordination with local authorities, establishing links with EO products based on Copernicus and other EO systems as well.
e) Upon market demands, create one tool for supporting decision making regarding aquaculture potential areas, demonstrating its scalability and applicability to several countries.

NOTE: The actions above shall promote the convergence with EU norms and standards through strengthening the digital regulatory and capacities framework and policy dialogue in digital transformation. Obvious references are the GDPR, cybersecurity regulations and the 5G Toolbox.

Intervention Topic 2: Foster digital ports in Western Sub-Saharan Africa

Problem Statement:

Most ports in Western Sub-Saharan Africa *are outdated and do not follow new ecological, energy, and logistical standards.*

Proposed Goal:

Support the transformation of the main commercial and fishing Ports (e.g the upcoming port in Mindelo, Cabo Verde) following emerging EU norms and standards.

Proposed Actions:

a) Assess the current situation, with respect to logistics, marine and air pollution.
b) Engage local stakeholders in the development of support port operations, including a monitoring system based on Earth Observation data (in-situ and satellite), as well as in the creation of proof-of-concept services to support the digital transformation of existing Ports.
c) Develop open source downscaled oceanographic models to allow the addressing of key parameters.

Note: Actions above shall promote the convergence with EU norms and standards through strengthening the digital regulatory and capacities framework and policy dialogue in digital transformation. Obvious references are the GDPR, cybersecurity regulations and the 5G Toolbox.

Intervention Topic 3: promote a Water & Food Security Monitoring System for Western Sub-Saharan Africa

Problem Statement:

Most Western Sub-Saharan African countries and regions, including Cabo Verde, have a long history of drought, with consequences on food security

Proposed Goal:

Create EO based data systems to monitor crucial variables and develop a better understanding the local water cycle, providing actionable information to stakeholders.

Proposed Actions:

a) Using Sentinel and other data repositories, support the Water & Food Security Monitoring System under development by INIDA and other related local institution in Western Africa, in close international cooperation (e.g. UTwente, NL).
b) Hosting services to support agriculture and crop productivity
c) Contribute with in situ sensing (based on LORAWAN network to be established such as temperature, humidity, and wind) that will be ingested by the monitoring system, e.g., inputs for evapotranspiration models).

NOTE: Actions above shall promote the convergence with EU norms and standards through strengthening the digital regulatory and capacities framework and policy dialogue in digital transformation. Obvious references are the GDPR, cybersecurity regulations and the 5G Toolbox.

Intervention Topic 4: promote a digital library of natural products to foster local bio economies in Western Sub-Saharan Africa

Problem Statement:
Unexplored natural products and endogenous natural resources, together with weak food value chains.

Proposed Goal:
Identify natural products and their potential to generate new sustainable agrobusinesses, improving and strengthening domestic/regional value chains and reducing the imports of food products.

Proposed Actions:

a) Foster a taskforce to sustainably exploit the potential of mountain ecosystems in Western Sub-Saharan Africa, including in Cabo Verde, to guarantee the characterization of plant species and development of natural compounds libraries.
b) Create one open-source repository/catalogue of local natural resources, in a way to foster the demand for new and emerging products, such as nutraceutical bio compounds and food industry.
c) Create monitoring tools for effective and efficient management of existing biosphere reserves in Western Sub-Saharan Africa, making use of EO data (e.g., temperature, radiation, soil moisture, NDVI).

Note: Actions above shall promote the convergence with EU norms and standards through strengthening the digital regulatory and capacities framework and policy dialogue in digital transformation. Obvious references are the GDPR, cybersecurity regulations and the 5G Toolbox.

Intervention Topic 5: Promote sustainable and healthy territories in Western Sub-Saharan Africa

Problem Statement:
High levels of poverty and social inequality, particularly in expanding urban contexts in Western Sub-Saharan Africa in association with desertification phenomenon, with devastating effects on the fragile ecosystems of the region
Proposed Goal:
Support inclusive urban planning and land use management making use of remote sensing together with modelling of sustainable solutions (social, energy, water).

Proposed Actions:

a) Develop social cartography applications to assist municipalities and other local institutes in the promotion of fair and inclusive urban development;
b) support municipalities with the automatic monitoring (mapping) of land use classification and its change, based on EO data, including very high-resolution information where necessary;
c) monitor the desertification process using satellite and in situ based EO tools to monitor soil humidity and change progress allowing a proactive approach to fight against desertification

4.4 Digital Infrastructure and Cybersecurity

To be able to address the aforementioned issues and develop the actions proposed, the new Centre (CAVIC) will promote **Cabo Verde is a hub of data connectivity** in the context of Western Sub-Saharan Africa, with privileged submarine cable connections to Europe, Brasil and West Africa. It aims to leverage this feature and further develop advanced digital services integrating EO systems to promote the sustainable growth of Western Sub-Saharan Africa together with innovation activities for blue and green growth in the Mid Atlantic.

The following digital infrastructures shall be established:

1. A **local EO laboratory**, which will operate in a collaborative Atlantic network;
2. A **low-cost long-range IoT communication network** for in-situ sensors;
3. One **direct receiving station (DRS)** to gather real-time, regional earth observation satellite data;
4. A **small, energy efficient, low-impact and cyber-secure Data Centre** to support both data storage and computation in EO, the hosting of webservices, the network data and webservices for the prototypes developed with stakeholders. The Data Centre will be internationally connected and create a hybrid cloud.
5. **Data gathering pipelines** and modelling towards the continuous development of Digital-Twins to support blue and green economies and associated applications;

To achieve this objective, **reliable and safe digital infrastructures of data communications, storage, and processing** will be made available to the operation of CAVIC its partner NOSi, aiming at planning, designing, implementing, maintaining, and monitoring a comprehensive cybersecure Data Centre.

