Terms of Reference

Development of a Central Database (CD) for Climatic Change and Disaster Risk Data

Development under Consultancy Services to Strengthen the Process and Capacity of Climate Information Sharing for the Implementation of National Adaptation Plan of Sri Lanka

1. Background

The International Water Management Institute (IWMI) is implementing an assignment to strengthen the process and capacity of climate information sharing for the implementation of the Climatic Change National Adaptation Plan of Sri Lanka (NAP). This assignment is part of the project to “Strengthen the Process and Capacity of the Implementation of the National Adaptation Plan of Sri Lanka” which is implemented by the Global Green Growth Institute (GGGI) in close collaboration with the Climate Change Secretariat (CCS) of the Ministry of Environment (MOE). As part of its consultancy services, IWMI proposes an online Central Database (CD) for Climatic Change and Disaster Risk Data.

In the context of developing a Central Database (CD) for Climatic Change and Disaster Risk Data, it is crucial to recognize the profound impact this initiative can have on Sri Lanka's ability to address the growing challenges posed by climate change and disasters. Sri Lanka has experienced a rising frequency of climate-related incidents, such as floods, droughts, and landslides, emphasizing the pressing need for a centralized repository of localized data to effectively understand climatic change aspects and mitigate/manage resulting risks.

The proposed system (CD) aims to bridge the existing crucial data gap by consolidating diverse sources of climatic and disaster-related information, facilitating data sharing, and providing actionable insights to decision-makers, researchers, and policymakers. By centralizing this data, Sri Lanka can empower itself to make informed decisions and develop targeted strategies to enhance climate resilience and disaster preparedness within the nation's borders.

2. Scope of the Work

The scope of work for the Central Database (CD) for Climatic Change and Disaster Risk Data project encompasses a multifaceted approach to data collection, consolidation, management, and dissemination. It includes:

1) **Central Database Development:** The creation of a robust and user-friendly central database for hosting climatic change and disaster risk data will be a core component. This database will not only store the integrated geographic data but will also offer advanced querying to visualize and disseminate information in meaningful ways to support decision-making processes. The availability of analytical capabilities to enhance decision-making capacity will be a value-added option.
2) **Data Collection and Integration:** The system will facilitate comprehensive collection and integration of climatic and disaster-related data from various sources, including meteorological agencies, disaster management authorities, research institutions, and

relevant government departments. Developers should refer to the National Adaptation Plan for Climatic Change Impacts in Sri Lanka (Nap 2016-2025), which stipulates 9 key vulnerability sectors and multiple cross-cutting areas in understanding the major stakeholders of the system. Maximum compatibility is required in data sourcing, archiving and storage.

3) **Data Standardization and Quality Assurance:** Ensuring data accuracy and reliability is paramount. The proposed system includes the establishment of rigorous data standardization and quality assurance protocols to validate, clean, and harmonize incoming information, thereby maintaining the integrity of the data stored in the proposed system.
4) **Data Accessibility:** The proposed system will develop interfaces and tools to make data readily available to stakeholders via comprehensive search, user-friendly, map-based visualization, and multiple data exporting/downloading. The system should also leave flexibility for data-sharing agreements through APIs.
5) **Capacity Building Support:** The developers of the system should provide system interfaces for conducting training without affecting the actual data of the system. Testing interfaces should be developed and manuals to be provided.
6) **Data Modeling Flexibility:** Beyond data storage, the project should leave flexibility for data modelling capabilities. of disaster risk modelling capabilities, enabling predictive analytics to assess future disaster scenarios and inform proactive mitigation strategies.

This comprehensive scope of work will establish the foundation for the CD, empowering Sri Lanka to harness the full potential of climatic and disaster risk data for informed decision-making, risk reduction, and climate resilience building.

3. System Overview and Specifications of Functions

1) System Overview

The functional block diagram of the proposed system can be illustrated using the diagram in Fig 1. The main functional elements are (a) Web Front-end for data sourcing, (b) Web Front-end for data viewing and sharing, (c) Databases, indexing services, and archiving services, (d) Web back-end functions for system configuration and management. Flexibility for the shopping cart function may be implemented as an optional data retrieving/sharing feature.

