REPÚBLICA DE CABO VERDE

MINISTÉRIO DAS FINANÇAS

Terms of Reference (ToR)

Technical Assistance for the Design, Implementation and Operationalization of the Electronic Communications Infrastructure Inventory System (SIC)

1. INTRODUCTION AND BACKGROUND

The Government of the Republic of Cabo Verde has received financing from the World Bank in the amount of twenty million United States dollars (US$ 20,000,000) of Additional Financing to support the implementation of the DIGITAL CABO VERDE PROJECT (P171099). The Project aims to contribute to transforming the country into a regional digital hub capable of accelerating its digital economy through enhanced digital infrastructure and a strengthened demand for digital services and skills.

The Project supports the Government's strategy to transform Cabo Verde into a digitally enabled services economy, thereby improving national competitiveness and attracting greater investment. Increasing the supply and demand of broadband connectivity and data repositories (digital infrastructure) is fundamental to enabling the development of public and private digital platforms and fostering new services for individuals, businesses, and government entities.

The Project comprises three main components, namely:

- **Component 1: Enabling Legal and Regulatory Environment.**
  Support to the Government of Cabo Verde (GoCV) in improving the digital economy legal and regulatory framework.

- **Component 2: Digital Competitiveness.**
  Equipping individuals and businesses across the country to be more competitive in the digital economy labor market, while fostering innovation and productivity growth.
- **Component 3: Digital Public Services and Digital Markets.**
  Support activities aimed at strengthening the capacity of the GoCV to provide improved digital public services.

This Technical Assistance (TA) is aligned with the objectives of **Component 1** of the Digital Cabo Verde Project, in particular **Sub-component 1.1 – ICT Policies and Regulations and Digital Infrastructure**, which supports the Government of Cabo Verde (GoCV) in strengthening the legal, regulatory and institutional framework for the digital economy. Specifically, this TA aims to establish a **regulatory, institutional and operational framework** through the design and implementation of an Electronic Communications Infrastructure Inventory System (SIC) that will serve as: (i) a **regulatory enforcement and monitoring tool** for ARME; (ii) a **foundation for infrastructure-sharing regulation, investment planning and sector supervision**; and (iii) a **permanent institutional asset**, fully integrated into the national regulatory ecosystem and not conceived as a pilot or temporary solution. Ultimately, the SIC is intended to promote the **efficient, transparent and non-discriminatory sharing of electronic communications infrastructure** among operators and public entities in Cabo Verde..

2. OBJECTIVES OF THE TECHNICAL ASSISTANCE

2.1 Overall objective

The overall objective of this technical assistance is to procure specialized consulting services for the design, implementation and operationalization of the Electronic Communications Infrastructure Inventory System (SIC), including the associated geospatial, cadastral, workflow and reporting components, to enable ARME to regulate, supervise and promote the efficient and transparent use of electronic communications infrastructure in Cabo Verde.

2.2 Specific objectives

The specific objectives of this Technical Assistance include, but are not limited to, the following, structured across **regulatory enablement, technical implementation, and institutional sustainability**:

(a) Regulatory and Policy Enablement

- Establish an **integrated regulatory framework and operational tool** that enables ARME to effectively regulate, supervise and monitor the use and sharing of electronic communications infrastructure, in accordance with **Law No. 58/VIII/2014** and other applicable legislation;
- Support **infrastructure-sharing regulation, investment planning and sector supervision** through reliable, up-to-date and auditable information on existing infrastructure assets.

(b) Technical Platform, Data and Functional Capabilities

- Design and implement a **centralised, scalable, interoperable, secure and responsive SIC platform**, based on open standards and recognised international good practices;
- Register, maintain and validate a **comprehensive inventory of infrastructure suitable for hosting electronic communications networks**, ensuring data accuracy, completeness and traceability;
- Provide **WebGIS functionalities** for georeferenced visualization, spatial analysis and consultation of infrastructure assets and related attributes;
- Define and implement a **robust data model**, including classification, validation and quality-control rules, ensuring consistent, high-quality and auditable information;
- Implement **end-to-end workflows** for the submission, technical and functional validation and approval of requests by different actors (including ARME, participating entities and, where applicable, the general public);
- Ensure **advanced mechanisms for consultation, search, reporting and dashboards**, including the definition and monitoring of **key performance indicators (KPIs)** related to infrastructure coverage, investment and utilisation.