The concerns over cybersecurity reflect the care of existing NOSi's own infrastructure and services it provides to the exterior, but also the protection of the communication infrastructure itself, in the protection of the EU, Brasil and African Countries directly connected through submarine cables. Cabo Verde aims to be fully aligned with the EU in terms of cyber security. Full compliance with the strictest standards, the use of novel methods and technologies and data sharing, perhaps even be open to integrate with the Information Sharing and Analysis Centres (ISACs), and the Joint Cyber Unit (JCU). Cabo Verde has already joined the Convention 108+ Data Protection from the European Council.

Much was learnt from the security breach in 2020, raising the awareness to and relevance of the topic, thus creating a favourable context for the adoption of a comprehensive security infrastructure adhering to the most rigorous European standards, and to directly collaborate with (or even integrate) its

institutions. The breach mobilized the country and cybersecurity is now seen as paramount across all sectors, both in public and private entities.

NOSi is leading the national effort to address cybersecurity, in deep involvement with the national regulator (ARME – "*Agência Reguladora Multisectorial da Economia*"), and government authorities (i.e., DGTED – "*Direção Geral de Telecomunicações e Economia Digital*"). NOSi itself, has established as one of its goals for 2022, the implementation of a Security Operation Centre (SOC), to detect cybersecurity incidents, starting with monitoring the governmental infrastructure.

The first National Strategy for Cabo Verde was approved in 2016, and included a four year plan (2016-19), which suffered an few relevant delays. Nonetheless, in 2019, the National Cybersecurity Nucleus was created ("*Núcleo Nacional de Cibersegurança*"), implemented through government actions ("*Despacho nº /2019 de Primeiro Ministro, de 19 de Abril - Implementação de Estratégia de Cibersegurança*"). Despite the progress already made, the ambitious plan aiming to be fully implemented by the end of 2019 has not yet been fully implemented, as described in the Annex to this document.

4.5 Work Program and Lines of action

The Centre will be set up with experts on advanced information and EO systems for blue and green growth enabling a wide range of technologies and knowledge areas, including digital technologies; digital representation and modelling ("Digital twins"); satellite EO technologies; fisheries; ocean biodiversity; sustainable agroforestry; natural products. In addition, the Centre should aim to integrate technical facilities, as well as implement and deploy a satellite Direct Receiving Station (DRS) comprising of a Data Centre with computers and algorithms, all working in partnership with local entities.

The **most prominent seven "Pillars" to be considered by the new Centre** are as follows.

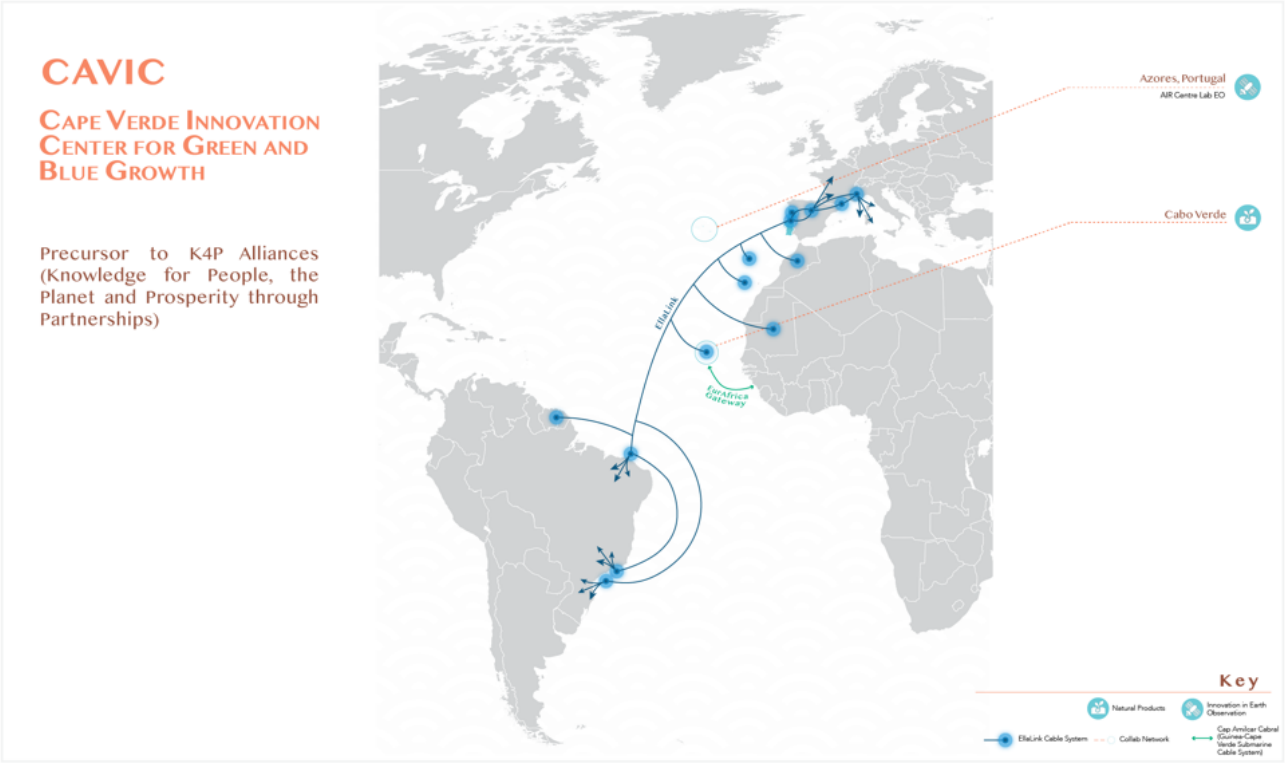
Pillar 1: INNOVATION IN EO AND RELATED DIGITAL TECHNOLOGIES
This pillar will consider:

- A **new highly energy efficient Data Centre for EO and related scientific, technological and innovation activities for blue and green growth**, including Remote Sensing and related initiatives oriented towards local markets and cultures, as well as new scientific challenges;

- Fostering a **Digital connectivity infrastructure**, including international connectivity (the EurAfrica Gateway), the Regional Fiber backbones and Satellite connectivity, together with **Secure EurAfrica Gateway Cable**;
- Promotion of the **Amilcar Cabral submarine cable**, connecting Cabo Verde to the underserved countries of Guinea, Guinea-Bissau, Liberia, Sierra Leone and The Gambia increasing their resilience and connecting them to **EllaLink** (see the ongoing feasibility study by ECOWAS to identify operating model, model for implementation and corresponding funding requirements);
- Stimulating compliance with **European cybersecurity standards and the 5G Toolbox**, aiming to become part of the ***cybersecurity preparedness facility of Cabo Verde***;
- Digital representation and modelling ("Digital twins"), including participatory social cartographies;
- Promotion of digital skills and specialized/professional training among local populations in Sub-Saharan Western Africa.