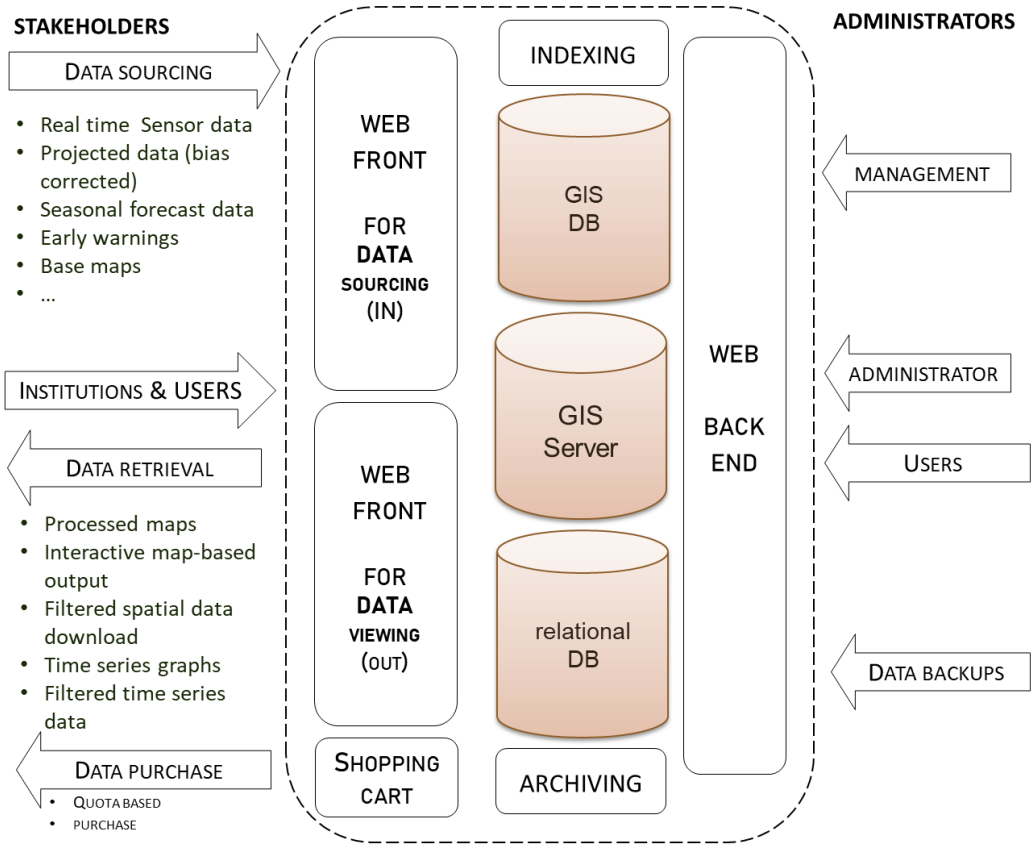

Figure 1 CD Functional Overview

2) System Functions

System functions and Data abstracts deemed necessary for the proposed system are tabulated below. The developers are advised to propose innovative solutions using state-of-the-art technologies and tactical options ensuring Agile Application Development.

CORE MODULE	FUNCTION	Data-level and function-level requirements
USER MANAGEMENT AND DATA ACCESSIBILITY CONTROL	Management of sectors and cross-cutting areas	○ Master templates and interfaces for registration ○ All known sectors and cross-cutting areas to be registered initially (approximately 15). ○ Interface for new additions and changes
	Management of geographic-level entities	○ Master templates and interfaces for registration of national, provincial, and district-level entities ○ All known geographic entries are to be registered initially. ○ Interface for new additions and changes ○ Tag changes in institutes or projects
	Management of project-level entities	○ Master templates and interfaces for registration of project entities with association to sectors, and institutions ○ Some related projects are to be registered initially. ○ Interface for new additions and changes
		○ Master templates and interfaces for registration of institution hierarchy and institutions.