(c) Governance, Capacity Building and Sustainability

- Establish **clear, documented and enforceable procedures** for the governance, operation and evolution of the SIC, defining roles, responsibilities and decision-making processes for all stakeholders;
- Deliver **training, capacity building and effective knowledge transfer** to ARME staff and other key stakeholders, enabling the autonomous operation, maintenance and progressive evolution of the SIC beyond the end of the contract.

3. SCOPE AND COVERAGE OF SERVICES

3.1 Overview

The services to be procured comprise, in an integrated manner, the design, development, implementation, initial operation, training and knowledge transfer associated with the SIC platform and related processes. The work will be structured into phases, with clear deliverables and milestones, and will be carried out in close coordination with ARME and the Project Coordination Unit.

The Consulting firm shall adopt a participatory and iterative approach, involving the main stakeholders (ARME, municipalities, operators and other entities) in the specification, validation and progressive rollout of the solution. The SIC shall **not duplicate authoritative data sources**, but integrate, synchronize or reference them, where applicable.

3.2 Phased structure

3.2.1 Phase 1 – Design, Development and Initial Implementation

Objective: to design, develop and bring into production the SIC platform, ensuring that the core functional and technical components are available for an initial group of priority entities and areas.

Main activities (non-exhaustive):

- Detailed analysis of business, functional and technical requirements, including consultation with ARME and relevant stakeholders;
- Detailed specification of the SIC architecture (presentation, application, data and integration layers) leveraging GEO.ANACOM [1]architecture, functionalities, and data models to identify best practices and potential modules for adaptation.
- Propose a scalable, secure, and resilient technical architecture for the SIC, including server infrastructure), database structure (i.e. PostGIS), and web-mapping components (i.e. Leaflet, OpenLayers, ArcGIS Stack).
- Design the logical and physical data models, including the Cadastral Objects Matrix and the rules for characterization, validation and quality control of data (i.e. fiber routes, tower locations, coverage maps, licensing details);
- Definition of user profiles and corresponding access levels, including ARME staff, operators, municipalities and other authorized entities;
- Development of the SIC platform, including web applications, APIs and background services, databases, reporting and dashboard modules, and the WebGIS component;

[1] https://geo.anacom.pt/publico/home

- Implementation of the technological infrastructure required for the operation of the SIC, including servers, storage, network, backup and security mechanisms (according to the hosting model agreed with ARME);
- Configuration of the initial catalogue of infrastructure types and attributes, in alignment with national law and international best practices;
- Implementation of priority workflows for the submission, analysis and approval of requests (e.g. infrastructure registration, updates, requests for access to ducts and poles, etc.);
- Develop a user-friendly interface to input, validate, and update infrastructure data (spatial and attribute);
- Initial loading and consolidation of data for a pilot set of municipalities and/or corridors, including the migration of existing data sources when available;
- Performance, security and usability testing, as well as corrections and refinements resulting from tests and feedback from pilot users;
- Preparation of user manuals, operational procedures and technical documentation for the solution.

Deliverables – Phase 1

Indicative deliverables for Phase 1:

- Inception Report, including the work plan, methodology and detailed timetable;
- Requirements Analysis and Detailed Design Report, including architecture and data models;
- GEO.ANACOM Model best practices study;
- Prototype / pre-production version of the SIC platform for pilot use;
- Technical, operational and security documentation;
- Phase 1 Completion Report, with an assessment of results and lessons learned.

3.2.2 Phase 2 – Roll-out and Consolidation

Objective: to extend the SIC to additional entities and geographic areas, refine functionalities based on feedback from the pilot, and consolidate operational practices.

This phase is **conditional on validated Phase 1 acceptance**.

Main activities (non-exhaustive):

- Progressive extension of the SIC to additional municipalities, operators and other entities, in accordance with the rollout plan agreed with ARME;
- Support for data collection, validation and loading for new areas and entities, including guidance on data standards and quality;

- Work with ARME to structure and import all existing, available digital infrastructure data (i.e. license data, existing operator maps, tower locations) into the SIC;
- Refinement and optimization of functionalities, workflows and reports based on feedback from users and ARME;
- Develop tools for complex spatial and attribute queries, such as identifying areas without adequate 3G/4G/5G mobile coverage (Coverage Gap Analysis); calculating network density per municipality; or mapping overlaps and potential interference areas (for spectrum management);
- Strengthen integration with other relevant systems (e.g. licensing, public works management, mapping and national geospatial data infrastructure);
- Design features to generate standardized reports (i.e. coverage statistics, infrastructure inventory) and export data in common formats (i.e. KML, Shapefile, CSV, PDF);
- Support ARME in the preparation and implementation of regulations, procedures and guidelines related to the use of the SIC and to infrastructure sharing;
- Preparation of specific thematic reports, dashboards and indicators requested by ARME.