Figure 6. CAVIC and the Secure EurAfrica Gateway.

Note: The Centre will consider measures to underpin a high common level of cybersecurity, when operating in a 5G network, and benchmark/align with a future European cybersecurity certification framework, which will be an essential supporting tool to promote consistent levels of security and in establishing data protection and privacy policies.



Pillar 2. BLUE ECONOMY FOR SUSTAINABLE DEVELOPMENT OF COASTAL AND MARINE AREAS

This pillar will consider:

- Maritime surveillance, supporting maritime traffic and help abolishing illegal attention;
- Harvest of living resources; supporting fisheries to ensure food security and supply proteins demand;
- Ocean health & protection: to enhance the protection and conservation of coastal areas (e.g. to protect livelihoods, mitigation of climate change, etc), including forms of coastal protection and preservation;
- Development of "digital twins" of the Ocean to model and promote new activities under the scope of the blue economy. For example, satellite data can be used to track the movements of fish stocks, identify areas of Illegal fishing, and monitor the health of coral reefs. This information can be used to improve the management of fisheries and to support the sustainable development of the blue economy.

- key-potential industries
  - Aquaculture → to ensure food security, to reduce overfishing;
  - Desalination → to increase the supply of fresh water, as solution for water scarcity;
  - Blue carbon → to support fish stocks and food security, sustain livelihoods;
  - Technology and mission-oriented R&D → to promote growth in coastal and ocean activities by R&D in ocean technologies (e.g. submersibles, ROVs, diving/scuba gears, buoys, water column samplers, sea floor mapping, etc…);

- key-potential ocean services
  - Sustainable tourism;
  - Ocean monitoring and coastal protection;
  - Carbon sequestration (this is a very important ocean service to be developed in the next decades as ocean-based approach to carbon dioxide (CO_2) removal);

- The services on natural processes, understanding current/future impacts new business and projects for Cabo Verde, marine spatial planning, assessment of natural capital or development of emerging technologies (e.g offshore wind energy or aquaculture), monitoring (both in space and time) and providing critical data for Marine Spatial Planning;

Pillar 3. MOUNTAIN RESEARCH, AGROFORESTRY AND VALORISATION OF NATURAL PRODUCTS

This pillar will consider:

- Mountain research and on the development of an open access library of natural products and components, together with ways of economically and socially valuing those products and components;
- Low carbon bio-economies and innovation in Land use, as oriented towards sustainable agribusiness;
- Sustainable exploitation of biological assets in agroforestry structures;
- The development of "digital twins" of agro-forestry structures and mountains, which will allow to monitor natural products and to foster sustainable agricultural production and help farmers optimize their use of water and fertilizer. This can lead to increased crop yields and improved food security.

Pillar 4. ENERGY SUSTAINABILITY POTENTIATING KEY TECHNOLOGIES

This pillar will consider:

- Four main sources of renewable energy will be promoted (in close articulation with PLOCAN in the Canary Islands, among other international partners), including:
  - Solar energy from the sun.
  - Wind energy, including wind offshore.
  - Biomass from plants.
  - Green Hydrogen
- The development of "digital twins" of energy structures and operations, will allow to monitor energy planning and to foster sustainable energy production and usage.

Pillar 5. SUSTAINABLE AND HEALTHY TERRITORIES AND URBAN LANDSCAPES

This pillar will consider:

- Analysis of complex urban landscapes in Western Sub-Saharan Africa, including urban expansion processes, making use of high-resolution EO systems, together with the development of social cartographies and the implementation of community-based participatory innovation;
- Development of digital tools and planning to help eradicating poverty through the remote monitoring of the most vulnerable urban zones. Includes the implementation of digital planning of urban expansions through "Digital twins".

Pillar 6. INNOVATION SERVICES

This pillar will consider:

- Actions/initiatives/"Proof of Concept" oriented to develop five main areas: i) digital services and the massive use of EO systems; ii) the blue Economy (e.g companies using natural solution/systems for restoration of marine environments, companies developing new/innovative solutions for aquaculture); iii) the Agro-forestry sector and the bioeconomy through the economic and social valorisation of biological assets; iv) energy sustainability; and sustainable and healthy territories, with particular relevance for complex urban landscapes in coastal areas.
- Engagement of regional stakeholders from Cabo Verde and continental Africa through the development of all initiatives including the organization of bilateral discussions, workshops and events;
- Innovation services shall promote technology transfer, spin-off entrepreneurship, business models built on open science, FAIR data and open innovation - mission oriented research will be carried out to guarantee regional technology and innovation-based impact by developing demand based and applied oriented organisational models of technology transfer and technology exploitation.

Pillar 7. CAPACITY BUILDING

This pillar will consider:

- The Centre will work with Universities and advanced training centres in Western Africa together with institutions in Europe to promote professional training

activities oriented towards re-skilling and upskilling of the human resources in Cabo Verde and continental Africa;

- In-job training and short/intensive courses and training actions to further develop regional capacity building activities that will include knowledge and skill transfer to the staff working for the Centre, as well as regional stakeholders in Cabo Verde and Continental Africa.