	Management of institutional entities	○ The template should include the association of sectoral and geographic associations. ○ Known related institute hierarchy and institutes are to be registered initially. ○ Interface for new additions and changes
	Management of users and user roles	○ Master templates and interfaces for registration of user roles ○ Interface for registration of users and assignment of user roles ○ Interface for new additions and changes
	User access control	○ Master templates for access privileges ○ Interface for privilege management for user roles ○ Interface of privilege definitions and functional assignment for each privilege ○ Registration of all known privileges and system-level implementation of required privilege functions ○ Interface for new additions and changes of privileges and privilege functions
DEFINITIONS OF CLIMATIC AND DISASTER DATA	Climatic data type definitions	○ Master templates for defining climatic data types depending on the source, data type, parameter, file format, and mode such as past, present, forecast and projected with and without bias corrections. ○ Define template functions to manage each type of data. ○ Registration of all known climatic data types at system initialization ○ Interface for new additions and changes
	Climatic data record definitions	○ Master templates for defining climatic data associations such as source, ownership, location, sector etc. ○ Registration of all known climatic data associations at system initialization ○ Interface for new additions and changes
	Disaster data type definitions	○ Master templates for defining disaster data types depending on the source, data type, parameter, file format, intended audience, and mode such as past, present, forecast and projected with and without bias corrections. ○ Define template functions to manage each type of data. ○ Registration of all known climatic data types at system initialization ○ Interface for new additions and changes
	Disaster data record definitions	○ Master templates for defining disaster data associations such as source, ownership, location, sector etc. ○ Registration of all known climatic data associations at system initialization ○ Interface for new additions and changes
	Handling of file input	○ Master templates for handling file input data ○ Define the file import process function for each file type. ○ Registration of all known file input types ○ Interface for new additions and changes

DATA INPUT, UPDATES, AND DATA MANAGEMENT	Handling of filed input	○ Master templates for handling filed input data. ○ Define the filed input process function for each filed type. ○ Registration of all known filed input types ○ Interface for new additions and changes
	Handling of API input	○ Master templates for handling API input data ○ Define the API read process function for each filed type. ○ Registration of all known API input types ○ Interface for new additions and changes
	EDIT and Validation	○ Validation functions for climatic and disaster data ○ Edit functions for past data. ○ Edit log management. ○ Interface for new additions and changes
	Periodic Management	○ Batch processes for routine management such as archiving and backups. ○ Batch process for data synchronization etc. ○ Interface for new additions and changes
DATA RETRIEVAL & REPORTS	Single query handling	○ Master template for possible single data query templates, query processing functions, and data output function ○ Register all single queries, query interfaces and process functions at the initial level. ○ Define export process function for different source and destination data formats, and watermark security etc. ○ Interface for new additions and changes
	Comparison query handling	○ Master template for possible data comparison query templates, query processing functions, and data output function ○ Register all comparison queries, query interfaces and process functions at the initial level. ○ Define export process function for different source and destination data formats, and watermark security etc. ○ Interface for new additions and changes
	Report query handling	○ Master template for reporting formats capturing access analytics. ○ Define report process functions and data analytics processing functions. ○ Register all reporting request types and analytics report types at the initial level. ○ Define export process function for different source and destination data formats, and watermark security etc. ○ Interface for new additions and changes
	Data sharing and EC	○ Master template for data sharing such as query and sharing user groups. ○ Define the data-sharing process such as encrypted URL links. ○ Define process data valuing data to be shared. ○ Define EC methods for trading

	Alert process handling	○ Master templates for possible alert generations. ○ Define alert process functions, target alert groups, and alert group subscription functions, ○ Register all possible alerts with audience groups and alert triggers. ○ Interface for new additions and changes

3) User Interface design

The system should feature a high level of user-friendliness by considering good practice design aspects such as:

(a) providing an interactive dashboard interface that makes the manipulation of system functions exceptionally user-friendly for its users.
(b) support responsiveness across different display sizes.
(c) ability to display Sinhala and Tamil characters on the dashboard and map outputs is also an important requirement.
(d) The administration interfaces do not necessarily require the same level of user-friendliness as the general user version. Nonetheless, it is essential to provide comprehensive admin manuals for clarity.

Dashboard example

This example in Fig 2 is provided solely as one of the possible dashboards for the CD, and creative freedom is encouraged. Developers are not constrained by this specific design layout, or the functions displayed in the interface. Interfaces required for data input, data comparison and retrieval, invoking various analytical functions, and system administration may necessitate separate dashboard interfaces for each category. The developers are advised to propose innovative solutions using state-of-the-art technologies and tactical options ensuring Agile Application Development. The functions and various data settings are not detailed here, as developers are encouraged to propose innovative solutions utilizing state-of-the-art technologies, while keeping the minimum requirements in mind.