Deliverables – Phase 2

Indicative deliverables for Phase 2:

- Updated version of the SIC platform with extended coverage and improved functionalities;
- Full system documentation, including technical manuals, user guides, and source code documentation.
- Data loading and validation reports for the entities and areas integrated in Phase 2;
- Recommendations for regulatory and procedural improvements associated with the SIC;
- Phase 2 Progress and Consolidation Report.

3.2.3 Phase 3 – Capacity Building, Support and Sustainability

Objective: to assure the consolidation of institutional and technical capacities for the autonomous operation and evolutionary maintenance of the SIC, as well as a smooth transition at the end of the contract.

Phase 3 is a **handover phase**, not parallel development.

Main activities (non-exhaustive):

- Design and delivery of training plans for ARME staff and other key users (municipalities, operators and other entities), including training-of-trainers where appropriate;
- Practical training on system administration, data maintenance, operation, monitoring, troubleshooting and basic evolutionary maintenance;
- Support in the review and finalisation of manuals, procedures and governance documents related to the SIC;
- Assistance in defining the roadmap for future evolution of the SIC, considering new functionalities, integrations and technological developments;
- Technical support during a 12 months after final acceptance, in close coordination with ARME, including resolution of incidents and fine-tuning of the solution;
- Preparation of a final transition and knowledge-transfer report.

Deliverables – Phase 3

Indicative deliverables for Phase 3:

- Training plans, training materials and attendance reports;
- Final versions of manuals, operating procedures and governance documentation;
- Roadmap for the medium-term evolution of the SIC;
- Final Project Completion and Knowledge-Transfer Report.

Warranty and Support: Provide a minimum 12 months warranty period for bug fixes and technical support following final acceptance.

4. FUNCTIONAL REQUIREMENTS

Without prejudice to the detailed specification that will result from the analysis phase, the SIC shall, at a minimum, provide the following functional capabilities:

- Registry and management of entities and users (ARME, municipalities, operators and other authorized entities), including roles, profiles and access levels;
- Inventory and cadastral management of infrastructure suitable for hosting electronic communications networks (ducts, poles, masts, towers, cabinets, manholes, etc.), with georeferenced location and detailed attributes;

- WebGIS visualization of infrastructure on maps with different base layers (orthophoto, topographic, cadastral and others), including thematic layers and symbology appropriate to the different types of infrastructure;
- Search, filtering and spatial query tools, allowing selection of infrastructure by type, location, owner, status and other relevant attributes;
- Management of requests and workflows related to the installation, modification, removal or sharing of infrastructure, including submission, technical analysis, decision and communication of results;
- Management of documents and attachments associated with infrastructure records and processes (plans, licenses, photos, technical reports, etc.);
- Reporting and dashboards with indicators on coverage, density and use of infrastructure, authorizations issued, works carried out, compliance with deadlines and other key aspects defined by ARME;
- Audit trail and logging of operations performed by users, ensuring traceability and accountability;
- Configuration and management of reference catalogues (types of infrastructure, status, materials, etc.) and validation rules;
- Support for multilingual interfaces (at least Portuguese, with the possibility of English where required by ARME).

5. TECHNICAL AND SECURITY REQUIREMENTS

The SIC must be designed and implemented in line with good international practices for information systems, using proven technologies, open standards and modular architecture.

5.1 Architecture and technologies

- Web-based, multi-tier architecture (presentation, application and data layers), allowing secure access through standard browsers;
- Use of relational database management systems with geospatial extensions suitable for handling geographic information and spatial queries;
- Use of standard APIs (REST or equivalent) to facilitate interoperability and integration with other systems;
- Modular design that facilitates maintainability, scalability and the future addition of functionalities;
- Preference for the use of open-source technologies and components, where appropriate, without compromising security, performance or support.

The detailed choice of technologies will be proposed by the Consulting firm and agreed with ARME during the analysis and design phase.