The new Centre will foster the development of Western Sub-Saharan Africa by stimulating new skilled job creation to foster new services providing accurate data that can be used for planning and decision-making purposes, as well support in the developing innovative products and services for regional and national challenges.

It shall attract a young talented generation and promote the use of satellite space data for the benefit of society. The new Centre will promote the use of satellite EO technologies and help to build capacity in Western Sub-Saharan Africa, working in coordination with regional stakeholders. It shall interface the **AIR Centre Atlantic network**, as well as other domains (agriculture and other natural products/resources), and it will also collaborate with the European Space Agency – ESA, as well as other international organizations.

The Centre will be managed in partnership with AIR Centre to ensure best common practices, methodologies and knowledge/data exchange. This shall enable leveraging the Atlantic dimension and ensure wide reach and visibility of the new Centre.

In summary, the preparation and implementation of the new Centre will consider the following seven main "Pillars" through several tasks, as follows.

Pillar 1 – Earth Observation and digital services	The development of digital services and EO infrastructure and services will be developed in close articulation with the AIR Centre and NOSI, together with other regional stakeholders envisaging sustainable development, and adaptation/mitigation of the local/regional environmental characteristics. A special focus will be given to the use of digital systems oriented to promote the **modernization of public administration in Western African regions**. It considers the installation of equipment in the existing **Data Centre for EO and related scientific, technological and innovation activities** for blue and green growth, as well as fostering a **Digital connectivity infrastructure**, including international connectivity (the **EurAfrica Gateway**), the **Regional Fiber backbones and Satellite connectivity, together with Secure EurAfrica Gateway Cable**.

	The Centre will comply with **European cybersecurity standards and the 5G Toolbox,** aiming to become part of the **cybersecurity preparedness facility of Cabo Verde** (in close collaboration with leading European institutions, including INESC TEC, from Portugal); In addition, activities will focus on the promotion of sustainable and healthy territories, the blue Economy, as well as sustainable energy solutions and sustainable Agroforestry, including the development of "digital twins" of specific landscapes.
Pillar 2 – Blue economy, fisheries and maritime surveillance	Activities will consider the **monitoring and protection of coastal areas, maritime surveillance, and monitoring of maritime traffic, as well as the monitoring of the biodiversity of the ocean**. Activities will consider the development of "**digital twins" of the ocean** to model and promote new activities under the scope of the blue economy. For example, satellite data can be used to track the movements of fish stocks, identify areas of illegal fishing, and identify new fishing banks. This information can be used to improve the management of fisheries and to support the sustainable development of the blue economy
Pillar 3 – Sustainable agriculture, water management, mountain research and natural products	The Centre will focus on mountain research and on the development of an **open access library of natural products**, as well as in the economic and social valorisation of biological assets. In addition, activities will consider water management and the development of **"digital twins" of agroforestry structures and mountains**, which will allow to monitor natural products and to foster sustainable agricultural production and help farmers optimize their use of water and fertilizer. This can lead to increased crop yields and improved food security.
Pillar 4 – Sustainable energy	The Centre will focus on four main sources of renewable energy, which will be promoted in close articulation with PLOCAN, including: i) Solar energy; ii) Wind energy, including wind off-shore; iii) Biomass from plants; and iv) Green Hydrogen The development of "digital twins" of energy structures and operations, will allow to monitor energy planning and to foster sustainable energy production and usage.
Pillar 5 – Sustainable and healthy territories and urban landscapes	Analysis of complex urban landscapes in Western Sub-Saharan Africa, in increasing expansion, together with community-based participatory innovation; Activities will consider the development of social cartographies, as well as the development of digital tools and planning to help eradicating poverty through the remote monitoring of the most vulnerable urban zones. Includes the implementation of digital planning of urban expansions through "Digital twins".
Pillar 6 – Innovation services	The Centre will assist/support Western Sub-Saharan Africa regional and national authorities and the private sector in the development of **innovation policies and actions/initiatives** oriented to develop three main areas: i) the **blue Economy** (e.g., companies using natural solution/systems for restoration of marine environments, companies developing new/innovative solutions for aquaculture); ii) the **agro-forestry sector and the bioeconomy**

	through the economic and social valorisation of biological assets; iii) sustainable energy; and iv) Sustainable and healthy territories and urban landscapes . In addition, the Centre will ensure the continuous and gradual increase in the implication of regional stakeholders in Western Sub-Saharan Africa through the organization of bilateral/multilateral discussions, workshops and events to ensure that the Centre's products and services are widely known and promote their use. This will include the refinement of stakeholder requirements as well as regular feedback on the activities in an iterative process.
Pillar 7 – Capacity Building	The Centre will work with the several universities and advanced training centres in Western Sub-Saharan Africa and collaborate with institutions in Europe to promote **professional training** activities oriented towards ***re-skilling*** **and** ***upskilling*** **of the human resources in Cabo Verde and continental Africa**. Activities will consider in-job training and short/intensive courses and training actions to further develop regional capacity building activities that will include knowledge and skill transfer to the staff working for the Centre, as well as regional stakeholders in Western Sub-Saharan Africa. Additionally, support shall be given to the development of new or existing courses on topics of interest with qualified staff, material, and test cases.

