







AMAZON COOPERATION TREATY ORGANIZATION – ACTO AND NATIONAL AGENCY OF WATER-ANA Brazil

AMAZON PROJECT: REGIONAL ACTION IN THE AREA OF WATER RESOURCES – PHASE II

PUBLIC BIDDING

MODALITY: GLOBAL PRICE TAKING

TYPE BIDDING: LOWEST PRICE

PROCESS: No. LP 001/2021

1. OBJECT

Hiring of a consulting company for the creation and implementation of the Thematic Module of Water Resources and the Amazonian Networks Integrator Module on the platform of the Amazonian Regional Observatory.

2. PHASES OF THE BIDDING PROCESS

- a) Submission of proposals: March 10th to 30th, 2021, until 11:59 p.m., Brasilia time;
- b) Analysis and assessment of the company: March 31st to April 19th, 2021;
- c) Expected date for the selection of a company: April 20th, 2021;
- d) Expected date for the announcement of the results: April 22nd, 2021.

TIME REFERENCE: All time references in the Call, in the notice and during the public session will necessarily observe the Brasilia-DF time and, therefore, will be registered by the following email: projeto.amazonas@otca.org

The PS/ACTO has the right to modify the deadlines for the analysis of the proposals and the final result at any time.

3. SELECTION COMMITTEE

For the selection process, the PS/ACTO will convene a Selection Committee, which will be integrated by an executive official and two employees from the institution, in accordance with the requirements of the position.









4. CRITERIA FOR QUALIFICATION

All the certification and qualification criteria of the consulting company are established in item 9 of the Terms of Reference of this Call.

5. TERMS OF REFERENCE

The Terms of Reference are described in this Call.

6. EXECUTION PERIOD AND CONTRACT DURATION

The final deadline for the rendition of the services is within 37 (thirty-seven) weeks of the date of signature of the contract, and the expected outcomes should be submitted in accordance with the Product Delivery Schedule of the Terms of Reference.

7. DEADLINES FOR SUBMISSION OF DOCUMENTS

Companies must send all the digital documents described in item 9 of the Terms of Reference of this Call, in Spanish, English or Portuguese to the institutional e-mail address: projeto.amazonas@otca.org, with the subject [Proyecto Amazonas – Módulo Temático Recursos Hídricos].

The winning company must send all the supporting documents in physical format, signed and recognized by a notary public (or a similar institution that proves the authenticity of the documents in their country of origin) when requested. Failure to deliver or incomplete delivery of documents will result in the disqualification of the company.

Applications will be accepted until March 30th, 2021, 11:59 p.m., Brasilia time, Brazil.







AMAZON COOPERATION TREATY ORGANIZATION - ACTO AND NATIONAL WATER AND SANITATION AGENCY – ANA-BRAZIL

SECOND PHASE OF THE AMAZON PROJECT: REGIONAL ACTION IN THE AREA OF WATER RESOURCES

TERM OF REFERENCE

1. IDENTIFICATION OF THE CONSULTANCY

Hiring of a consulting company for the creation and implementation of the Thematic Module of Water Resources and the Amazonian Networks Integrator Module on the platform of the Amazonian Regional Observatory.

2. JUSTIFICATION

The Amazon River basin is the largest hydrographic network in the world, occupying a total area of approximately 6,110,000 km², from its headwaters in the Peruvian Andes to its mouth in the Atlantic Ocean. This basin extends to several countries in South America: Brazil, Peru, Bolivia, Colombia, Ecuador, Venezuela, Guyana and Suriname, covering 44% of South America's land area. The Amazon Basin is responsible for 20% of all fresh water discharged daily into the oceans (PAE, OTCA. 2008).

The Amazon Cooperation Treaty (ACT) was signed on July 3, 1978 by the governments of Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela, in order to carry out joint actions and efforts to promote the harmonious development of their respective Amazon territories in order to produce equitable and mutually beneficial results and also to achieve the preservation of the environment and the conservation and rational use of natural resources.

On December 13, 2002, the Amazon Cooperation Treaty Organization (ACTO) and its Permanent Secretariat were installed in Brasilia, with international legal status, with the objective of improving and institutionally strengthening the process of cooperation, coordination and joint actions of its Member Countries to promote the sustainable development of the Amazon within the ACT. ACTO approved a Strategic Cooperation Agenda for the Amazon (AECA, 2010-2018), which is in the process of being updated, in which, among other issues, those related to water management and climate change are prioritized.

In 2016, the second phase of the Amazon Project: Regional Action in the Area of Water Resources began, which is an initiative of the National Agency for Water and Basic Sanitation (ANA), the Amazon Cooperation Treaty Organization (ACTO), the Brazilian Cooperation Agency (ABC/MRE, Portuguese acronym) and the South American Department of the Ministry of Foreign Affairs (DAS/MRE, Portuguese acronym).

The objective of this Second Phase of the Amazon Project is to contribute to the promotion of shared and sustainable management of water resources in the Amazon Basin. Provided through the implementation of shared networks for hydrological monitoring and water quality, the structuring of a database on water resources and climate change, the dissemination of





knowledge on the Amazonian reality and technical capacity building actions with the officials of the institutions involved with water resources in ACTO Member Countries.

This second phase of the Amazon Project continues the activities developed in Phase I of the Amazon Project (2012 to 2017), which contributed to strengthening articulation and technical cooperation among ACTO Member Countries.

Among the products foreseen in this second phase of the project, one refers to the structuring of a hydrological information, sedimentometric and water quality module that will allow the exchange of data between the countries of the Amazon Basin and ACTO. This information module is part of the Amazon Regional Observatory being developed by ACTO.

The implementation of the Amazon Regional Observatory-ARO has been prioritized by the Permanent Secretariat of ACTO as a space of articulation in different areas of information of the Amazonian countries. As a first step towards the implementation of this observatory, ACTO signed a contract with EXCO Company, which carried out the operational and technical design of the ARO, which involved a process of consulting the countries, mapping requirements and defining computer solutions.

3. OBJECTIVES

General Objective

To implement and publish the Amazon Regional Observatory-ARO online platform, regarding the Water Resources Thematic Module and the Amazonian Networks Integrator Module on the ACTO website, and its start-up, making its different parts operational with all their functionalities, including the load of pre-existing data from public and official sources.

Specific Objectives

- Carry out a diagnosis of the databases, information systems and IT infrastructure used for hydrological data management in the member countries that are part of the AHN (Amazonian Hydrological Network) (Bolivia, Brazil, Ecuador, Colombia, Peru).
- To create the Water Resources Thematic Module and the Amazonian Networks Integrator Module, computer platform of the Amazonian Regional Observatory-ARO and put them into operation, considering the interoperability standards defined for the ARO. Both modules should have different formats for viewing information (e.g. dashboards, graphics, etc.).
- Develop the databases (including historical level and flow data) and load the data into the IT platform with official information from ACTO Member Countries and other existing systems.
- Ensure the publication of the IT platform on the ACTO website.

4. TECHNICAL SPECIFICATIONS

Perform a diagnosis of databases, information systems and IT infrastructure used for hydrological data management of member countries that are part of the AHN (Amazon Hydrological Network) through virtual meetings and contacts with focal points of institutions responsible for data management.



The modules should be developed considering the ARO conceptual framework, presented in Annex 1.

The Water Resources thematic module will be integrated in the ARO database and allows the visualization of geographic, document, statistical, good practices, programs and projects, among others, for each of the themes. The Water Resources thematic module will have specific information that will not be shared in the integrating module.

The information should also be organized by country, allowing the presentation of information in the form of relevant charts and graphs of each of the member countries participating in the Amazon Hydrological Network.

The Amazonian Networks integrating module will be a space for articulating the different initiatives of ACTO's water resources monitoring, such as: critical events situation room, Amazonian Hydrologic Network-AHN, and the Water Quality Network. In this sense, the module must have applications of the "embedded" type that allow the integration of these monitoring systems developed with other ACTO partners, that is, with screens of geographic or statistical information systems. In addition, the module must have functionality for manual data loading and historical data loading.

The Water Resources Thematic Module and the Amazonian Networks Integrator Module of the Platform of the Amazonian Regional Observatory - ARO should be developed considering the following technical specifications:

- Work with software packages and services based on functionality criteria, usability, implementation time efficiency, licensing and implementation cost efficiency, technical implementation complexity, support, information security and maintenance and operation efficiency for module deployment and management.
- Develop the items in open software and in the cloud. Define the key audience based on updated patterns of user experience and user interaction.
- Create the main pages and modules contemplating open (with free access) and closed (for internal use) sections.
- Develop the modules using free and open source tools and the content management system similar or equivalent to "Wordpress". The geographic information module must use the Geonode/Geoserver platform.
- The platform must have the incorporation of "Google Analytics and RSS" tools.
- The data management platform must consider the best options between the Sentrifugo, Alfresco and Mayan systems, according to the specifications and recommendations of the study of the conceptual framework prepared by EXCO and ACTO.
- The background layers must present data from the Open Street Org. open platform. . The platform data must be available in cloud storage services such as Amazon, Microsoft Azure, Google Cloud, IBM Cloud, and V Box.
- The best technological alternative to the cloud storage solution should be based on the criteria of the ARO conceptual framework developed by EXCO.
- All modules and pages must be linked to a database that retrieves official country information or other unofficial information automatically or through manual options. All modules must have a private area where the information is stored and processed in interaction with the countries to be previously disclosed.
- All modules must have internal search options.









- Develop the administrative panel based on specific environments and sections for the management of different types of website users: administrators, content editors, and content viewers.
- All pages and modules must be presented in Spanish, English and Portuguese.

5. ACTIVITIES

The activities foreseen for this consultancy, articulated to the specific objectives, are the following:

1. Perform a diagnosis of databases, metadata, protocols, responsibility matrixes, information systems and IT infrastructure used for hydrological data management of the member countries that are part of the AHN (Amazon Hydrological Network), focusing on the construction of the module below, using whenever possible the points already defined in the diagnosis prior to this project (ARO conceptual design).