5.2 Integration and interoperability

The SIC must be able to integrate, where relevant and feasible, with other information systems and data sources, including:

- Existing ARME systems related to licensing, supervision and management of the electronic communications sector;
- Municipal information systems, particularly those related to works, land-use planning and urban management;
- National geospatial data infrastructures and other mapping platforms;
- Other systems identified jointly with ARME during the project.

5.3 Security, privacy and continuity

The solution shall comply with the applicable legislation and good practices relating to information security, privacy and business continuity, including at least:

- Implementation of strong authentication and role-based access control mechanisms;
- Encryption of communications and sensitive data, whenever appropriate;
- Logging and monitoring of access and operations, with mechanisms for detecting anomalies;
- Regular backup and restoration procedures, including periodic tests;
- Definition of incident management and recovery procedures in case of failures or security events.

The Consulting firm shall propose a security model consistent with recognized standards, such as ISO/IEC 27001, and aligned with ARME's internal policies.

6. TRAINING AND CAPACITY BUILDING

The Consulting firm shall design and implement a **comprehensive, structured and results-oriented training and capacity-building program**, tailored to the different profiles of users, administrators and decision-makers involved in the operation and governance of the SIC. The objective of this program is to ensure the **autonomous, sustainable and effective use, administration and evolution of the SIC by ARME** beyond the end of the contract.

The training and capacity-building program shall include, at a minimum, the following components:

- **Training needs assessment**, including the identification of target groups and user profiles (e.g. system administrators, technical users, regulatory analysts, decision-makers) and the definition of corresponding learning objectives;

- **Preparation of training plans, programmes and materials**, adapted to each target group, including presentations, user manuals, technical guides and practical exercises, ensuring clarity, consistency and applicability to ARME's operational context;
- **Delivery of training sessions** for ARME staff and other key stakeholders, in formats agreed with ARME (in-person, remote or hybrid), combining theoretical instruction with hands-on practice using the SIC;
- **Training-of-trainers**, where appropriate, to enable ARME to internally replicate and update training activities, thereby reducing long-term dependency on external providers;
- **Evaluation of training effectiveness**, including feedback collection, assessment of learning outcomes and consolidation of lessons learned, with recommendations for further capacity strengthening where needed.

All training materials, documentation and supporting content produced under this assignment shall be delivered to ARME in **editable format**. ARME shall retain **full ownership and unrestricted rights** to adapt, update, reproduce and reuse these materials in future initiatives related to the SIC or other regulatory and digital transformation activities.

7. IMPLEMENTATION, COORDINATION AND REPORTING

7.1 Implementing and supervising entity

ARME in close coordination with the Project Coordination Unit (UGPE), will oversee the implementation of the activities aimed at improving the management, transparency and optimized use of telecommunications infrastructure in Cabo Verde.

ARME will be the implementing and supervising entity for this technical assistance, responsible for overall guidance, validation of key deliverables and decisions, and coordination with other national stakeholders and with the World Bank.

7.2 Coordination mechanisms

A Steering / Monitoring Committee will be set up, comprised of representatives from ARME, UGPE and, where relevant, other entities. This Committee will:

- Monitor project progress against the agreed work plan;
- Validate key deliverables and milestones;
- Facilitate coordination with other ongoing initiatives and projects;
- Support the resolution of strategic or inter-institutional issues that may arise.

Operational coordination will be carried out through regular working meetings between the Consulting firm and ARME's project team, as well as through appropriate communication channels (email, collaborative platforms and others to be agreed).

7.3 Reporting and communication

The Consulting firm shall submit the following reports, at a minimum, in Portuguese:

- Inception Report, to be delivered shortly after the start of the contract, detailing the methodology, work plan, resources and updated timetable;

- Periodic Progress Reports (e.g. quarterly or as agreed with ARME), summarizing the activities carried out, results achieved, difficulties encountered and mitigation measures;

- Phase Completion Reports, at the end of each project phase, including an assessment of results and recommendations for the follow-up phase;

- Final Project Completion Report, at the end of the contract, consolidating the achievements, lessons learned and recommendations for the future evolution of the SIC.

Additional thematic or ad hoc reports may be requested by ARME whenever necessary.

8. DURATION OF THE TECHNICAL ASSISTANCE

Months 1–14: Full implementation (Phases 1–3).

Months 15–26: Warranty period limited to:

- Corrective maintenance,
- Bug fixing,
- Support (no new development).