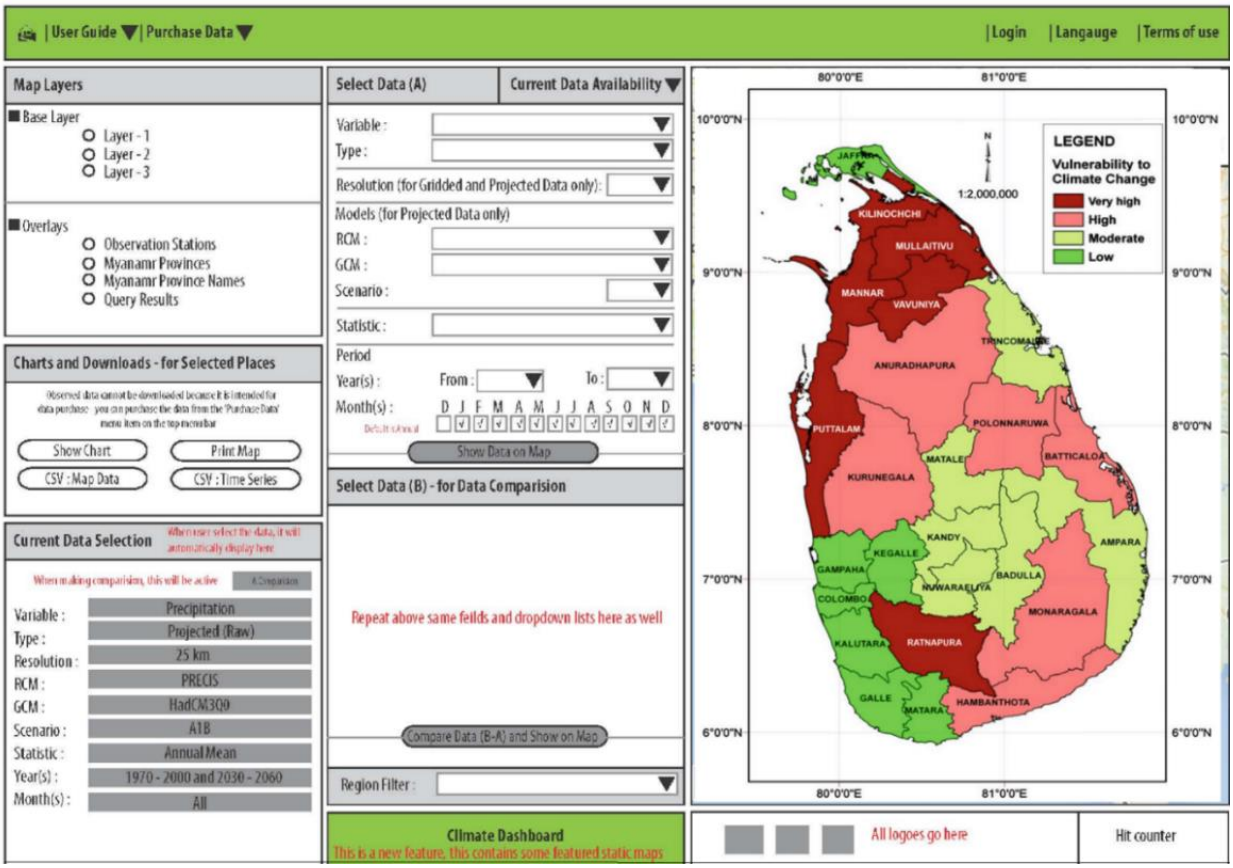

Figure 2 Sample User Dashboard for CD

4. System Specifications

The following system specifications are essential to ensure the reliability, security, and scalability of the Central Database (CD) for Climatic Change and Disaster Risk Data, enabling it to effectively serve its purpose in managing and analysing critical data for decision-making and disaster risk reduction. Specific hardware and third-party software choices may be explained with relevant budget constraints.