2. Create the Water Resources Thematic Module and the Amazonian Networks Integrator Module in the platform of the Amazonian Regional Observatory-ARO and put them into operation. In the development of this module it should be considered that it will be divided into back-end and front-end, emphasizing that:

- I. The CONTRACTED PARTY will carry out a preliminary survey and indicate possible convergences of other similar initiatives for the integration of monitoring networks and dissemination of hydrometeorological and water quality data, whether from international, national or non-governmental organizations, possibly existing in the framework of Amazon basin and its sub-basins or other transboundary basins.
- II. The CONTRACTED PARTY is responsible for (a) the initial load of data in the shared database when dealing with data that consumes services available in real time (automatic load), and (b) the initial load of files in the document database, when the countries that compose the project are not able to make the data available in real time (manual load).
- III. In the construction of the back-end the CONTRACTED PARTY shall use, in addition to the technologies already identified in the diagnosis prior to this project, other free and open source technologies.
- IV. The CONTRACTED PARTY shall, based on the initial diagnosis, create the necessary services for this phase of the project and/or provide them with mentoring to make the data available in real time, based on the defined protocols, always guaranteeing interoperability.
- V. Develop the necessary database for the project and load the information on the computer platform with official information from the countries or other existing systems.
- VI. In the construction of the front-end the CONTRACTED PARTY must follow the visual identity defined by ACTO and excel by the best user experience, following the technology already defined in the diagnosis previous to this project, or proposing other free and open source technologies.
- VII. Ensure the publication of the IT platform on the ACTO website.
- VIII. Perform the publication of the web platform and its features.







- IX. Develop an operating manual on how the modules work.
- X. Carry out training for ACTO and country staff.
- XI. Provide system maintenance and user support for a period of ninety (90) days from the end of the project.

6. **PRODUCTS**

It should be noted that the work should be carried out remotely. That said, air tickets and per diem are not included.

The focal points in each participating country, which will subsidize the work, will be defined by ACTO.

The products of the consultancy will be the following:

- a. Work plan.
- b. Diagnosis of the organizations involved in the project, containing:
 - i. Base types/sizes (identifying the origins).
 - ii. Technical capacity to integrate and update bases.
 - iii. Pre-existing reusable systems/services, and other resources accessible to the project.
 - iv. Definition of the stakeholders (Products Owners PO).
- c. Data exchange plan, containing:
 - i. Data exchange protocol proposal.
 - ii. Data model needed for the project (real time and static data).
 - iii. Definition of the metadata that will be used to index the files and bases made available via this module.
- d. Architecture document, containing minimally:
 - i. Target audience (already defined in the ARO conceptual design).
 - ii. Technical condition of each country for the maintenance of this module.
 - iii. Possible automated loading processes.
 - iv. Free tools to be adopted in the project: for data repository with indexed metadata [e.g. DSPACE with indexed metadata], CMS (e.g. wordpress), database, map app [GEONODE, GEONETWORK]. The survey already conducted by the EXCO consultancy should be considered *updating it if necessary* and allow/predict the use of embedded tools, webservices/api/micro services, and other related technologies.
 - v. Information security policy/best practices to be adopted [including focusing on attack and invasion prevention].
 - vi. Cloud infrastructure deployment proposal (considering the survey already conducted by EXCO), and update/support proposal.
 - vii. Proposal of visual identity compatible with the implementation of the ARO.
- e. Implementation of the water resources thematic module and the Amazonian networks integrating module:









- i. Installation of the Redmine and GitHub tools to be used in project management, on the server to be indicated by the contracting party.
- ii. Initial definition of sprints/service orders.
- iii. Creation of the necessary databases for the project.
- iv. Creation of api, microservices, SQL query and webservices necessary for the project.
- v. Complete development/implementation of the module, including all back-end and front-end.
- vi. Initial/manual/assisted input of files limited to up to 50 documents/country of the project (static).
- vii. For up to 125 monitoring points defined for the project area, for the countries integrating the project that do not have conditions to provide data in real time, the initial load on the project database of key curves, level, flow and water quality, for this defined universe of stations, must be provided by the CONTRACTED PARTY, for direct execution or as assisted operation.
- viii. For the countries that are part of the project and have conditions to provide data in real time, the CONTRACTED PARTY must provide the real time load in the project database of key curves, level, flow and water quality data.
- ix. Construction for each country that is part of the project that is able to provide data in real time, up to 5 GIS app with up to 5 thematic layers each, *preferably* with automatic feeding/updating.
- x. Incorporation of up to 15 GIS app to the portal for each country that is already part of the project (i.e., built prior to the project), provided the technologies are compatible with those defined for the module.
- xi. *Performing*, before deliveries, the necessary tests to ensure product quality and safety (black box tests, regression, usability, safety, integration, performance, maintenance and functional).
- xii. Creation and availability of documentation regarding the products delivered in standard/form to be agreed with the CONTRACTING PARTY.
- xiii. Project closing term.

7. SERVICES EXECUTION MODEL

The priority is the delivery of the solution for deployment (release), with the documentation of artifacts as the secondary objective.

The work plan to be delivered by the CONTRACTED PARTY must bring the minimum information necessary for its execution (scope, non-scope, start and end date, estimated count, product acceptance requirements).

The CONTRACTING PARTY is responsible for defining the scope.

The CONTRACTING PARTY is responsible for (re)prioritizing the product backlog, the definition of the Releases, their Sprints and the prioritized user stories;

For products b, c, d, e, the payment for deliveries will be a function not only of the metrics associated with their items, but also of the reach of service levels in each delivery, which will consider criteria of time and quality (SLA).









Leadership, management or facilitation activities - such as those of the Technical Service Manager, or Scrum Master - that are not directly related to a deliverable, such as participation in meetings, will not be directly remunerated.

Any necessary adequacy to the correction of non-conformities in the deliveries (errors, defects, among others) will be carried out by the CONTRACTED PARTY without any charge to the CONTRACTING PARTY, within the period of execution, receipt and guarantee of the services, which will be of 12 (twelve) months counted from the date of the definitive acceptance in the delivery, regardless if this period extends after the end of the validity of the contract.

The dimensioning of the team for the adequate execution of the contracted service is the exclusive responsibility of the CONTRACTED PARTY, and it must be sufficient for the complete fulfillment of the deadlines, quality and service levels required.

The execution of the object by the Contracted Party shall take place in accordance with the conditions, processes and activities established in this Term of Reference and annexes.

The CONTRACTING PARTY may, however, at its discretion, establish specific conditions of supply - deadlines, deliverables, and quality criteria by respecting the limits established in the Term of Reference.

The delivery of the artifacts and by-products is carried out from their beginning to their end, in accordance with the phases of the process and the production of the products.

The delivery on a provisional basis (**provisional acceptance**) will take place through the electronic registration in the CONTRACTING PARTY's monitoring tool.

The unappealable delivery (**definitive acceptance**) will happen through the electronic register in the monitoring tool of the CONTRACTING PARTY and its respective artifacts (in the form defined by the CONTRACTING PARTY) and the issuance and signature of the Final Receipt Term (FRT) by both parties.

Features that need more than one sprint to be developed will only be counted in the sprint in which they are delivered and accepted in full.

The modus operandi of the meetings related to the agile methodology will be defined by the CONTRACTING PARTY and passed on to the CONTRACTED PARTY, and may undergo adjustments during the execution of the object and validity of the contract.

Concerning the releases:

- i. The Release SO remains open until its last sprint is closed and it is deployed.
- ii. One release may contain up to 04 (four) sprints, at the CONTRACTING PARTY's discretion.
- iii. The release characterizes a new cycle of the Project, which closes after the iterations are completed and implantation in Production.
- iv. Considering the aspects of agile development, there may be refinements between the sprints of the same release, due to the natural evolution of the understanding of the requirements and the solution design. The refinements are registered as Change Request.









v. The CONTRACTED PARTY shall consider as normal refinements of up to 30% performed throughout the release cycle, and there will be no additional remuneration.

All activities that have a direct relationship with the development process are included in the price: survey and specification of requirements (user stories), analysis, project, modeling, project management, coding, automation, coding and test execution, support for user approval, interaction and support to the CONTRACTING PARTY's teams, implementation and transfer of knowledge of the service performed, and all meetings planned (sprint/release planning, review and retrospective).

The iterations (sprints) will last 2 (two) weeks. Exceptionally, in case of necessity and relevance, the sprints may have differentiated terms, at the discretion of the CONTRACTING PARTY.

The sprints may include several features, in quantity to be defined in the planning meeting.

The CONTRACTED PARTY's team must perform, regularly throughout the execution of the services, the updating of products, source code, scripts, artifacts, work items, activities in the tools used for the management of the project, of the product and for the contractual follow-up existing in the CONTRACTING PARTY's environment.

The CONTRACTED PARTY shall record the deliveries of the products in the CONTRACTING PARTY's Follow-up Tool (Redmine tool).

The CONTRACTED PARTY shall deliver the source code and the build project and relative documentation, in the CONTRACTING PARTY's version control system and build (GitHub tool).

The CONTRACTED PARTY shall accompany the publication of the release and the promotion in the environments of the CONTRACTING PARTY.

The meetings of Product Understanding, Release Planning, Planning, Sprints Review and Retrospective, must occur in an agreed manner with the CONTRACTING PARTY, together with the company hired to implement the ARO.

The definitive acceptance of the services is issued only after the general and specific conditions of the contracted services are met, as established in this Term of Reference.

At the exclusive discretion of the CONTRACTING PARTY, the stage of the work plan may be concluded by the CONTRACTED PARTY with the partial delivery of the services and/or artifacts requested in the SO. In this case the missing items may be executed in another step, and the sizes of the affected deliveries should be recalculated, reflecting the new values obtained of term and amount.

Regarding the products delivered and for which TRD has been issued, the CONTRACTED PARTY shall ensure the **WARRANTY** of the same against defects and non-conformities, for a period of 12 (twelve) months from the date of signature of the respective TRD. This guarantee is valid even after the end of the contract.

Acceptance, criteria and methods (products b, c, d, and e)

a. In the evaluation phase of the services, after the provisional delivery (registered in the Redmine Tool), the CONTRACTING PARTY performs all the activities for









verification and validation of the services, resulting in the issuance of the Final Receipt Term.