The services will be carried out predominantly in Cabo Verde, with the possibility of remote work arrangements, subject to prior agreement with ARME, in particular for activities such as development, documentation and remote support. Certain key activities (such as requirements analysis, training, acceptance testing and Steering Committee meetings) should necessarily involve direct interaction with ARME and other stakeholders, preferably in person.

DELIVERABLES, REPORTS, AND IMPLEMENTATION SCHEDULE

No.	Phase	Deliverable / Report	Description / Key Content	Indicative Timing*	Acceptance Authority	Payment
D1	Phase 1	**Inception Report**	Detailed methodology, work plan, governance arrangements, risk analysis, detailed timetable, and confirmation of deliverables	After sign (AS)+Month 1	ARME / Steering Committee	15%
D2	Phase 1	**Requirements Analysis & Detailed Design Report**	Functional, technical and regulatory requirements; system architecture; data model; interoperability approach; security model	(AS)+Month 2	ARME	
D3	Phase 1	**GEO.ANACOM Benchmark & Best Practices Study**	Analysis of GEO.ANACOM model, identification of reusable concepts and adaptation recommendations	(AS)+Month 3	ARME	
D4	Phase 1	**Prototype / Pre-Production SIC Platform**	Operational SIC prototype including WebGIS, workflows, data model, and user profiles for pilot use	(AS)+Month 6	ARME	20%
D5	Phase 1	**Phase 1 Completion Report**	Summary of results, testing outcomes, lessons learned, and readiness for roll-out	(AS)+Month 7	Steering Committee	
D6	Phase 2	**Updated SIC Platform (Roll-out Version)**	Extended functionalities, optimized workflows, enhanced	(AS)+Month 10	ARME	15%

			reporting, and expanded geographic and institutional coverage			
D7	Phase 2	**Data Loading and Validation Reports**	Documentation of datasets integrated, validation results, data quality issues and corrective actions	(AS)+Month 11	ARME	
D8	Phase 2	**Regulatory & Operational Recommendations Report**	Recommendations for regulatory adjustments, procedures and guidelines linked to SIC use and infrastructure sharing	(AS)+Month 12	ARME	20%
D9	Phase 2	**Phase 2 Progress and Consolidation Report**	Assessment of roll-out results and confirmation of operational readiness	Month (AS)+13	Steering Committee	
D10	Phase 3	**Training & Capacity-Building Materials**	Training plans, manuals, guides, exercises, training-of-trainers materials (editable formats)	Months (AS)+8–13	ARME	
D11	Phase 3	**Capacity Building & Knowledge Transfer Report**	Summary of training delivered, effectiveness evaluation, lessons learned, sustainability recommendations	(AS)+Month 14	ARME	
D12	Phase 3	**Final Project Completion Report**	Consolidated results, compliance with ToR, sustainability roadmap, transition to autonomous operation	(AS)+Month 14	Steering Committee	20%

D13	Warranty	**Warranty Support & Corrective Maintenance**	Bug fixing, corrective actions, support services during warranty period (no new development)	(AS)+Months 15–26	ARME	10%

- Indicative timings are subject to refinement in the Inception Report and approval by ARME.
- Payments shall be linked to the formal acceptance of deliverables, in accordance with the contract.
- All deliverables shall be submitted in Portuguese, with English versions provided where required.
- Acceptance of each phase is a prerequisite for progression to the subsequent phase.

9. PROFILE AND QUALIFICATIONS OF THE FIRM AND THE TEAM

9.1 Consulting firm

The consulting firm (or consortium) must be a legally established entity and have at least five (5) years of demonstrated experience in projects of similar nature and complexity, in particular in the fields of:

- Design and implementation of information systems for regulation, infrastructure management or public administration;
- Development of complex, large-scale geospatial WebGIS solutions and infrastructure inventories, preferably for government/regulatory bodies;
- Analysis and assessment of telecommunications/digital infrastructure, including regulatory requirements, network planning, and key performance indicators;
- Projects related to the electronic communications sector, infrastructure sharing or public works management;
- Proficiency in relevant technologies, including: Web Mapping Libraries (e.g., OpenLayers, Leaflet, ESRI products); GIS Database Management (e.g., PostgreSQL/PostGIS, MongoDB, Oracle Spatial); Programming Languages (e.g., Python, JavaScript, PHP, Java); Cloud Services (AWS, Azure, or Google Cloud).
- Training and capacity building for public sector entities.