ITEM	DESCRIPTION
HARDWARE SPECIFICATIONS	
Server Infrastructure with a server migration plan.	• High-performance servers with multi-core processors to handle data processing and storage demands. • Sufficient RAM to support concurrent data access and analysis. • Redundancy and backup systems to ensure data integrity and availability.
Storage	• Large-scale, fault-tolerant storage solutions for data archival and retrieval. • Scalable storage options to accommodate future data growth. • Backup and disaster recovery systems to prevent data loss.
Network Infrastructure	• High-speed, reliable network connections to facilitate data transfer and accessibility. • Security measures such as firewalls and intrusion detection systems to protect against cyber threats.
SOFTWARE SPECIFICATIONS	
Database Management System (DBMS)	• Robust DBMS capable of handling large datasets, such as PostgreSQL or MySQL.

	• Robust GeoDBMS capable of handling large GIS data sets (GeoServer etc.) • Support for spatial data types and geospatial indexing for disaster mapping and analysis.
Web-Based User Interface	• Use of standard development frameworks (e.g., Magento, Django, Ruby on Rails) for creating user-friendly responsive interfaces for multiple devices. (Use of non-standard frameworks may require disclosing developer notes) • Data visualization libraries (e.g., D3.js, Leaflet) for interactive data exploration. . (Use of non-standard frameworks may require disclosing developer notes)
Data Integration and compatibility	• Input compatibility: devise data input interfaces to be compatible with multiple standards geographic data formats such CSV, GeoJson, ShapFiles, NetCDF etc. • Output compatibility: devise data output modes to include standard GIS formats and visual output formats such as interactive titled maps, and PDF/SVG exporting with suitable checksums or watermarks to ensure data integrity.
OTHER SPECIFICATIONS	
Scalability	• Scalable architecture to accommodate future data growth and increased user access. • Load balancing to distribute incoming requests efficiently.
Data backups	• Regular automated data backup procedures to prevent data loss. • Off-site backups for disaster recovery.
Performance monitoring	• Monitoring tools to track system performance, resource utilization, and data processing times. • Alerts and notifications for system administrators in case of performance issues.
Security and Authentication:	• Robust security protocols, including encryption of data in transit and at rest. • User authentication and authorization mechanisms to control access to sensitive data.

5. Tender Proposal structure

IWMI expects the vendor to provide state-of-the-art technologies and innovative solutions to meet the project requirements. The vendors are requested to submit the following documents:

1. Description of the company/firm
2. Concept approach to Implementation (Background, Objective, working methodology, deliverables, maintenance and security, platform deployment, technology transfer, work plan)
3. Provide clear evidence of your past assignments that align with the current requirements.
4. Financial proposal (total cost, payment schedule, milestone/activity-wise cost break-down structure, human resource-wise cost break-down, module-wise cost break-down and maintenance support for three years)
5. The above development plan and its costing should also include the following:
   (a) User manuals: Manuals covering general system usage and system administration/maintenance.
   (b) Developer manuals: Manuals for software, including source code details, database structure, and necessary instructions for system maintenance, renewals, upgrades, and migration.

(c) Copyright: Copyright transfer to CCS for editing and upgrading of manuals, as well as system's source code and database structure.
(d) 3-year maintenance: The contract should include a 3-year maintenance period by the developers. Most appropriate server/hosting plan should be selected,

*Please mention in the proposal if the firm requires an external consultant/institute to fulfil the assignment.

6. Method of selection

The selection will be made based on the merits of the technical and financial proposals. An expert panel will review the proposal. Selected vendors may be requested for additional clarification at the final stage of the selection. The selected vendor will be working with GGGI/IWMI, and relevant government agencies including the Climatic Change Secretariat (CCS) to comprehensively implement the CD.

The evaluation criteria of the proposal are as follows:
Technical proposal (65 Points)

- Understanding the TOR (10 points)
- Proposed Methodology (System functionality, usability, data structuring) (25 points)
- Adequacy of the proposed work plan (15 points)
- Specific experience of the consulting firm related to the proposal (10 points)
- Overall experience of the consulting firm (05 points)

Financial proposal (35 Points)

- Adequacy of the explanation of cost (25 points)
- Proposed maintenance and support strategy (10 points)

Based on the scoring of both technical and financial proposals, a firm will be selected and awarded to implement the CD.

Important date
Last date of submission: 31st October 2023