- b. The validation and verification of the services delivered are performed by the Product Owner (PO) and by the CONTRACTING PARTY's inspectors.
- c. The preliminary and provisional evaluation of the delivered services is initially carried out, only after this stage, and with the agreement of the CONTRACTING PARTY, the definitive delivery and respective issuance and signature of the TRD may be carried out.
- d. The provisional acceptance is given by the technical inspectors and is conditioned to the fulfilment of the conditions established in the respective service order.
- e. The final acceptance is conducted by the inspectors, technical inspectors and managers of the Contract.
- f. Once the deliveries specified in the service order have been made, the CONTRACTING PARTY must homologate them, considering them accepted, enabling the CONTRACTED PARTY to include them in the billing.
- g. During the product evaluation phase, non-conformities are communicated to the CONTRACTED PARTY.
- h. If the CONTRACTING PARTY, prior to the issuance of the TRD, judges that the quality of the delivered products and items not conforming to the specification is low (i.e., exceeds 40% [forty percent] of the scope of the SO), the CONTRACTOR may formally cancel the SO or part of it, informing the fact to the CONTRACTED PARTY, without prejudice to the application of the sanctions defined in this call notice.
- i. Once the *non-conformities* are solved by the CONTRACTED PARTY, the latter makes a new delivery of the services and the reception flow is repeated.
- j. The deadline for the correction by the CONTRACTED PARTY of the "*non-conformities*" identified after the provisional acceptance is 5 (five) working days after the communication.
- k. The CONTRACTED PARTY may formally request the CONTRACTING PARTY to extend this deadline, before its termination. The new deadline proposal and its justification must be included in the request.
- 1. There will be as many corrections as necessary to meet the technical quality or what was specified.
- m. The conditions for accepting the services must be described in the respective service orders.
- n. The issuance of the TRD does not exempt the CONTRACTED PARTY from eventual revision or audit of the products or services delivered, which may generate sanctions or charges.

SLA - Service Level Agreements (b, c, d, and e)

a. The CONTRACTING PARTY will use service level indicators to measure the level of performance achieved in service provision (IAES and IQES).









- b. Payment for a Service Order may be reduced in situations where the minimum service levels established in this section are not met.
- c. When applicable, the SLA indicators should be added up for the application over the amount to be invoiced in the respective SO (that is, they are cumulative).
- d. The indicators will be measured from the beginning of the contractual execution, in the defined periodicity, and the CONTRACTED PARTY will be informed of the results in order to provide the eventual adjustments that will be necessary in the dynamics of the provision of services.
- e. At the discretion of the CONTRACTING PARTY, in the first 90 (ninety) days of Contract, due to the adequacy to the model of execution of the object by the CONTRACTED PARTY, the application of the charge of service levels may be dismissed.
- f. The CONTRACTED PARTY shall be responsible for determining the quality and performance indicators of the Service Orders, with immediate verification by the CONTRACTING PARTY.
- g. When the failure to reach the service levels has been motivated by factors caused by the CONTRACTING PARTY, or resulting exclusively from unpredictable factors beyond the control of the CONTRACTED PARTY, the latter shall present the justifications for analysis by the CONTRACTING PARTY.

IAES - Delay in Services Execution Indicator,

- h. Applied to all Service Orders, as defined:
 - i. Indicator IAES Delay in Services Execution Indicator
 - ii. Objective Measure delays in SO execution.
 - iii. What it measures Days of delay of the CONTRACTED PARTY to complete the service.
 - iv. Periodicity Measured for each SO after definitive receipt.
 - v. Where it measures CONTRACTING PARTY services follow-up tool
 - vi. Who measures CONTRACTED PARTY
 - vii. How it measures:

IAES = (PES-PMES)

Where:

IAES – Delay in Services Execution Indicator.

PES – Deadline for the Execution of Services, in working days.

PMES – Maximum Deadline for Execution of Services, in working days, according to SO.

viii. The counting of the period of execution of the services (PES) begins on the date of issuance of the SO, when the CONTRACTED PARTY receives the notification of the opening of the SO, and it is calculated based on working days, and it ends with the definitive delivery, except for the periods determined during





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the phase of provisional receipt by the CONTRACTING PARTY (delivery assessment).

- The final deadline will be considered the date of the last delivery that resulted ix. in the definitive receipt of the product.
- The maximum execution time of the services (PMES) is the term defined for х. this type of Service established in the respective SO.
- xi. The discount factor applied to reduce the SO payment is calculated considering the proportion of 1% (one percent) for each positive unit of IAES calculated, and the maximum discount is 15% (fifteen percent) per SO.

IQES - Deliverables and Service Quality Indicator,

- i. Applied to all Service Orders, as defined:
 - Indicator IQES Deliverables and Service Quality Indicator i.
 - ii. Objective - To measure the quality level of the deliveries - SO artifacts and products - and the conformity to the execution processes and methodologies.
 - iii. What it measures - Number of assessments of deliverables and services performed that are not satisfactory, considering the criteria described in the Service Quality Specifications Item. The same deliverable may undergo more than one assessment if delivered more than once.
 - iv. Periodicity - Measured for each SO, after each provisional receipt.
 - Where it measures CONTRACTING PARTY services follow-up tool. v.
 - Who measures CONTRACTED PARTY vi.
 - vii. How it measures:

$IQES = (Qrejected \div Qtotal) \ge 10$,

Where:

IQES = Deliverables and Service Quality Indicator

Orejected = Quantity of rejected items within the SO, considering all provisional deliveries.

Qtotal = Total quantity of SO items

viii. The discount factor applied to reduce the SO payment is calculated considering the proportion of 1% (one percent) for each 01 (one) unit of IQES calculated, and the maximum discount is 10% (ten percent) per SO. If the rounding of the IQES result is necessary, the nearest integer will be adopted, in the case of the 0.5 fraction, the upper integer will be adopted.

8. **PAYMENT SCHEDULE**

The payments schedule for the consultancy will be as follows:

Products	payment %	Deadline for delivery (weeks)
A - Work plan in its final version.	10.0	3









Products	payment %	Deadline for delivery (weeks)
B - Diagnosis of the organizations involved in the project.	20.0	10
C - Data exchange plan.	2.5	2
D - Architecture document.	2.5	5
E - Implementation of the thematic module of water resources and the integrating module of Amazonian networks.	60.0	20
F - Project closing term.	5.0	1

Note: The deadlines refer to the execution of each of the respective products

9. QUALIFICATION OF THE COMPANY

9.1. Classification Criteria

The classification will be carried out with the following parameters:

Parameter	Percentage (%)
Company Profile	10
Profile of the technical team	55
Technical proposal	25
Economic proposal	10

9.1.1. Qualification requirements (eliminatory):

No.	Criterion (Yes/No)		
1	The company must have a registration in its country that allows it to perform the		
1	specific work of the consultancy.		
	Technical team composed of at least 6 people: 1 scrum master/project manager, 1		
2	hydrology specialist, GIS specialist, 1 requirements analyst, 1 systems		
	analyst/developer, 1 systems architect		
	Of the four professionals in the team, the project manager and two specialists must		
3	have knowledge of at least two of ACTO's official languages (Portuguese, Spanish and		
	English).		
4	Delivery of the company's CV, individual team CVs, technical proposal and econo		
4	proposal.		
	Qualification of companies from Member Countries:		
	NIT; RIF; RUC - issued by official bodies;		
5	Social contract, reforms and appointments of administrators and legal representatives,		
	in the chamber of commerce with jurisdiction at the domicile of the respective		
	company.		







9.1.2. Classification of the desired experience:

The percentage weights for each punctuation criterion will be distributed as follows:

Company experience (up to 10 points)

At least two (2) works performed by the company in the last five (5) years, related to the development of platforms and information systems.

Work team professional experience (up to 55 points)

Type of Expert	Profile
SCRUM MASTER: Professional responsible for the general coordination of the project's Agile team, guiding efforts as a facilitator for the delivery of the product, according to the specifications defined in the context of Service Orders. Professional Experience: 02 (two) years in IT project management, being at least 30% (thirty percent) of that time in Agile projects; Hold certifications in technologies compatible with that of the CONTRACTING PARTY and with the profile on screen.	Maximum score: 15
SPECIALIST IN HYDROLOGY: Desirable experience in hydrological database and hydrometry	Maximum
SPECIALIST IN SIG: Desirable experience in geographic information systems focused on water resources, and knowledge in SIG tools defined here.	Maximum score: 12
REQUIREMENTS ANALYST: Responsible for raising needs and requirements with the business areas for system development, analyzing problems and specifying user stories in easy-to-understand language (understood by the development team and the business area), turning it into easy-to-understand documentation for any party involved in the process. Professional Experience: 02 (two) years as a Requirements Analyst, with at least 40% of performance in Agile projects and also training in SCRUM.	Maximum score: 8
SYSTEMS ANALYST/ SENIOR/FULL DEVELOPER: Responsible for translating the specifications raised with the business area (user area) into system solution. His focus is to develop solutions according to the needs raised, always in alignment with the architectural and software design standards established by the CONTRACTING PARTY. For SENIOR, the professional experience must be of at least 5 (five) years, and for FULL over 2 (two) years, both as Programmer or System Developer in any of the CONTRACTING PARTY's technologies for which certificates were required. To execute item 1 of the object the CONTRACTING PARTY must allocate at least 01 (one) SENIOR professional per Scrum cell. Hold certifications in technologies compatible with the CONTRACTING PARTY and with the profile in screen and also training in SCRUM.	Maximum score: 4
SYSTEMS ARCHITECT: Technical responsible for the solutions developed by the CONTRACTED PARTY, acting in the conception, project, design and architectural development of the system solution. Responsible for aligning the development team with the CONTRACTING PARTY's software architecture and design standards, ensuring the adherence of all projects and development efforts. Responsible for the technical decisions of greater	Maximum score: 4









Type of Expert	Profile
impact, always aligned with the technical area of the CONTRACTING	
PARTY. Professional Experience: 05 (five) years in Software Architecture or	
systems integration (using technologies compatible with that of the	
CONTRACTING PARTY) and to have worked in projects that adopt Agile	
methods of development. Hold certifications in technologies compatible with	
the CONTRACTING PARTY and with the profile in screen and also training	
in SCRUM.	

9.1.3. Technical proposal (up to 25 points)

Companies should make a brief presentation of the consulting capacity and methodological development in line with the objectives, products and activities presented, including specific procedures and strategies for operationalization of the most relevant activities, as well as propose other complementary activities if appropriate. The technical proposal will be presented in up to five A4 format pages, and can be complemented in Attachments with graphical elements and tables in other five pages. Maximum score: 25 points.

The technical capacity of the consulting company will be assessed in relation to the understanding of the consulting, and there will be an obligation in relation to the link between the technical proposal and what will be developed in the consulting work.

9.1.4. Economic Proposal (up to 10 points)

The Price Proposal (Fm) assessed as the lowest receives the maximum financial score (Sf) of 100 (i.e., 10%).

The formula to determine the financial score (Fp) of all other proposals is the following: Sf = 100 x Fm/ F, where "Sf" is the financial score, "Fm" is the lowest price, and "F" is the bid price being considered.

9.2. Assessment score

1. The Assessment Score (NA) will be obtained using the following formula, using two decimal places.

$$(NA) = N1 + N2$$

Where:

(NA) = Assessment Score

N1 = Presentation of the documents requested in the ToR;

N2 = Technical score.

The technical documents of each bidder will be evaluated and a "rating score" will be awarded, ranging from 0 (zero) to 100 (one hundred) points.