Experience in projects financed by international development partners (World Bank, African Development Bank, European Investment Bank or similar) will be considered an

asset, as well as the existence of certified quality management and information security systems (for example, ISO/IEC 27001 and ISO/IEC 20000-1).

9.2 Minimum technical team

The team must be multidisciplinary and include, at a minimum, the following key profiles:

- Project Coordinator / Team Leader;
- GIS / WebGIS Specialist;
- Information Systems Development Specialist;
- Database Specialist;
- Information Security Specialist;
- Service Management / Systems Operations Specialist;
- Training and Change Management Specialist.

For each team member, the proposal must indicate the name, role in the project, academic qualifications, years of relevant experience and key reference projects.

Below are indicative profiles and minimum requirements for the main positions. The Consulting firm may propose additional team members as deemed necessary.

a) Project Coordinator / Team Leader

Minimum academic qualifications:

- University degree in Computer Engineering, Systems Engineering, Computer Science, Information Systems or a related field;
- Postgraduate studies or additional training in Project Management will be considered an advantage.

Minimum professional experience:

- At least 10 years of professional experience in information and communication technologies (ICT) projects;
- At least 7 years of specific experience in coordinating complex information systems or digital transformation projects, preferably with a GIS/WebGIS or cadastral component;
- Participation, as Project Coordinator or equivalent role, in at least 2 projects financed by international development partners will be considered an advantage.

Valued certifications and skills:

- Certification in project management (e.g. PMP, PRINCE2, IPMA) and/or in service management (e.g. ITIL);
- Strong capacity to coordinate multidisciplinary teams, manage risk, plan and monitor projects;
- Excellent written and oral communication skills in Portuguese; knowledge of English will be considered an asset.

Main responsibilities in the project:

- Overall coordination of the project's team and main interface with ARME;
- Planning, monitoring and control of project execution, including risk, schedule, cost and quality management;
- Ensuring coherence between the functional, technical, operational and capacity-building components;
- Representing the project in Steering Committee meetings and other strategic forums.

b) GIS / WebGIS Specialist

Minimum academic qualifications:

- University degree in Geography, Geographical Engineering, Geomatics, Geoinformation or a related field.

Minimum professional experience:

- At least 7 years of experience in the design, implementation and operation of GIS/WebGIS solutions;
- Participation in at least 2 projects involving infrastructure mapping, cadastral systems, network inventories or similar.

Valued technical skills:

- Experience with leading GIS tools and platforms (e.g. QGIS, ArcGIS or equivalent);
- Experience in publishing and consuming OGC-compliant web services (WMS, WFS, etc.);
- Knowledge of spatial databases and geospatial data modelling;
- Experience in designing map representations, symbology and thematic layers.

Main responsibilities in the project:

- Supporting the design of geospatial components and data models for the SIC;

- Configuring and optimizing WebGIS functionalities and map services;
- Defining cartographic representation rules, symbology and thematic layers;
- Supporting the definition of spatial validation processes and data quality controls.

c) Information Systems Development Specialist

Minimum academic qualifications:

- University degree in Computer Engineering, Computer Science, Information Systems or a related field.

Minimum professional experience:

- At least 7 years of experience in the analysis, design and development of multi-tier web information systems;
- Demonstrated experience in at least 2 projects for the development or modernization of information systems for public entities or regulators.

Valued technical skills:

- Experience in the development of web applications (front-end and back-end), REST APIs, system integration and authentication/authorization mechanisms;
- Knowledge of modular and service-oriented architectures (SOA/microservices);
- Familiarity with secure development practices, automated testing and version control.

Main responsibilities in the project:

- Leading the design and implementation of the SIC application components;
- Ensuring integration between the different modules and with external systems;
- Supporting performance, security and usability tests and respective corrections.

d) Database Specialist

Minimum academic qualifications:

- University degree in Computer Engineering, Computer Science, Information Systems or a related field.

Minimum professional experience:

- At least 5 years of experience in the design, implementation and administration of relational databases, preferably including spatial extensions;

- Experience in data modelling, optimization, backup and recovery strategies.

Main responsibilities in the project:

- Designing and optimizing the SIC databases, including geospatial structures;
- Implementing mechanisms for backup, recovery and performance tuning;
- Supporting data loading, migration and validation activities.

e) Information Security Specialist

Minimum academic qualifications:

- University degree in Computer Engineering, Information Security or a related field.