5. Tentative roadmap and Timeline (2022-2027)

5.1 Institutional Roadmap: Evolving phases

The creation and promotion of CAVIC (referred as Centre) goes through several phases, including:

- **Phase 1 - Preparation**: starting with a preliminary roadmap until the definition of the legal regime to be adopted by the new Centre and the potential creation of a new legal entity. This phase is expected **to last between six months and one year** and requires a dedicated team. It will depend on the first funding contract for the establishment of the Centre and the possibility of recruitment of human resources and collaborators. This phase **includes the identification and selection of the potential future "Founding Members", potential "Affiliated Institutions" and other potential partners of the Centre**, as well as the confirmation and potential alteration of the name of the institute to be established;

- **Phase 2 – Installation**: starting with the creation of a new legal entity, to be registered by the "Founding Members" in Western Africa. This phase is expected **to last about one year** and will include the recruitment of the initial human resources and collaborators of the Centre, as well as

the initial infrastructures. In addition, this phase will also include the **creation of an "Installation Committe", an "International Scientific and Advisory Committee"** and the development of partnerships with the "Founding Members", with potential "Affiliated Institutions", as well as other potential partners of the Institute. By the end of this phase, at the end of year 1, the Centre should have ten permanent staff members and include some other thirty collaborators (i.e., external experts, students, visiting experts);

- **Phase 3 – Growth**: starting about one year after the creation of a new legal entity, as it will be oriented to the growth and development of the Centre. This phase is expected **to last about three years** and will include the growth of the Centre´s organizational structure, management team, own human resources and collaborators, its infrastructures, as well as partnerships with the "Founding Members", with potential "Affiliated Institutions", as well as other potential partners of the Centre. By the end of this phase, at the end of year 5, the Centre should have fifty permanent staff members and include some other one hundred collaborators (i.e., external experts, students, visiting experts);

- **Phase 4 – Maturity**: starting about four to five years after the creation of a new legal entity, as it will be oriented to the expansion and mature operation of the Centre.

5.2 Human Resources Roadmap

To achieve the proposed goals and guarantee the development of the various lines of action, the Centre will integrate different types of collaborators, as follows:

- **Technical staff, with full-time contracts**:
  - including people with doctorate, master and higher education degrees diplomas;
  - the goal is to start with 10 staff members by the end of the first year and get to 50 people by the 5th year of operations;
  - human resources shall be recruited internationally with a target of hiring at least 50% of the staff from Western Africa, including regional director;
- **External collaborators, with part-time contracts**:
  - includes experts form the partner institutions;
  - the goal is to start with 5 external collaborators by the end of the first year and get to 30 external collaborators by the 5th year of operations;
- **Visiting scientists and experts, for temporary periods (3 to 12 months) at the Centre**:

- Includes experts coming from form the partner institutions, as well as from other institutions worldwide, that are expected to work in the Centre for periods between 3 to 12 months;
- the goal is to start with 5 visiting experts by the end of the first year and get to 15 visiting experts by the 5th year of operations;

- **Research Students, with part-time and temporary fellowships and assignments:**
  - Consider students for the elaboration of research and innovation projects, or thesis work (final degree projects, master thesis, doctoral thesis);
  - the goal is to start with about 15 students (e.g., 5 undergraduate students, 3 master students, 2 doctorate students) by the end of the first year and get about 100 students by the 5th year of operation (e.g., 30 undergraduate students, 50 master students, 20 doctorate students);
- **Directorate, Administrative staff, project managers and secretariat:**
  - the goal is to start with 1 Director/CEO, 1 project manager and 1 secretary by the end of the first year and achieve 1 Director/CEO, 2 co-directors, 3 project managers and 2 secretaries by the 5th year of operations;

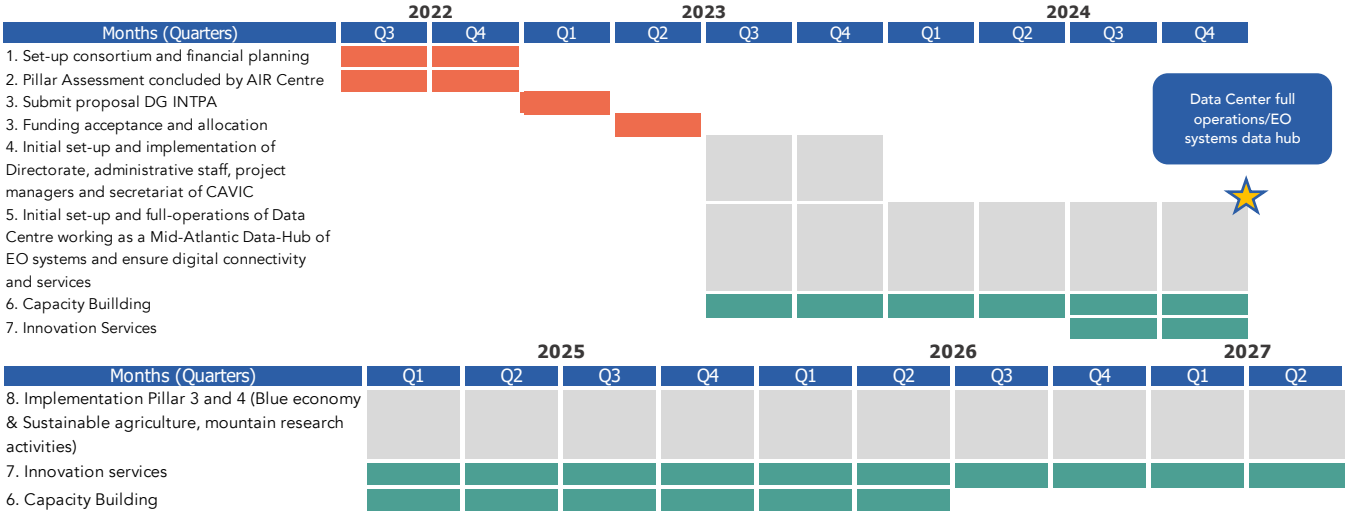
The following table includes a preliminary proposal for the development of the Centre's own staff and external collaborators.