The applicant who obtains in any criterion a zero score, or a score of less than 70 (seventy) points in the sum of the items, will be disqualified.









10. COORDINATION AND SUPERVISION

The consulting company will provide its services to the Permanent Secretariat of the Amazon Cooperation Treaty Organization, under the responsibility of the Amazon Project Coordination. The consulting services will be supervised by the Technical Support Unit of ACTO and the National Agency of Water and Basic Sanitation – ANA.

11. LOCATION AND AVAILABILITY

The consulting company may have legal registration in any of the ACTO Member Countries, and must be available to hold the virtual meetings that are requested by the contracting party.

12. SUPERVISION OF THE CONSULTANCY

The total amount of the consultancy is R\$ 590,053.83 (five hundred ninety thousand and fifty-three reais and eighty-three cents). The payments will be made according to the delivery of the products and will correspond to a percentage of the total amount as described in the payments schedule.

The contracting party reserves the right to grant payment authorization for the products according to their quality, according to the foreseen schedule.

13. PLACE OF EXECUTION OF SERVICES

The services will be performed in the country of registration of the consulting company.

The consulting company should foresee virtual meetings with the countries.

The consulting company should also provide monthly virtual meetings to monitor the work of the consulting company.

14. DURATION OF THE CONSULTANCY

The contract term is 37 (thirty-seven) weeks, following the procedures that are defined in the decision instances of ACTO.









ANNEX I

SUMMARY OF THE IKMS CONCEPTUAL FRAMEWORK DOCUMENT AND PRELIMINARY DESIGN OF THE AMAZON REGIONAL OBSERVATORY WITH ITS TECHNOLOGICAL INFRASTRUCTURE

Contents

- 1 Preliminary design of the ARO
 - 1.1 Structure of the solution with all ARO applications
 - 1.1.1 Actors and user profiles
 - 1.1.2 Operational process of the ARO solution
 - 1.2 General functionality of the ARO with menus and contents
 - 1.2.1 Thematic modules
 - 1.2.2 Integrator modules
 - 1.2.3 General modules
 - 1.3 Sketches for each ARO content and module subpage
 - 1.3.1 General recommendations for graphic design
 - 1.3.2 Home Page Home page
 - 1.3.3 Explanatory web page
 - 1.3.4 GeoAmazonia Regional geographic information
 - 1.3.5 Additional information notifications and alerts
 - 1.3.6 Restricted area User access or creation
 - 1.4 ARO interoperability model for information gathering
 - 1.4.1 Technical introduction
- 2 Requirements for the operation of the ARO
 - 2.1 Defined software tools for ARO
 - 2.2 Infrastructure necessary for the implementation of the ARO
 - 2.3 Scenarios and alternatives for ARO technology infrastructure









1 Preliminary design of the ARO

Since the ARO is an integral solution that will be supported by ACTO's Knowledge Management Information System (KMIS), the following is a description of the preliminary design of the ARO considering technological aspects for an adequate operation of the service. The Amazon Regional Observatory - ARO - requires a computer tool to be used via the Internet that allows the acquisition, storage and publication of information corresponding to the themes of the ACSA and that comes from various government entities of the member countries, or even better, from the National Information Systems. In this way the ARO compiles and processes the data that comes from the information services from the countries.

Prior to the publication of collected and processed information, some activities and agreements must be executed in order to obtain an agile, efficient and effective publication that meets the information needs of the users of the ARO information portal to be implemented.

From the functional computer and operational perspective of an initial version of the ARO, it is summarized in the data acquisition and consolidation activities generated by each of the different entities of the MCs related to the ARO for the purpose of generating and providing information of interest in the different topics. The data acquisition activity is accompanied by a processing that allows the consolidation of information in repositories and then publish them on the Internet through friendly interfaces and above all functional for the user.

It is important to emphasize that the responsibility, as far as the validity, pertinence and timely delivery of the data is concerned, is solely and exclusively of the entity that generates or provides it. Therefore, processes, modules and tools to be implemented will be in charge of supporting the loading, consolidation and publication of data.

For the execution of the data loading and consolidation processes, certain recommendations and procedures are given to guarantee the quality of the data collection and publication process in the portal.

Based on the identification of needs carried out with the MCs in the area of Knowledge Management specifically in the CITES theme, they make it possible to propose the ARO solution with the different modules and computer tools to maintain an interaction with the MC entities as information providers.

The work meetings with the MCs made it possible to address aspects of the operation of their IT systems specifically for CITES and Biodiversity, the breadth and diversity of the information and technology systems handled by each of the MCs did not make it possible to identify, and even worse, define a technological platform on which the ARO Solution can be implemented. Therefore, this document describes functional aspects that are independent of the technological platform, so the definition of the technological platform will make a proposal of two technological alternatives on which the ARO Portal can be implemented.

1.1 Structure of the solution with all the applications of the ARO

By means of a diagram, the macro solution that is being proposed for the Amazon Regional Observatory-ARO is presented. This will be a full web solution oriented to the provision of sustained information services and aligned to the Knowledge Management System -IKMS- of ACTO.



Object 1: Component diagram of the ARO solution

As can be seen in the component diagram, the ARO solution initially includes functional software components which, as defined in the IKMS, are classified mainly into thematic modules and integrating modules which will be supported by software tools as described in the Information and Knowledge Management System (IKMS), which will be available through the ARO Web Portal:

- **Thematic modules,** oriented to the acquisition and consultation of data from the different sub-themes of the ACSA such as CITES, Biodiversity, Forests, Water Resources and others.
- Integrator modules, mainly oriented to provide integrated information consultation services of all the sub-themes, to all users of the ARO. GeoAmazon, Digital Amazon, Amazonian Networks and Our Amazon are proposed as integrating modules.
- General modules, groups together the functionalities of purpose and cross-cutting support throughout the ARO Portal, oriented to the management of security and information management, also allowing the acquisition and consultation of information that is not related to the themes and sub-themes of the ACSA, that is to say, allowing the management of socio-economic and joint information of the member countries and the region, for example, but which is important to consider as basic information.

IKMS Modules or tools to support learning and collaboration processes can also be part of the ARO solution, however, according to ACTO's initial needs, these modules can be incorporated at a later stage as part of the IKMS or another full solution such as RedCia.

The stated components that are going to be implemented as part of the ARO solution will be operative and technologically integrated according to the conceptual definition of the IKMS, these modules will be visible to the user through the ARO web portal component, this portal will be publicly accessible with open information, but will also have a set of restricted access functionalities for the main users of ACTO and member countries that will actively act in the exchange of information.









1.1.1 Stakeholders and user profiles

In general terms, there are three types or levels of stakeholders identified for the proposed solution: the ARO as the solution's administrative entity (ARO), the entities participating in the process that provide or consume information (External Entities), and on the other hand the general users who will consult information through the portal (citizens in general).

STAKEHOLDER	DESCRIPTION
ACTO / Amazon Regional Observatory	Entity responsible for the management and administration of the full solution, processes and information of the Amazon Regional Observatory -ARO
External Entity	It corresponds to all the entities of the member countries that are involved in the process of collecting, loading and publishing information both as providers of the data and as beneficiaries of the information.
External Computer Systems	It refers to the information systems identified in Entities of the Member Countries and the Region that have information with which interoperability could be implemented to exchange information with the ARO Portal through technological means.
General Citizenship	General stakeholder corresponding to all individuals representing different sectors who will consult information and data that will be available through the ARO portal

Object 2: Types of stakeholders identified for the ARO solution Source; Own preparation

For the specific case of external entities, during the phase and visits to the countries, several institutions related to CITES have been identified that have expressed their willingness to collaborate and participate in the exchange of information with the ARO, information that will be consolidated and structured for consultation within the same information portal.

Based on the definition of the components, modules and functionalities to be implemented in the ARO solution, it has been possible to identify the user profiles for each of the stakeholders: ACTO / ARO, External entities that provide data and citizenship in general. The user profiles presented below have been identified taking into account the stakeholders of the solution, the modules, tools and functionalities of the system and the responsibilities that the professionals of the ARO Observatory should have for the management and administration of the data.

Once the solution has been implemented, the ARO must consider these user profiles within its organization for proper functioning as part of the operation.

Stakeholder	User profile	Description
	System Administrator	ARO professional who manages the Information System.
ACTO / Amazon	(ICT specialist)	Responsible for managing user creation, user groups, access and other system settings.
Regional	Information Manager /	ARO professional who manages the Information System as the
Observatory	ARO	person responsible for the data stored. Responsible for the parameterization and configuration of the computer tool where
	(Data Science Specialists)	the options for loading, administration, maintenance and publication of data are established.
	GIS Manager	ARO professional responsible for managing geographic information, using GIS tools, processing and preparing data for
	(GIS Specialists)	visualization.
	Portal Administrator	ARO official in charge of keeping the content of the Observatory
	(Communication	portal updated: Publications, news, graphic design, among
	Specialist)	others.









Stakeholder	User profile	Description
MC / Extern Entity	Data Manager / Provider al Entity (Focal point by topic)	The person responsible for the data is the user or officer of an information provider, who is in charge of generating, periodically uploading and editing, if applicable, the data required by the ARO. He has access mainly to the data acquisition module. They will primarily be officials of Government Entities, but may also be individuals from Private Companies or others who wish to share information.
	Institutional Consultation (Focal point)	User of consultation, official of the entities related to the process and that demand information from the system. They are registered as a query user and are assigned a credential to access queries with exclusive functionalities for this group of actors
	Information Systems	User defined at a Computer System level that automatically and by means of the implemented technical interoperability carries out the load of information to the ARO; in addition he would also allow the consumption of information of the ARO.
General Citizenship	Citizen consultation user	General profile of consultation oriented to the general public that consults information in the portal without any restriction. You will only be allowed to consult information but will not have access to the restricted functionalities within the portal.

Object 3: User profiles identified for the ARO solution

1.1.2 Operational process of the ARO solution

The design of the proposed full ARO solution will support the operational processes of the IKMS and therefore the ARO, within which some activities have been identified that are part of the main processes of the ARO value chain related to the operation of the ARO portal, these are:

Process	Sub-Processes/Activity	Description
External entities of the member countries	Generation of the information (Management).	It is executed in the supplier entities that are part of the process and the ARO. This is where the source data is provided as input for processing, analysis and subsequent publication. The data must be prepared under a defined semantic standard
Storage Management	Data Acquisition	It refers to the set of activities and elements involved in the collection of data from different external entities such as information providers to storage in the ARO databases. Data acquisition is based on previously defined standards and can be done using office tools, through software facilities or through interoperability between computer systems.
Information Analysis	Information processing and analysis	The information collected and stored in the ARO databases is reviewed, standardized, purified, and processed according to the structures defined for the ARO system. They can be processed to make specific reports on one or several topics; in addition, information analysis can be made always generating results that can be published through the system.
Information Publication	Presentation and publication	The information received from the member countries, already validated, can be published in the portal and made available to external and internal users through the different functionalities of the corresponding integration modules.
Exchange of Information	Provide information	The ARO portal shares the information consolidated, standardized, processed and validated by the Observatory through technical interoperability functionalities that allow other computer systems to share.