Minimum professional experience:

- At least 5 years of experience in information security, preferably in contexts involving public sector or critical infrastructure;
- Experience in defining and implementing security controls, risk analysis and incident response.

Valued technical skills:

- Knowledge of standards and good practices (e.g. ISO/IEC 27001, ISO/IEC 27002);
- Experience with security mechanisms relevant to web applications, databases and infrastructure.

Main responsibilities in the project:

- Supporting the definition and implementation of the SIC security model;
- Advising on risk mitigation measures and security monitoring;
- Supporting the preparation of security procedures and incident response plans.

f) Service Management / Systems Operations Specialist

Minimum academic qualifications:

- University degree in Computer Engineering, Information Systems or a related field.

Minimum professional experience:

- At least 5 years of experience in the operation, monitoring and support of information systems or ICT services;

- Experience in environments with service level agreements (SLAs) and structured support processes.

Valued technical skills:

- Knowledge of service management frameworks (e.g. ITIL) and monitoring tools; Experience in incident, problem and change management.

Main responsibilities in the project:

- Supporting the definition of operational and support procedures for the SIC;
- Contributing to the definition and monitoring of SLAs and key performance indicators;
- Supporting the transition to regular operation under ARME's responsibility.

g) Training and Change Management Specialist

Minimum academic qualifications:

- University degree in Social Sciences, Education, Management, Information Systems or a related field.

Minimum professional experience:

- At least 5 years of experience in designing and delivering training and change management programs, preferably in public sector or ICT projects.

Main responsibilities in the project:

- Designing and implementing the training and capacity-building program for the SIC;
- Supporting communication and change management activities to promote adoption of the solution;
- Consolidating lessons learned and recommendations for sustaining the SIC over time.

10. DATA, FACILITIES AND SERVICES TO BE PROVIDED BY ARME

ARME shall provide the Consulting firm, on a **best-effort and progressively available basis**, with the data, information, facilities and institutional support necessary for the execution of the assignment, including, at a minimum:

- **Access to relevant information and documentation** required for the design, development and implementation of the SIC, including legal, regulatory, technical and operational documents;
- **Access to key stakeholders and counterparts** within ARME and other relevant public or private entities, for consultation, requirements validation, testing and acceptance activities;
- **Where applicable, access to premises and basic facilities** necessary for meetings, training sessions, workshops and working sessions;
- **Technical guidance on existing systems, infrastructure and organizational processes** relevant to the SIC, including systems related to licensing, supervision, infrastructure management and geospatial information.

The Consulting firm acknowledges that **data availability may vary in scope, format and quality**, and that access to certain datasets may be **progressive** over the duration of the contract. Such data availability shall **not be considered a precondition for delivery**, and the Consulting firm shall design and implement the SIC in a manner that accommodates incremental data integration and validation.

The **specific datasets, systems, facilities and access modalities** to be made available by ARME shall be identified, detailed and agreed at the **start of the contract**, and may be further refined and updated throughout implementation, as appropriate, in coordination with ARME.

11. ACCEPTANCE CRITERIA AND QUALITY ASSURANCE

11.1 Verification and acceptance of deliverables

Each deliverable will be formally submitted by the Consulting firm to ARME, accompanied by the respective documentation. ARME will verify the deliverables against the agreed specifications, within a reasonable period to be defined in the contract.

Deliverables will be accepted when they comply with the requirements established in these Terms of Reference, in the approved work plan and in the contract, and when any corrections or improvements requested by ARME have been duly implemented.

11.2 Technical warranty

The Consulting firm shall provide a technical warranty period (12 months), during which it will correct, without additional cost to ARME, any defects, errors or non-conformities detected in the SIC that are attributable to the Consulting firm, as well as provide support to ensure the proper functioning of the solution.

The duration and specific conditions of the warranty will be defined in the contract, taking into account the nature of the services and the implementation schedule.

11.3 Intellectual property

All products, software developments, documentation, data models, training materials and other outputs produced under this assignment will be the exclusive property of ARME and/or the Government of Cabo Verde, without limitation as to their use, adaptation or reproduction.

The Consulting firm may not use, reproduce or disclose such outputs for purposes other than those foreseen in the contract without the prior written authorisation of ARME.

11.4 Confidentiality

The Consulting firm and its team members shall treat as confidential all information obtained in the course of the assignment and shall not disclose it to third parties without the prior written consent of ARME, except where the information is already in the public domain or where disclosure is required by law.