Table 5: *Proposal for Human Resources Roadmap, to be recruited internationally*

Type of collaborator	Expected skills	Expected number of HR by the end of the 1st year (2023)	Expected number of HR by the end of the 5th year (2027)
Technical staff, with full-time contracts	Individuals with doctorate, master and higher education degrees diplomas	10 staff members	50 staff members
External collaborators, with part-time contracts	Experts form the partner institutions	5 external collaborators	30 external collaborators
Visiting scientists and experts, for temporary periods (3 to 12 months)	Experts coming from form the partner institutions , as well as from other institutions worldwide, that are expected to work in the centre for periods between 3 to 12 months	5 visiting experts	15 visiting experts
Research Students, with part-time and temporary fellowships and assignments	Students from Cabo Verde and institutions worldwide for the elaboration of research and innovation projects, or thesis work (Final degree projects, master thesis, doctoral thesis)	15 students: 5 undergraduate students, 3 master students, 2 doctorate students.	100 students: 30 undergraduate students, 50 master students, 20 doctorate students.
Directorate, Administrative staff, project managers and secretariat		1 director/CEO, 1 project manager and 1 secretary	1 director/CEO, 2 co-directors, 3 project managers and 2 secretaries

5.3 TIMELINE

Table 6: *Proposed TIMELINE*



5.4 PROPOSED INVESTMENT LEVEL: INITIAL FIVE YEARS

The proposed roadmap for the new Centre needs to guarantee the development of its own **financial and scientific autonomy** to succeed in the various proposed lines of action, together with the development of the Centre's own staff and external collaborators. **The goal is to raise about 10 to 12 Million euros of EC investment for the first phase, 2023-2027 (5 years), under the "Global Europe programming" (i.e., NDICI-Global Europe regulation"), to be continued with EC investment at least until 2035**.The new Centre will become fully integrated in the **Atlantic International Research Centre – AIR Centre network**, including its "Earth Observation Laboratory, in the Terceira Island of Azores, and related activities in Brazil (e.g., Rio Janeiro, Ceará) and Africa (e.g., South Africa and Nigeria).

In addition, the centre will be developed under the overall "umbrella" and in a close articulation with the "**K4P Alliances – Knowledge for People, the Planet and Prosperity through Partnerships**", in terms of a network of regional Centres of Excellence and "Collaborative Laboratories" in the Global South to be promoted under the Global Europe programming with expected cofounding by EC-DG INTPA.

ANNEXES (NEXT PAGES)

Annex 1: Main elements of the National Cybersecurity Strategy of Cabo Verde

Table 1 - Outline of Cabo Verde's Cybersecurity Plan

	5 Pillars	Description		Current Status
1	Organizational Measures	Existence of a national cybersecurity strategy		The strategy exists, however the National Cybersecurity Center needs to be operationalized
2	Legal Measures	Creation of related legislation		The country already has all the basic legislation
3	Technical Measures	Existence at national level of an incident response center (CERT/CSIRT)		The center has not yet been created
4	Capacity Building	Existence of higher education courses in cybersecurity/cybercrime in the country. Existence in the country of entities that provide education, training and international certification of people in cybersecurity/cybercrime		The country does not have international training and certification in this area. In 2022, the first Graduate Program in Computer Security was created
5	Cooperation	Realization/existence of public-private cooperation (public entities and operators and private entities), national and international		Cabo Verde has already adhered to 3 international conventions: Budapest Convention (international) - Cybercrime and electronic evidence Malabo Convention (African Union) - Cybercrime, electronic evidence, and data protection Convention 108+ (European Council) - Data Protection

Table 2 - Four Main Goals and Achievement Status

	Goal	Description		Status
1	Implementing the National Cybersecurity Centre (which will include the CSIRT).	Definition of cyber security policies, standards and guidelines that must be used and applied by critical infrastructures[1]; Audit of critical infrastructures to verify compliance with policies, standards and guidelines; CSIRT - assists all critical infrastructures in the occurrence of cyber incidents		Not achieved
2	Secure critical infrastructure	Depends on the implementation of objective 1		Not achieved
3	Assure the security of the national security forces (including agents, legal system, armed forces, etc.)	Depends on the implementation of objective 1		Not achieved
4	Develop a cybersecurity culture in Cabo Verde	Awareness campaigns: Ensure the introduction of disciplines on this issue in the structure of public education		Under development. Example projects: Weblab (digital letteracy) NosiAkademia Glacy+ KodeVerde

Table 3 - Activities Implemented towards Cybersecurity in Cabo Verde

Objetives	Activities
Implementation of CERT	Created a decree-law January 9/2021, 2021, on cybersecurity Created the regulatory decree for the CERT team - regulatory decree No. 1/2021 With funding from the World Bank - study on the state of maturity of cybersecurity in the state of Cabo Verde. Study carried out in September 2019 by the University of Oxford. They used the Oxford framework - CMM (Cybersecurity Capacity Maturity Model which has clear evaluation metrics) - study is not public ECOWAS project, OCWAR-C: funding of 7 million dollars for the implementation of 2 pilot CERTs. CaboVerde was chosen as one of the countries. Consultants have come and already made a

	complete implementation plan. Training and capacity building sessions have already been carried out (awareness raising at Ministerial level, CERT team training) Actions taken: Technical and scientific training in CSIRT – for Ministers, PCA, service directors and technicians of national critical infrastructure Definition of CSIRT-CV implementation roadmap Pending actions: Definition of the national CERT team - which people will be part of and operationalization of the CERT
Implementing the National Centre for Cybersecurity (Centro Nacional de Cibersegurança (CNCS))	Need for the creation of other conditions. No concrete plan yet – Foreseen activities in an Action Plan

Table 4 - Current NOSI Partnerships to foster cybersecurity in Western Africa

Partner	Scope
CEDEAO/African Union	Project: OCWAR-C
World BAnk	Financing for the study of the CMM (Cybersecurity Maturity Model) in Cabo Verde
USA	The US asked Cabo Verde (CV) for information on the possible scope of cooperation. They defined the implementation of CERT as a priority. The strategic action plan was made available The US has two training centers - Germany (Cybersecurity Studies Centers) and Washington (Africa Center) - annually it is intended to finance the travel of national technicians to the two centers for training