Object 4: Main activities of the ARO solution









From the operational perspective of the ARO, the person responsible for the activity is listed below. He or she will have a user profile within the ARO solution and for each one there is a general description of the activities he or she will carry out for the operation of the Observatory.

User profile	Activity
Data Manager / Provider Entity	The Entity has the data that have been agreed to be exchanged with the ARO; it prepares the data according to the standards defined with the Observatory. For system exchange, it coordinates the implementation of web services (interoperability) based on the standards defined by the ARO and the MC.
Data Manager / Provider Entity	The external Entity, within the framework of the exchange agreement, sends or records the standardized information. For the deposit of data in the Portal, the Entity can do it through the platform in two different ways: Online loading, web service. Alternatively you can send the standardized data in file for upload by the ARO.
IKMS Systems - Data Acquisition / ARO Module	The ARO observatory's technological solution, for cases where it applies mainly document, multimedia and alphanumeric information, automatically validates the data and stores it in the system's databases.
GIS / ARO Administrator	The ARO professionals will be in charge of reviewing, processing and loading the geographic data and parameterization of geographic data. They will be in charge of collecting all the MC information, consolidating, standardizing and uploading it on the ARO spatial data infrastructure platform.
Information Manager / ARO	The professionals of the observatory will also be able to review and upload the document, multimedia and alphanumeric data in case the member countries cannot do it through the platform.
Information Manager / ARO	The professionals of the observatory will be able to review, approve, process and analyze the information according to the specific needs. These activities will be carried out with the support of the technological solution and the designed modules, as well as with the use of specialized technological tools for analysis and processing.
Information Manager / ARO	As the ARO has validated information, it can publish the information through each of the integrated modules. Thematic information should be reviewed and updated on an ongoing basis.
Portal Administrator	Communication and graphic design professionals will be able to carry out maintenance activities of the website: updating texts, infographics, images, videos, in order to attract more external users.
Institutional consultation	Professional members of some of the Provider Entities who can view information they have shared and who have shared for the ARO, will be able to see all the information, except for restricted information.
Citizen Consultation	This is the external end user who has access to the internet portal, and will be able to view all the public information that exists in the ARO.

Object 5: Operational activities by user profile.

1.2 General ARO functionality with menus and contents

The ARO portal will be the entry point to ARO information, a website that will allow users to access resources and information related to the Amazon Region in a simple and integrated manner.



Object 6: ARO Portal Solution Site Map

The ARO web portal will be supported by content management software -CMS- which will allow the appropriate organization of the integrating and thematic modules that are part of the IKMS and which will be incorporated into the ARO portal. In addition to these modules, there will be web pages with textual content, links, images, documents, computer graphics and others, allowing the portal to meet the objective of communicating information to users in a simple and user-friendly manner.

The modules with their general sketches or "mockups" are described below, the functionality of each according to the ARO site map. After the description of these IKMS modules with their sketches in the following section will describe the menu options of the portal and some sketches of the portal itself.

Category	IKMS module in the ARO portal	
Thematic modules	Thematic data acquisition (document, geographic, alphanumeric)	
	Standardized alphanumeric data acquisition	
	CITES (detailed data acquisition), Biodiversity, Forests, Water Resources	
Integrator modules GeoAmazon		
	Digital Amazon	
	Amazonian Networks	
	Our Amazon	
General modules Acquisition indicators		
	BI or management reports	
	Administration and Security	
Interoperability	Web Services for Interoperability (Provider - Consumer)	

Object 7: IKMS module catalog in the ARO portal solution

Based on the requirements gathering in the member countries and ACTO, the functional design proposal is made, which allows attending the needs raised by the users. The modules or specific functionalities that the full solution of the ARO will have are grouped by component and will be implemented within the development phase of the solution.









1.2.1 Thematic modules

The thematic modules, as defined above for the IKMS, correspond to those that have information management functionalities with themes established in the ACSA, initially and with greater emphasis will be the facilitators of the acquisition or capture of data for each theme at different levels, summary or aggregate acquisition of thematic data or detailed acquisition of specific data. For these two levels, standards for information exchange and forms of interoperability must be defined as part of the technical design.

Thematic data acquisition

This is the most important module for collaboration and information exchange between the ARO and the Information Providers of the member countries. Technically, it is ideal to have the interoperability standards defined at a legal-organizational, semantic and technical level, However, in the event that technical interoperability cannot be achieved in the first phase, since it depends on implementations in both the ARO and country systems, the information collection process as described in the Information Exchange Procedure may be non-automated with the support of personnel dedicated to the capture, standardization and processing of information.

The users of this module will be the information generators or suppliers both of the ARO and of the member countries. This module within the ARO Portal will have restricted access, and each user profile will only be able to edit their information, with the exception of the platform administrator.

Functionally and as described in the IKMS Data Acquisition module, which is immersed in the ARO Portal, it has three functionalities that respond to each type of information.

Document and multimedia data acquisition

After entering the restricted area, the user will have an option that allows him to upload document or multimedia type data. The following illustration shows how the user can upload a document; before uploading a document or multimedia type file, the data corresponding to the Dublin Core metadata must be registered:

- Content: Title, keys, label, description, coverage
- Intellectual Property: author, editor, other collaborators, rights
- Instantiation: Date, format, identifier, language

These must be entered along with the digital file.









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Object 8: Sketch for uploading documents and multimedia files

In the case that the technical interoperability is implemented in the information provider systems by the member countries, there should be an automatic functionality through the implemented web services, whose programmed execution will not be visually evident to the user, but to the system administrators or managers.

Geographic Data Acquisition

This sub-module is oriented to the administration and configuration of the geographic viewer that constitutes the basis for the module called GeoAmazon. It is a module oriented only to the ARO's geographic information manager, more than a module, it corresponds to a series of tools and procedures that the geographic information manager must follow to collect, prepare, standardize, and make the geographic information compatible:

Geographic Information Management involves:

- Review of the geographic information delivered in the case that it is in shape or geodatabase format, the geographic information must be edited or processed to put all the information in a regional standard that must be defined.
- Carry out the storage of geographic data in the corporate database (geodatabase) that has been defined for the ARO; they must be stored according to the thematic classification and categories of the ACSA.









- In the case where member countries can exchange information through web services, the administrator must review and configure the services within the map server for the publication of the same through GeoAmazon.
- Carry out the publication of map services following OGC standards. The map services will configure:
 - The symbolization of each layer
 - Its display according to scale limits
 - The typology of the service: map service, feature service, tile service, OGC service
 - Configure the set of layers accessible from GeoAmazon
 - Loading of geographic information metadata according to a defined semantic standard

The ARO GIS administrator user must have access to the various software components for data collection:

- GIS software tools for editing: ArcGIS, qgis, gvsig or others to be defined.
- Access to the corporate geodatabase with reading and writing permission
- Access to map server for administration

With respect to geographic information, the level of technical interoperability that can exist between the ARO and the member countries is quite good because all the countries have published information; however, this information does not necessarily correspond to the topics of the ACSA and the regional standards required to present the information in a consolidated manner.

Standardized Alphanumeric Data Acquisition - Thematic Indicators

It corresponds to the module that allows the loading of alphabetical and numerical data prior to the definition of a standard at the semantic and technical level that allows the exchange of information with member countries. For the specific case of the Observatory, knowing the diversity of themes and sub-themes that it must handle, we propose, based on the best practices of Observatories that handle regional information, the collection of consolidated and summarized data through indicators which must be previously defined and consider some of the following variables:

- Thematic/sub-thematic ACSA
- Date (year, month or day) to which the data corresponds
- Geographical coverage (country, region of the country, etc.)
- Category or categories within the sub-theme to which the data corresponds
- Specific quantitative or numerical data with its respective unit of measurement

This semantic standard that would apply to all ACSA themes/sub-themes must be supported internally by a suitable relational database structure. Below is a sketch of what the module must have for this data load, which, as part of the information exchange between ARO and MC, may be by means of a screen, a previously prepared Excel spreadsheet file, and even better, by means of web services. The member country, depending on the level of implementation of its IT systems, may exchange the information in one of the above-mentioned ways.









Welcome SITD

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3	10	1	1	1999		02					0.1	1.708.424,96		
4	10	1	1	1999		03					0.1	1.874.946,78		
5	10	1	1	1999		04					0.1	1.338.965,40		
6	10	1	1	1999		06					0.1	2.979.816,37		
7	10	1	1	1999		05					0.1	1.543.909,18		
8	10	1	1	1999		08					0.1	3.032.379,64		
9	10	1	1	1999		22					0.1	1.251.528,72		
10	10	1	1	1999		10					0.1	1.663.208,89		
11	10	1	1	1999		11					0.1	3.372.361,47		

Object 9: Sketch for loading standardized indicator data

Knowing that for each theme/sub-theme of the ACSA there is important regional information for the observatory that must be acquired or collected, functionalities must be defined at the level of detail that will allow the collection of specific information for CITES, Biodiversity, Forests, water resources and others; each of these modules must be designed specifically as proposed in the IKMS, however within the ARO Portal they can be incorporated as they are implemented according to your needs.

Data acquisition from monitoring networks

Within this category of detailed data acquisition, as well as CITES, will be the database models and definitions made for the collection of detailed data from monitoring networks such as water resources monitoring networks, river water quality monitoring network, groundwater monitoring network and others.

As with the collection of geographic data, the data acquisition manager must design an oriented module that allows monitoring network information management. This module will be supported by a series of tools and procedures to collect, prepare, standardize, and make geographic information and standardized alphanumeric information compatible.

The level of technical interoperability that may exist between the ARO Portal and the Monitoring Data Providers must be defined after agreements and semantic definition for data exchange.

The information acquired from the technical-scientific entities that manage the monitoring networks can be in two ways:

- Through web and online services made available by the provider (technical and online interoperability)
- By delivering files or offline information service with certain periodicity.

The information collected within the ARO will allow specialists to process and analyze information to obtain results for decision support at the regional level.