The obligation of confidentiality shall remain in force even after the end of the contract.

12. PAYMENT STRUCTURE AND FINANCIAL GUARANTEES

Payments will be made against the submission of invoices and subject to the prior acceptance of the corresponding deliverables by ARME, in accordance with the provisions of the contract and the Project Schedule (Annex 1).

The contract may provide for the submission of appropriate financial guarantees, where applicable, in line with the regulations of the Government of Cabo Verde and the requirements of the World Bank.

13. ENVIRONMENTAL AND SOCIAL ASPECTS

The project shall observe good environmental and social practices, in line with the applicable national legislation and with the relevant environmental and social requirements of the World Bank, where applicable.

The Consulting firm shall ensure that the activities under this assignment do not cause significant adverse environmental or social impacts and shall promptly notify ARME of any risks or incidents that may arise, proposing appropriate mitigation measures.

14. WORKING LANGUAGE

All documentation, communications, reports and manuals shall be prepared in Portuguese.

Whenever justified by the need for coordination with international partners or for other reasons indicated by ARME or the World Bank, certain key documents may also be requested in English. In such cases, the Consulting firm shall provide the English version, it being understood that, in case of divergence, the official Portuguese version approved by ARME shall prevail.

ANEX

Regulatory context

Law No. 58/VIII/2014 of 21 March, which establishes the legal regime applicable to the installation of systems and equipment and the laying of electronic communications networks, created the basic conditions for the development of infrastructures suitable for the hosting of electronic communications networks, including ducts, poles, masts, towers, cabinets and other passive infrastructure elements.

The same law provides for the implementation of an information-sharing platform between ARME and the participating entities, setting out the main obligations of the different stakeholders and the rules for access, use and control of information. Despite this favorable framework, the country still lacks an integrated, up-to-date and digitalized snapshot of the electronic communications infrastructure deployed throughout the national territory.

Motivation for the SIC

Over the last decade, Cabo Verde has witnessed a significant expansion and densification of electronic communications networks, driven by the growth of mobile, fixed broadband and data services, the emergence of new operators, and the increasing importance of digital services in all sectors of the economy.

The deployment and maintenance of this infrastructure involve substantial investments and multiple public and private actors, including electronic communications operators, municipalities, central government entities and other infrastructure assets (energy, water and sanitation, roads, ports and airports, among others). In many cases, there are overlaps and duplications of infrastructure, as well as difficulties in coordinating interventions in public space.

In parallel, the demand for more resilient, secure and high-capacity networks has been growing, in line with international trends (5G, fiber-to-the-home, AI, data centers, cloud

services, IoT, etc.), which reinforces the need for better planning, optimization and sharing of existing infrastructure.

Currently, the information on electronic communications infrastructure is fragmented, heterogeneous and often only available in analogue or non-standardized digital formats. This situation leads to several challenges, such as:

- Limited capacity for strategic planning and regulation, due to the lack of a consolidated and georeferenced snapshot of the country's infrastructure;
- Difficulties in coordinating public works and interventions in the public domain, increasing costs and disruptions for citizens and businesses;
- Inefficient use of public domain and available infrastructure, resulting in overlaps and under-utilization of assets;
- Challenges in monitoring compliance with legal and regulatory obligations on network installation, maintenance and safety;
- Obstacles to infrastructure sharing, co-investment and the development of new business models, such as neutral networks;
- Increased complexity in analyzing investment proposals, authorizing works and resolving conflicts between stakeholders.

The Electronic Communications Infrastructure Inventory System (Sistema de Informação Centralizado, SIC,) is conceived as a centralized platform to collect, store, manage and disseminate information on electronic communications infrastructure at national level, with a strong geospatial component. The SIC will:

- Support ARME in its regulatory, supervisory, planning and decision-making functions;
- Facilitate coordination between public entities and operators in managing the public domain and authorizing works;
- Promote transparency and the efficient use of existing infrastructure, encouraging infrastructure sharing and the reduction of duplication;
- Provide qualified information for public policies relating to connectivity, coverage and resilience of electronic communications networks;
- Contribute to safeguarding the environment and public safety by improving control over works, interventions and the conditions for the installation and maintenance of networks.

The implementation of the SIC seeks to respond to these challenges, creating an integrated, modern and sustainable solution that will become a reference tool for ARME, and all stakeholders involved in the development and management of electronic communications infrastructure in Cabo Verde.