GLACY+ - Conseil of Europe	Project that supports countries in the fight against cybercrime; Training activities for judicial agents. Three activities have already been implemented, coordinated by the team of the GLACY+ project at national level. The team is made up of the Ministry of Justice and NOSI: 1. 2019 a) May - basic training of trainers in cybercrime and electronic evidence for judges, lawyers, magistrates, judicial police and national police (judicial agents): 30 people trained b) October - advanced training for the same group 2. 2021 a) 4 elements from the previous group were chosen to form a larger group of people. Pending: the implementation of a forensic laboratory and training of the judicial police team in computer forensics was pending (it was not carried out due to the pandemic). Only one workshop was held with Interpol to reinforce training and a diagnosis was made of the current state of the PJ in terms of needs in this forensic area.
University of Coimbra, PT	Implementation of a Postgraduate course in Computer Security, in partnership with the University of Coimbra

Annex 2: Main Promoter and Points of contact

Atlantic International Research Centre (AIR Centre)

AIR Centre has a wide experience in managing large projects both from and technical and scientific point of view but as well as coordination large support actions at international level. With an excellent track record of identifying funding initiatives, AIR Centre has involved many of its partners in securing funding sources for its activities. Leveraging on its wide network of members and experts, AIR Centre can provide rigorous technical and scientific guidance in setting up ambitious and fast-growing initiatives with ability to create value and connect regions in the Atlantic dimension.

Additionally, AIR Centre has developed in its Azores office a dedicated infrastructure including, hardware for a Data Centre (including large storage, processing and geoservers), a Direct Receiving Station and a Data visualization Centre and a IoT (Internet of Things) infrastructure in the archipelago of Azores based on LoRAWAN.

This experience is invaluable for setting up and enacting the present Centre of Excellence. Finally, it's important to note that AIR Centre organizes regularly networking and high-level events and workshop training which can be also be used to link to initiative to be promoted by the present initiative.

AIR Centre is also an ESA_Lab in Earth Observation and a GRID-node of the United Nations Environmental program (UNEP) which can also support relevant initiatives promoted. Overall, the relevance of the AIR Centre participation on this initiative is vital to guarantee success of implementation.

Figure - *Data Centre (including large storage, processing and geoservers) and a Direct Receiving Station*

NAME	ENTITY	POSITION	E-MAIL
Emir Sirage	AIR Centre	CEO	emir.sirage@aircentre.org
Pedro Silva	AIR Centre	CTO	pedro.silva@aircentre.org
João Pinelo	AIR Centre	Head of Data Science, Infrastructure and Cloud Services	joao.pinelo@aircentre.org

ANNEX 3: "K4P ALLIANCES - KNOWLEDGE FOR PEOPLE, THE PLANET AND PROSPERITY THROUGH PARTNERSHIPS" - BRIEF COMMUNICATION PROFILE

*An initiative launched by the **AIR Centre** (Atlantic International Research Centre), **CEiiA**, Centre of Engineering and the **Centre for Innovation, Technology and Policy Research, IN+,** of the Instituto Superior Tecnico of the University of Lisbon, in close cooperation with African and Latin American institutions*

Brief Communication Profile, November 2022

- **What is this initiative?**
  An international joint venture to strengthen the transatlantic dialogue for the next decade promoting *Human Agency* and the governance of *data ecologies* towards greening our economies, **promoting healthier societies and reduce inequalities in the digital age**.

  It is an international alliance to promote ***Sustainable and Healthy Territories*** through research and innovative social practices, together with the **creation of new jobs** and initiatives that stimulate the **ecological transition of the economy and society** and the understanding of its dynamics in the "Anthropocene:
  - It considers a ***cultural movement*** throughout all areas of knowledge to promote the use of data derived from Earth Observation systems in combination with other advanced data acquisition and processing systems, to enable **innovative policies and practices** driven by **new research** to deal with complex landscapes, including those in vulnerable urban areas and rural landscapes;
  - It includes a network of ***transdisciplinary data centers*** and related scientific, technological and innovation activities in association with advanced remote sensing systems oriented to sustainable urban growth, as well as blue and green growth. The data centers are expected to operate in **fully compliance with cybersecurity standards**, aiming to become potential regional hubs of cybersecurity.

- What is its main objective?
  The goal is to help accomplish the target of greening our economies and promoting ***Sustainable and Healthy Territories***, together with achieving carbon neutrality, or "net zero", by 2050, through a network of data centers and pilot projects in Latin America and Africa and, eventually, in the Indo-Pacific, stimulating an cultural movement and providing capacity building and fostering new jobs through **community-based participatory research and innovation**.

- What are the three secondary objectives?
  The pilot projects will be implemented through an international network of centers of excellence promoting:
  i) **Build a new network of *transdisciplinary data centers* to foster new *data ecologies*** through the combination and integration of advanced forms of satellite-based remote sensing and Earth Observation systems in close articulation with other data collection systems and skills;
  ii) **Promote a network "Collaborative Laboratories"** involving local actors, in the form of *centers of excellence* involving the public and private sectors, as well as NGOs to **foster interface and intermediation activities** with the public and private sectors; and
  iii) **Engage people and experts throughout all areas of knowledge** to help stimulating a ***cultural movement*** promoting *Human Agency* and the governance of *data ecologies* towards greening our economies.

- What should this project become in the short term (1 to 2 years)?
  The initial seeds of an international network of **"Collaborative Laboratories" in Africa and Brazil,** as centers of excellence including ***Transdisciplinary Data Centres*** equipped with Earth Observation capacity and skills for *practical actions* towards sustainable urban growth, blue growth and green growth.