1.2.2 Integrator modules

As defined in the Information and Knowledge Management System -IKMS-, the information system modules called integrators are conceptualized to group and present in an integrated and easy to use way, information that was provided from different data sources, stored according to the type of









information and classified according to the theme/sub-theme to which it belongs. These modules will be supported by various technology tools whose technical characteristics and benefits will be transparent to users who consume the information that is organized within the IKMS.

GeoAmazon

GeoAmazon will be a geographic information viewer that will allow the publication of geographic and document information related to the themes/sub-themes of the Amazon region. This information will be available and organized according to the themes and categories that are defined. The information to be presented will be accessible to the user through an Internet application within the ARO web portal, which will provide full access and navigation facilities. Certain information will be restricted and as such may only be viewed by ARO users.

In general terms GeoAmazon will be composed by two great functionalities of information consultation, for these two functionalities of the module to take like reference base, which is available in the websites http://plataforma.Amazonía.mapbiomas.org/map and https://www.globalforestwatch.org

Geographic viewer (Geovisor)

Viewer to present geographic information of all countries, it will be an easy to use geographic viewer that will have the following basic and traditionally used functionalities:

- Selection of specific geographic information that needs to be visualized
- Geographic information search engine within a list of layers, which will be organized and classified by topics/subtopics and categories.
- The application will have a direct interaction between map and list of geographical layers. Each geographical layer will have its key and explanation of the data.
- You will be able to consult alphanumeric information associated with the specific geographic element selected.
- The viewer will allow the presentation of information both from the ARO database and external information available through WMS, WFS or other standards defined by OGC.
- The viewer includes geographical navigation tools (move, zoom in, zoom out), activation of layer display, transparency and print map.
- You may also have links to documents or statistical information as attachments.



Object 10: Sketch of geographic viewer with example of geographic data

Geographical analysis

In a second stage and once the primary information of the countries is available, the GIS administrator will be able to process and carry out certain analyses on the geographic information, these results can be presented in a tool that facilitates the reading of these specific analyses to the final user. From the functional point of view, specific, attractive, simple and intuitive reports should be designed, but they are considered functionalities to visualize:

- historical series,
- comparative maps,
- evolution or changes in evolution over time,
- Statistical graphs linked to geographical information.

Regarding security, external customers will only be able to view public information. Restricted information can only be viewed if users enter the system with their credentials through the restricted area option.



Object 11: GlobalForestWatch site-based geographic analysis viewer

Digital Amazon

This module, according to the IKMS, has great functionalities for consulting information that must be enabled in the ARO portal: Consultation of document and multimedia information, as well as presentation of corresponding thematic and category indicators.

Document and Multimedia Information

This functionality, as part of the Digital Amazon module, will allow the search of documents based on the metadata entered through the corresponding module. The documents and multimedia files will be classified by topic / subtopic and later by category, of each document the name, a summary description and other basic data will be visualized, after finding a document and selecting, the user will be able to visualize and download the file according to the format: pdf, docx, doc, xml, mp4, wav, shp, among others. Additional search filters can be incorporated for the search, such as the Country of the documents, dates, among others.



Object 12: Sketch of document and multimedia information search engine

Indicators

The standardized alphanumeric data that were collected as indicators through the corresponding data acquisition functionality can be presented with some richness at the regional level of the member countries, these indicator reports can be represented as heat maps or coroplets, various bar graphs, pies, lines and others, in addition to presenting tabular data which could be downloaded by users.

The information corresponding to the indicators can be visualized under the same suggested organization: thematic/sub-thematic ACSA and its categories for each one of them, additionally there will be additional consultation filters that the user can use as Member Country and year of the information. About this functionality you could incorporate links to related document information or multimedia files.



Object 13: Sketch of presentation of indicators

Amazonian Networks

This module considers the presentation of information acquired or collected from entities responsible for governance and monitoring of natural resources at regional and local levels. This module will be a fundamental tool for the situation room in Water Resources of the ACTO, which will have information through the collection of data and interoperability with the systems of the National Water Agency - ANA- of Brazil; additionally and in complement with the data provided by ANA, it will have the information of the Amazon Hydrological Network -AHN.

Considering initially the two sources of information mentioned above, for the Observatory it is suggested to present information in two ways: Online network monitoring dashboard and monitoring network information reports for analysis (historical management).

Online network monitoring dashboard

It refers to a functionality for displaying the most up-to-date information from the monitoring networks, i.e., information reporting by each of the monitoring networks; this information is summarized and must be consulted online through web service interoperability between the ARO systems and the monitoring entity's systems. If online consultation is not possible, updated summary reports should be provided at a frequency agreed upon with the responsible entity.

For the specific case of the ANA Information source through the situation room, this information is available publicly on the website <u>http://portal1.snirh.gov.br/ana/apps/webappviewer/index.html?</u>.

- Maps of waterway sections vulnerable to flooding
- Emergency situation or public calamity status due to flood
- Emergency situation or public calamity due to drought



Tablero de monitoreo - Recursos Hídricos Fuente: ANA



Object 14: Sketch of water resources monitoring dashboard - online, maps taken from ANA website http://portal1.snirh.gov.br/ana/apps/webappviewer/index.html?

Within the monitoring dashboard, information will be available for the management of critical situations, which are coordinated by the state's water resources management agency -ANA-, where representatives of the local meteorological institute and the state's Civil Defense may also be present, and seek to identify events and subsidize the decision making process of adopting early measures to mitigate the effects of droughts and floods. In addition to ANA's public information, other related data sources are available, such as the Amazon Hydrology Network (AHN), and all the georeferenced information of the Project can be presented within a geographic viewer.

Geographic information of the network will be presented in the control dashboard. For example, when selecting a point of interest, station information will appear, as well as other summarized information resulting from the data collection carried out in each of the stations. Among the information that can be presented is:

- Location maps of existing river stations in the Amazon basin (Colombia, Ecuador, Peru, Bolivia and Brazil RHNR)
- Inventory of stations (Hydro);
- First version of the monitoring network of the Amazon Project;





Object 15: Sketch of monitoring dashboard - Amazon Hydrology Network - AHN - online

Monitoring network information reports

A second consultation functionality of the Amazon monitoring networks that will initially be based on ANA and AHN sources, will be a set of detailed and managerial reports that will be the result of information collection, processing and design oriented to have information to support decision making, these reports will be designed on the detailed technical and historical information of the data. For example, data from hydrometeorological networks, specifically reading data from fluviometric stations, telemetry or others that generate data by the minute, can be processed and consolidated in order to have reports on behavior trends at the level of hours, days, weeks, months and years by geographic coverage and other variables that specialists can define.



Here is a screenshot as an example.

Object 16: Sketch of monitoring networks analysis report result of processing, based on Power BI example reports









Our Amazon

The Our Amazon module, as well as Digital Amazon, will have document information, allowing the search of documents which will be based on the metadata entered through the corresponding module. It will have similar operation, however, what changes is the source of information provider, for Digital Amazon the source of information will be the governmental entities of the member countries, while in Our Amazon will be presented information provided by the private company, this information will not be able to be official of the countries, however, it will be able to pass a process of validation on the part of the administrator of administration of the system.

Additionally this module will be able to present information that is captured from social media such as Twitter, Facebook, Instagram and others, about initiatives related to the topics, basically in these can also be stored to a database and then can generate reports on this information. Part of a second phase will be to make sentimental analysis, to geographically locate these initiatives in order to know more about the themes, consultation functionality that will be supported in functionalities under the concept of Bigdata.

Country Window

The Country Window module will present tabular, document, statistical and geographic information related to socio-economic data from each of the eight ACTO member countries, showing socio-economic data such as: Population, Poverty Indicators, Gross Domestic Product, ODS indicators, and other relevant data at the country and Amazon region levels. In addition, this module will present economic information that is considered important at the regional level, such as data and situation regarding COVID19, among others.

1.2.3 General modules

There are modules or functionalities not categorized within the integrated modules or thematic modules, however these can be implemented and if necessary incorporated into the ARO Portal because they are part of the IKMS. The functionalities that are within the defined modules are:

Data acquisition - Socio-economic indicators

For the specific case of the Observatory in complement to the themes and sub-themes of the ACSA, it is necessary to collect consolidated and summarized data and indicators related to socioeconomic information of each of the member countries, each of these indicators with the following variables:

- Socio-Economic Theme,
- Date (year, month or day) to which the data corresponds
- Geographical coverage (country, region of the country, etc.)
- Category or categories within the socio-economical theme to which the data corresponds
- Specific quantitative or numerical data with its respective unit of measurement

Internally, it may be supported in the same relational database structure of the ACSA indicators, for this data load, which as part of the information exchange between ARO and MC may be through screen, previously prepared Excel spreadsheet file, and even better, through web services. The member country, depending on the level of implementation of its IT systems, may exchange the information in one of the above-mentioned ways.









BI Reports

Specific reports are designed to present information about the existing information in the ARO databases. These reports will be oriented to the management level, that is why it will be important to create them using tools called BI, which will present dashboards that will allow the user to obtain a summary of the data, and will present dynamic reports, allowing users to select dimensional variables to run reports and to build new information from the data and dimensions presented in the report. These reports are very important, since they allow the user through the ARO portal to interact with existing information to organize it and generate specific information or results of interest to the information user.

These reports can be put into consideration in some way so that the ARO administrator can publish them through the portal.

Governance - Administration and Security

The access and navigation to the Portal is free for every user, however, for the entrance to the modules that will allow the administration tasks and to certain functions of restricted access, it will be required to have a user name and a password. For this the Portal will have a module that will allow registering a user, assigning profiles, updating and editing, parameterization options if the case is the elimination of a user.

				🍰 Área privada 🔍 Buscador 📷 Contáctenos			
©∩∩®	Observ Region Amazó	ratorio al Inicio Sobre ORA • Geoarnazonía • nico	Amazonia digital Redes amazónicas Nuestra amazonia				
OTCA - Área privada - Ar	OTCA - Äres privada - Administración						
Administración	Param	etrización API Consumo de Datos Web Service Seguimiento	Análisis Carga y Registro BIG Data				
Área privada.	Área privada. Administración						
Bierrivenido, Usuario enoistrado		Usuario					
ADMINISTRACIÓN				~			
all Indicadores	Ť	Tipo usuario	Ninguno V				
🖻 Carga	~	Departamento	Ninguna 🗸 🗸				
Reportes	÷	Usuario Directorio Activo Windows *	Usuario Directorio Activo Windows (de 1 a 256 caracteres)				
O ₀ ⁰ Macstros	÷	Nombre de usuario *	Nombre de usuario (de 1 a 286 caracteres). Debe ser el mismo del Directorio Activo de Windows				
		Email*	Email (de 1 a 1024 caracteres)				
SEGURIDAD		Nombre corto *	Nombre corto (de 1 a 128 caracteres)				
🏝 Usuarios	×	Nombre persona *	Nombre persona (de 1 a 1024 caracteres)				
Permisos		Activo					
• Rol	_	Usuario	Usuario (de 1 a 5 caracteres)				
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C Autora	Ĵ		Naro				
٢		Usuario		^			

Object 17: Sketch for administration, parameterization and security to the system Sources: Own elaboration



1.3 Sketches for each content and module sub-page of ARO

After describing the functionalities of the thematic modules and IKMS integrators that are part of the ARO, the menu of fundamental options of the ARO portal is presented below, as well as the proposed web pages and screen shots that would go inside the Portal. On this basis, during implementation, all communication and graphic design aspects must be taken into account so that the Portal has the expected impact on end users.

Menu	Submenu - pages	Description		
Open options	·			
Home	Home	ARO portal home page		
About ARO	What is ARO	Explanatory web page		
	Information exchange	Explanatory web page		
GeoAmazon	What is GeoAmazon	Explanatory web page		
	Regional geographic information	Page with a catalog of regional geographic information available for download in shape format or link to services		
	Geovisor	Described in integrator module - Geographical viewer		
	Information analysis	Described in Integrator Module - Geographical Analysis		
Digital Amazon	About Digital Information	Explanatory web page		
	Documents and multimedia	Described in integration modules - Digital Amazon - documents and multimedia		
	Indicators	Described in integrative modules - Digital Amazon - Indicators		
Amazonian Networks	About monitoring networks	Explanatory web page		
	Online monitoring	Described in integrator modules - Amazonian networks - online monitoring dashboard		
	Monitoring reports	Described in integrator modules - Amazonian networks - monitoring network information reports		
Our Amazon	About Our Amazon	Explanatory web page		
	Information	Described in integrative modules - Our Amazon		
Country Window	About Socio-Economic Information	Explanatory web page		
	Country Reports	Described in integrator modules - Country window		
Additional Information	Notifications and alerts	Page indicating the most consulted information and the recently published information		
	Contact us	Explanatory web page		
	Help	Explanatory web page		

Object 18: Catalog of public pages of the ARO portal Sources: Own elaboration

On the other hand, below is a list of the set of pages or functionalities that should be considered within the ARO portal, but as restricted access.

Menu	Submenu - pages	Description
Restricted area	User creation	User creation request page
Data Acquisition	About data acquisition	Explanatory web page









	Document and multimedia	Described in thematic modules - Data acquisition - documentaries and multimedia
	Geographic	Described in thematic modules - Data Acquisition - Geographic
	Alphanumeric - Indicators	Described in thematic modules - Data Acquisition - Indicators
CITES	CITES	Complete module to be described in the detailed CITES design chapter. It can be embedded as a complete component within the portal
Governance	Administration and security options	Module for security management, access and parameterization: Creation of user profiles Assigning user profiles Parameterization for handling information catalogs

Object 19: Catalog of ARO portal pages

Next, the sketches of the main screens exclusively of the Portal are presented, these complement of the sketches of IKMS modules of the previous section, the idea with the presented ones is to show the structure or elements to be taken into account during the implementation, these can change depending on the graphic design and communicational aspects to be considered inside ACTO.

1.3.1 General recommendations for graphic design

The design of the portal is a fundamental factor for its success since a good user experience in both browser and tablet environment ensures that the user is kept as long as possible in the portal and improves traffic.

It is recommended that the graphic design be done following ACTO's guidelines through the Communications area:

- The design will be done under responsive criteria, establishing specific CSS style sheets that modify and complement those of a CMS Portal Administrator, it will be possible to use Responsive UI libraries, relying on Bootstrap to achieve the adaptation of content to different devices, browsers and correct display in both landscape and portrait mode.
- As for the different graphic components, text and images will be used intensively, avoiding the use of content that requires some kind of plug-in for its execution, using both HTML5 and CSS3 for components that require dynamism as it is the case of graphic elements (charts).
- A personalized Masterpage will be created for the ARO with ACTO's corporate branding based on the selected design. The Masterpage will include the Header and Footer of the portal, which will be repeated on all pages of the portal. The logos in these design sections will be stored as site assets so that they can be modified if necessary.
- As for layouts or page designs, the necessary ones will be created to respond to the proposed design for each part of the portal.









1.3.2 Home page

The ARO Portal will be the entry point to the observatory and from which the various functions of the observatory will be accessed, grouped into different thematic and integrating modules that are developed in the following points:

- The Portal will have the typical capabilities of a web portal, oriented to the dissemination of information through the Internet and accessible through the usual browsers
- It may be supported by a CMS content management system that allows access control of users at different levels of permissions and capabilities for organizing, editing and updating content by users with the appropriate roles.

The portal will have a distribution of content and menus as described above.













1.3.3 Explanatory web page

Corresponds to the set of web pages whose content must be designed graphically and communicatively during implementation according to the objective of informing and communicating on the website, these pages may have text, images, computer graphics and even present data that is consulted from IKMS databases. According to the proposed pages these are the pages to be designed.

- What is GeoAmazon
- About Digital Information
- About monitoring networks
- About Our Amazon
- Contact us
- Help
- About data acquisition



Object 21: General sketch for the explanatory web pages

1.3.4 GeoAmazon - Regional geographic information

Page in which the user can know all the geographical information available in the Observatory, there will be a catalog of this information classified by subjects, it will be possible to download the information in shape format or to know the links of the information for the consumption by means of web services.



Object 22: Sketch for presentation of existing Amazon regional geographic information in the ARO portal

1.3.5 Additional information - notifications and alerts

It corresponds to including on the home page a notification or alerts of the most prominent or most consulted information of the ARO portal or the information published recently, they can be pages with summary figures on certain topics











Object 23: Sketch for notifications and information alerts in the portal

1.3.6 Restricted area - access or user creation

The portal will allow access to the restricted modules of the system through the presentation of the user login screen in which each user will enter the username and password credentials that have been assigned or can be created. For this the user will use the "labeled access" section as a private area, which when activated will present the screen as follows.

PROJETO AMAZONAS AÇÃO REGIONAL NA ÁREA DE RECURSOS HÍDRICOS	ANA AGÊNCIA NACIONAL DE ÁGUAS E SANEAMENTO BÁSICO		Organização o de Cooperaçã	A do Tratado ão Amazônica	MINISTÉRIO DAS R
Observatorio Regional Amazónico	Home Sobre ORA - Geoarnazoni	a≁ Amazonía digital≁ Re	edes amazónicas +	Nuestra amazonía +	
 Login/Register Restore Password 	Creación cue	enta usuar	io		
> My account	Your personal details			Important In	nformation
> Address book	First Name *			Lorem ipsum do dolore adipiscina	lor ut sit ame z elit, sed sit
> Wish list				nonumy nibh se laoreet dolore m	d euismod ut agna aliguarm
> Returns	Last Name *			erat sit volutpat. tation ullamcorp	Nostrud exerci
> Newsletter	Email *			lobortis nisl aliquip commodo quat.	
	Your password			Duis autem vel e vulputate velit e	um iriure at dolor sse vel molestie at
	Password *			dolore.	
	6 - 1			More details	
	Confirm password *				
	Newsletter				
	Singup				
	for Newsletter				

Object 24: Sketch of user creation of the portal to enter a restricted area Sources: Own elaboration

1.4 ARO Interoperability Model for Information Collection

This section provides information on the service the ARO provides to enable automated data loading of indicators, documents and useful data for geographic information managers. These data are provided by the data providers who are the accredited external information providers.

1.4.1 Technical introduction

Operational and technical considerations

- ARO provides data providers with a testing and production environment.
- Guidelines in the parameterization of data provider applications in order to be compatible with the web service provided by ARO.
- Web services exposed for data loading with their XSD schemas and XML formats
- Data upload files sent by the data provider should have an electronic signature to ensure their origin for those providers who are able to do so.

Process for accreditation as an electronic data provider in the ARO

It is necessary to satisfy the requirements of suitability to be accredited as a data provider by fulfilling the following criteria:

• To be the representative or focal point who delivers data duly authorized by the member country.









- To be the representative or focal point that delivers data duly authorized by the academic, scientific, technical, NGO or other entity that ACTO considers appropriate.
- To be included in the catalog of organizations recognized by ACTO with the respective unique identifier code that appears in the ARO database.
- To be approved by ACTO operators once these criteria have been verified.
- The data provider must first enable the test environment in the ARO to ensure that its system performs interoperability correctly.
- Once the tests have been passed, the data provider must enable the production environment in the ARO portal to send the actual data.

When sending and receiving data

- The data provider must prepare the XML structure according to the regulations in the subsequent part of this section.
- The data provider must connect to the ARO web service and all its files will be received by the ARO web service and immediately processed so that an approval or rejection response is sent to the data provider indicating any errors found.

Process of generation, electronic signature and approval to send data

The data providers will generate their data files in .xml format according to the .xsd schemes indicated. The records generated must contain a unique identification key in order to prevent duplication in the ARO database. The unique identification mechanism should be implemented through a Guid or UUID type variable.

Type of environment

Type of environment	Code	Requirement
Tests	1	Required
Production	2	Required

Data Provider Identification

Identification	Data type	Number	Requirement	
Id_single_required_by_ACTO	Integrate	12345	Required	
Warning table: There is no data provider ID in ACTO's database				

Warning table: There is no data provider ID in ACTO's database

2 Requirements for the operation of the ARO

2.1 Software tools defined for ARO

Based on the results of the evaluation, technical aspects for the integration of software tools and the exploration of the referential costs (per year and user) of licensing, the following technology in its latest versions is recommended.