  Potential sample projects include: i) **Innovation in sustainable and healthy territories**, integrating **participatory social cartographies**; ii) ***open access libraries*** of natural products and components, together with ways of economically valuing these products and components; iii) **digital modeling for low carbon economies**, including the systematization of the digital representation of urban and agroforestry areas in the form of "Digital Twins", together with modeling scenarios oriented towards sustainable development; iv) **Low carbon bio economies and innovation in land usage,** facilitating better sustainable exploitation of biological assets in agroforestry structures in Tropical Biomes and in the Tropical rainforest in Africa; v) **Innovation in coastal bio economies and blue carbon**, including tropical mangroves and green aquaculture, along with innovation in land use and wetland/mangrove carbon mapping; and vi) Innovation in **Sustainable and renewable energies**; and

- And in the midterm, after 5 years?
  An international alliance with 4 lines of action, as follows:
  1. An international network of "Collaborative Laboratories", through the engagement of local actors, public and private and ONGs, in the following new Collaborative Laboratories, in collaboration with the laboratories of the *Atlantic International Research Centre – AIR Centre*.
  2. Two major international observatories:
     a. Land use, Soil and Carbon Observatory, to provide a new satellite-based and data-driven land-use monitoring system and carbon mapping designed to dynamically map urban zones, forest/agro-forestry structures and coastal areas;
     b. Community-centered Innovation Observatory, to provide a systematic identification, description and analysis of emerging innovation paths engaging communities and people at large in greening the economy and society
  3. A program to foster New Knowledge and Capacity Building, including: i) Visiting Scholarships Program; ii) Research Students Program; iii) Joint and double post-graduation diplomas (short, non-degree diplomas) and potential joint Degree programs (Master level); iv) Competitive Program for Collaborative Research; v) Policy briefs; vi) Workshops, conferences, outreach and community engagement;
  4. An organizational structure of "Regional Chapters", including Latin America and Caribe; Sub-Sharan Africa; international comparative studies in Europe and USA.

- And by 2030?
  An international network of "Collaborative Laboratories" and 2 major international observatories, together with a program to foster new Knowledge and Capacity Building, organized in regional Chapters.

- What words are associated with this initiative?
  - People: promotion of the right to security and health conditions, through the humanitarian, social and economic valorization of the concept of "One Health"), with experimentation, observations and recommendations of public policies on planetary health and ***sustainable and healthy territories***, as well as health and disease determinants such as education, food security, healthy jobs, housing, racism and xenophobia that affect the most vulnerable populations. Also noteworthy is the understanding of the impact of the social footprint on the planet in different socio-economic development scenarios;

- **Planet**: guaranteeing carbon sequestration in complex rural and coastal landscapes in association with the establishment of land use, soil monitoring, water management and carbon observation, together with the stepwise experimentation and development of smart regulatory regimes towards the effective implementation of carbon markets;
- **Prosperity**: sustainable land, water and soil management (e.g. biomes and biodiversity in tropical areas, as well as Mediterranean forests) and coastal areas (e.g. mangroves in tropical areas, and saltmarshes elsewhere), together with the social and economic valorization of biological assets (e.g. natural products) and the development of regional bioeconomies;
- **Partnerships**: **Engaging people and experts throughout all areas of knowledge** to help stimulating a ***cultural movement*** promoting *Human Agency* and the governance of *data ecologies* towards greening our economies through an international network of "Collaborative Laboratories". These centers aim to operate as effective centers of excellence in close collaboration with local actors, involving interface and intermediation activities with the public and private sectors, aimed at creating jobs and markets, together with capacity building at institutional and human levels.

- **What are the target audiences, in order of priority?**
  - ONGs and Non-for profit associations with local action in terms of the Sustainable Development Goals (SDGs) and the 2030 Agenda;
  - Public and private sectors;
  - Researchers, practitioners, end users and students worldwide;

- **What kind of behaviour do you hope to promote in each audience?**
  - ONGs and Non-for profit associations: engagement and active participation, namely to help building a network of Collaborative Laboratories
  - Public and private sectors: institutional support, co-funding and active participation;
  - Researchers, practitioners, end users and students: engagement and active participation

- **What values do you associate with this initiative?**
  Sustainable Development Goals (SDGs) that shaped the 4 main pillars of the 2030 agenda, with emphasis in the principle "**leaving no one behind**", that is the bulk of development for providing a shared global vision towards sustainable development for all.

- **Are there any other projects/programs that it resembles?**
  i) **CEGA – Centre for Effective Global Action**, https://cega.berkeley.edu/ ;
  ii) **CLUA – Climate and Land Use Alliance**, https://www.climateandlandusealliance.org/ , focused on Tropical Forests (Brazil, Indonesia, Mexico and Central America, Colombia and Peru) and

sponsored by a group of four major US private foundations, including the Climateworks Foundation, The David and Lucile Packard Foundation, the Ford Foundation and the Gordon And Betty Moore Foundation.

iii) **AGRA – Sustainable Growing Africa´s Food systems** (previously, "Alliance for the Green Revolution in Africa"), sponsored by the USAID and the Belinda and Gates foundation, https://agra.org/;

iv) **Afrialliance – Africa-EU Innovation Alliance for Water and Climate**; https://afrialliance.org/about-afrialliance, sponsored by the European Union's Horizon 2020 research and innovation programme;

v) **Global Alliance Africa**, https://ktn-uk.org/programme/africa/, sponsored by the UK´s Foreign, Commonwealth and Development Office (FCDO);

- **Which recent research is associated with this initiative?**

vi) ***Steering Research and Innovation for Global Goals (STRINGS)*** project, http://strings.org.uk/: a major global study into the alignment between science, technology and innovation (STI) and the Sustainable Development Goals (SDGs). It highlights a glaring mismatch between STI and the SDGs; warns that, if this mismatch is not addressed, it will undermine progress on the SDGs; and makes recommendations about how to tackle this imbalance; October 2022;

vii) ***Do the science on sustainability now***, Nature, Vol. 610, 27 October 2022, pp 605-606; also at : https://www.nature.com/articles/d41586-022-03389-x

viii) ***An Industrial Policy for Good Jobs,*** *Policy Proposal:* The Hamilton Project, at the Harvard´s Kennedy School of Government and the Brookings Institute, September 2022; see at https://www.brookings.edu/wp-content/uploads/2022/09/20220928_THP_Proposal_Rodrik_GoodJobs.pdf;

ix) ***Uncertain Times, Unsettled Lives: Shaping our Future in a Transforming World;*** UNDP (2022), "The Human Development Report 2021-22", UNDP, New York; https://hdr.undp.org/content/human-development-report-2021-22 ;