About fundamental tools

- Programming language and application server: PHP + framework, Core .Net or other
- Database Manager: Postgres/Postgis









• Geographic Information Server: Geoserver/Geonetwork

About consultation and publication tools

- GIS publishing tools: Openlayers, Leaflet or other free
- Reports and analysis (BI): MS Power BI
- Document manager: Alfresco Community
- Analytical (BigData, Machine Learning): Microsoft Cloud Services
- Portal Administrator (CMS): Wordpress

About collaboration, learning and office automation support tools

- Collaborative tools (Chat, videoconference, forum, e-mail) Ms Teams
- Relationship Management (CRM): MS Dynamics Customer Services
- Learning Management System (LMS): MS LMS365
- Project management: MS Project
- Office automation tools: Open Office



Object 25: IKMS technological architecture and ARO solution with selected software tools for implementation based on a diagnosis of the current situation of the countries in the area of CITES

The following is a series of comments and technical recommendations on the technological platform selected for the IKMS and ARO solution:

- 1. The selected tools that are within the "fundamental" category are in accordance with the free software policies of the member countries and ratify the strength and maturity of these policies. However, it is recommended that the team in charge of developing the IKMS modules and ARO solution define the programming language and application server according to other criteria such as knowledge and experience in similar projects that will improve the implementation time of the modules and the solution as a whole. Languages such as PHP, Core .Net, NodeJs, Java EE, Javascript, Python, Ruby on Rails are also robust alternatives for the development of system modules that comply with the free software policy.
- 2. The development of the modules must be done with one of the enterprise languages selected by the implementer with the libraries considered necessary in its last stable version, it will be









mandatory to comply with an internal model architecture via MVC controller; this architecture must follow the best practices, as well as UI and UX standards of the industry.

- 3. The IDE spatial data infrastructures implemented in institutions in some member countries further ratify the selection of the use of Postgres with its Postgis extension as an information database manager for the IKMS and ARO solution, these are complemented by the geoserver and geonetwork as servers for the integrated management of geographic information.
- 4. The tools selected for publication or visualization of geographic information Openlayers, Leaflet or other will demand programming work and longer implementation times but will meet the needs of a geographic viewer; The proposal in the ARO portal is also to present information for geographic management analysis, so if the ARO requires efficiency in the implementation of visually attractive geographic information management reports, it is recommended to analyze the use of certain complementary tools such as ArcGIs Online (Storymaps), Cartodb or others that are licensed; or if not, during the implementation, free software initiatives aimed at improving the visual presentation of geographic information could be analyzed, but which will undoubtedly require more time and effort.
- 5. The exception within the group of free tools for consulting and publishing information is Microsoft Power BI, the efficiency for generating management reports and its low cost becomes an ideal alternative for implementation in the IKMS, we must take into account that while there is a licensing cost that can be increased depending on the need for data security of the ARO and the volume of information, but undoubtedly is the best alternative for its efficiency and because the free software option Pentaho, for example, in its Community version, is far from reaching the functionality required for the ARO.
- 6. The server proposed for Alfresco document management, initially is not mandatory, however, under the best criterion of the implementer, another document server can be adopted or simply handle features that are part of the CMS, for example, that even handle the proposed standard of Dublin core.
- 7. In the case of tools for analytics, big data, machine learning, the recommendation, as per the evaluation, is the recruitment of cloud services, the alternative to implement with tools from their installation requires too many hardware requirements that in a first phase will not be necessary. For basic functionalities for bid data such as social media data harvesting, its storage and subsequent presentation of data is sufficient to use the evaluated free software tools; however, the implementer must evaluate its effort and the demand of hardware requirements.
- 8. Wordpress is one of the most used CMS tools in the world which ratifies the selection; however, to support the proposal of a tool that supports the simultaneous administration of several portals, Ms Sharepoint is an ideal alternative that should be evaluated by the implementer, but considering the cost of it.
- 9. In the case of the CRM tool and the need on the part of ARO to install a software not to contract the service, ACTO may consider evaluating other open source tools such as Drupal's CRM Core or other after a detailed evaluation of the functionalities and the implementation effort.
- 10. Ms Project and Open Office, as support tools for project management and office automation respectively, will always be available and the decision to implement will be not only a cost decision but also a decision of ACTO as an adoption strategy not only for the ARO, but for the organization.





2.2 Infrastructure required for ARO implementation

The implementation of a platform that will support the IKMS comprises a technological architecture integrated by several components that together provide the expected services. The proposed architecture will allow an efficient management both for the administration and maintenance of the platform and for the interaction of the users through the user and portal modules implemented in the PS/ACTO.

IKMS basically comprises 4 major components within its technological architecture, which are:

- Database (data information layer). It comprises the relational (alphanumeric), geographic and documentary database managers. The core part of the IKMS is the level where all data collected from member countries and generated by ARO as a result of conversions, processing and analysis will be stored. This layer will be supported by Postgres, PostGIS and Alfresco.
- Services (server layer). Different services for web publication of geographic information, alphanumeric, metadata and modules developed, this part of the architecture is, as well as a map server, in this case our map server is Geoserver, which offers a series of geospatial APIs to encode and display all the cartography, Geonetwork is a metadata server, and an application server on which to deploy thematic modules, integrators, management and others that need to be published through the web server.

For security reasons it is recommended that only the web server in which the CMS is can also be exposed to the internet, the rest of the servers for both services and data and information should be within a secure zone.

• **User Interface (client layer),** Modules with functionalities that allow navigation for the entry and consultation of data by the user.

Based on these levels of selected software components and tools, we present below a diagram of the physical infrastructure necessary for the installation and configuration of the base software on which the IKMS and ARO solution will work properly.











Object 26: Hardware components and technological architecture services for IKMS and ARO

The following are the recommendations and characteristics of each of the physical or virtual servers to be considered for initial operation:

Number	Hardware component	Initial technical characteristics
1	Database server	Postgres / Postgis
		Initial MV characteristics:
		Plus 30 Gb disk, 4 Gb memory, 2 CPU, Tier III
2	Document Server	Alfresco
		Initial MV characteristics:
		Dhua 20 Ch diale 4 Ch mamany 2 CDLL Tiar III
•	01	Plus 50 GD disk, 4 GD memory, 2 CPO, mer m
3	Storage unit	Purchase or contracting as the information grows.
		The unit can be distributed for alphanumeric, document and geographic
		data, in this last one, in the case of having spatial information, the demand
		of space will be significant.
		Initial storage size:
		On demand
4	Man Server	Geoserver
-		
		Initial MV characteristics:
		Dius 30 Ch disk / Ch memory 2 CDU Tier III
-	Matadata aswes	
5	ivietadata server	Geonetwork









Number	Hardware component	Initial technical characteristics
		Initial MV characteristics:
		Plus 30 Gb disk, 4 Gb memory, 2 CPU, Tier III
6	Application Server	Core Net / PHP / Java (To be defined by the implementer)
		Initial MV characteristics:
7	Web server	WordPress
		Initial MV characteristics: Plus 30 Gb disk, 4 Gb memory, 2 CPU, Tier III

Object 27: List of hardware components considered in the technological architecture Notes: only considers production environment, not hardware components for use in testing and development

The following is a complementary list of cloud services (SAAS) that we suggest you contract on a mandatory and optional basis to meet the needs of the IKMS and ARO.

Number	Service component	Number of initial licenses		
1	Power BI	BI Reports		
	(Required)	10 Power BI Pro licenses		
		(1 license for each country's focal point, 2 licenses for ARO		
		administrators)		
2	Teams	Collaboration tool		
		10 licenses		
3	Dynamics CRM	CRM tool - stakeholder management		
		10 licenses		
4	LMS 365	Learning Tool		
		10 licenses		
5	Project	Project monitoring		
		10 licenses		

Object28: List of proposed IKMS / ARO cloud software services (SAAS)

On the definitions of hardware and software, below we make some recommendations that should be taken into account before your purchase or contracting:

- In general, the recommended hardware characteristics are sufficient for the IKMS and ARO Portal to work in an optimal way, also considering that the load of information, users and transactionality will not be elevated initially, as one of these three increases, it will be possible to update or increase the physical resources.
- In the first stage, the ARO implementer will be able to evaluate whether or not all the proposed hardware components are necessary. One way to optimize the contracting or purchase of hardware will be to install, in some cases, two pieces of software, for example, the Geonetwork Metadata server and Alfresco as a Document server can be installed in a virtual machine. In the same way, contracting additional storage to that of the machines is not necessary unless you already have a dimensioning of the amount of information that could be collected.
- The contracting of both hardware and services can be when the implementation is already a little advanced and there are more precise dimensions regarding the amount of information, number of users and level of transactionality.
- The contracting of the suggested software services can start with one or two initial licenses, which will allow to know in detail the functionalities, to configure according to the needs of the ARO, to define the procedures and detailed activities of the use of these









tools to obtain the desired results; after these the number of licenses can be increased gradually.

- It is not essential for the ARO Portal to contract all the proposed cloud services.
- In the case of contracting cloud platforms, the handling of https security protocol will be indispensable.

2.3 ARO Technology Infrastructure Scenarios and Alternatives

For the physical implementation of the Information and Knowledge Management System -IKMS- and ARO, it is proposed to do so through cloud infrastructure and services. On the other hand, cloud infrastructure is understood as the set of tools needed to host services and applications in the cloud.

As developed in the technology architecture conceptualization section, the alternative of contracting a cloud service provider was based on the convenience of 5 evaluation factors:

- Cost
- Security
- Implementation
- Flexibility
- Mobility

For the cloud-based infrastructure (IaaS and PaaS) recommendation, the Gartner quadrant for cloud infrastructure as a service in its most recent version of July 2019 was taken.

For the selection of the three alternatives to be evaluated, those located as leaders are recommended:

- Google Cloud
- Microsoft Azure
- Amazon AWS

However, on the recommendation of ACTO we have excluded Amazon AWS from the evaluation and the regional provider Redehost located in Brazil was evaluated.

Characteristic	Google Cloud	Microsoft Azure	Redehost
Data Center Location	Sao Paulo	Sao Paulo	Sao Paulo
TIER availability level	IV	IV	
Windows Server Options	Windows Server 2008 R2	Windows Server 2012 R	Windows Server 2012 R
	Windows Server 2012 R	Windows Server 2016	Windows Server 2016
	Windows Server 2016	Windows Server 2019	
	Windows Server 2019		
Linux Server Options	Ubuntu 16.04 and 18.04	Ubuntu 12.04	Ubuntu 18
	Debian 9	Debian 7, 8, 9 and 10	Debian 8
	Centos 6 and 7	Centos 6, 7 and 8	Centos 7
	RedHat Entreprise 6, 7 and	Oracle Linux 6.4 and 7	
	8	RedHat Enterprise 7 and 8	
		Suse Linux Enterprise 11, 12	
		and 15	
		Open Suse	
		Core Os	
Monthly reference price for a	USD 54.0	USD 61.2	USD 38.2
4GB 2vCPU Memory server,			



Characteristic	Google Cloud	Microsoft Azure	Redehost
150 GB on disk and 1TB			
transfer			

Object 29: Global and regional provider comparison for IaaS and PaaS services Source: Google.com, azure.com and redehost.com.br, own adaptation

In conclusion, the cloud infrastructure is the general recommendation for ACTO to start the implementation of ARO as a fast, efficient solution without large initial investments. The table summarizing the needs and functionalities for each module is included in Annex 5.