Terms of Reference (TORs) for

GIS Developer / Modeling Expert - NatCat Data Center

- **Position Title:** GIS Developer / Modeling Expert - NatCat Risk Modeling (National)
- **No of Position(s):** One (01)
- **Type / Duration**: Project-based Contract (Initially for 06 months, with possibility of further extension)
- **Location:** Islamabad (Occasional visits to field)
- **Reports to:** Team Lead NatCat Data Center / Manager DRR, NDRMF

A.   Background:

The National Disaster Risk Management Fund (NDRMF) is a not-for-profit company incorporated with the Securities and Exchange Commission of Pakistan, under Section 42 of the Companies Ordinance 1984. It is a government-owned non-banking financial intermediary with a corporate structure. The NDRMF is working for reducing the socio-economic and fiscal vulnerability of the country and its population to natural hazards by prioritizing and financing investments in disaster risk reduction and preparedness that have high economic benefits, taking into account climate change, as well as disaster risks and their impacts. Under the Disaster Risk Financing portfolio, NDRMF aims at improving fiscal management of natural hazards and disasters in Pakistan and achieving fiscal resilience. In this connection, the Fund, in addition to carrying out other projects, is also in the process of developing Pakistan's first Disaster Risk Financing Strategy.

Disaster Risk Finance (DRF) is a growing discipline that addresses the fiscal impacts and economic losses caused by natural hazards (e.g. cyclones, droughts, earthquakes, floods) and supports countries to increase their financial resilience to natural disasters[1]. It is designed primarily to release rapid, predictable funding to governments in the aftermath of a disaster for response, recovery and reconstruction; reducing the economic and fiscal burden of disasters[2].

The risk modeling work will provide quantitative information on the expected levels of loss for hazard events of varying types, intensities, and return periods, including probable maximum loss curves, which will be positioned on an accessible open-source platform. It will provide the basis for a separate activity to develop a national DRF strategy for Pakistan and pilot disaster risk financing products. The national DRF strategy will identify appropriate tools for each layer of loss, based on multi-hazard loss frequency curves and taking into account the scale of funding required for each layer of loss, the speed with which disbursement of funding is required, and the relative cost-effectiveness of alternative instruments for specific layers of loss. The modelling work will

also provide the basis for pricing disaster risk financing products by the insurance sector. Currently the domestic catastrophe insurance market, for instance, is highly under-developed in part because of limited catastrophe exposure analysis and modeling.

The risk modelling work will also support the prioritization of investments under the National Disaster Management Plan and the National Flood Protection Plan-IV. However, there is a dire need to fulfill the risk modeling gaps for sector and area specific implementation strategy deployment.

SUPARCO has been entrusted important task of this probabilistic risk modelling of Pakistan, first time in the country, rather first initiative at national level in the region. It is covering all primary perils related to geo-physical and hydro-metrological / climate change. The system will be deployed and commission by the SUPARCO and NDRMF will continue its development and outreach to next steps, and at pace with the international practices and emerging technologies.

B.   Purpose of the role / Scope of Work:

The role of the full-stack GIS Developer / Modeling Expert is to take responsibility for designing and developing of front-end and back-end components for NatCat Risk Modelling Dashboards at NDRMF. Related activities including but not limited to automation of data processes, application development, incorporating AI / ML elements, efficient running and improvement of 'Risk Calculator' (web-based interface for general and specified user), providing role-based data access to identified partners with all security and access protocols, development of analytical products based on the available risk datasets, models, scenarios, and visualizations techniques in space and time. The Data Centre service operations based in NUST using best practices and standards and to ensure data center capacity meets the Natural Catastrophe (NatCat) Model existing and future requirements.

C.   Duties / Responsibilities

- Work closely with Team Lead to understand stakeholders' requirements for the NatCat dashboard.
- Automate integration of diverse national and global data repositories of various formats, including spatial data, remote sensing data, tabular data, real-time data feeds, and external APIs, ensuring data accuracy, consistency, and interoperability within the dashboard.
- Developing and linking analytical models, AI models, and simulation tools into the NatCat dashboard/applications that allow users to interactively perform risk analysis, scenario planning, and predictive modeling based on their inputs and parameters.
- Implement geospatial analysis functionalities for end-users within the dashboard, enable users to overlay multiple layers of data, use geospatial tools (such as spatial queries, buffer analysis, overlay operations, network analysis, and terrain modeling), and generate customized maps and charts to support decision-making and scenario evaluation.

- Provide role-based data access to identified partners with all security and access protocols.
- Collaborate with cross-functional national and international development teams, including risk analysts, AI/data experts, software engineers, and domain experts, to gather requirements, exchange knowledge, and ensure alignment with NatCat goals.

D. Knowledge/ Skills / Qualifications/ Experience

- BS/MS in Geoinformatics, Computer Science, GIS Development and programming and related fields.
- At least five (05) years of experience with minimum three (03) landmark national and international projects of similar nature.
- Expert in developing intuitive user interfaces and interactive visualizations for the dashboard using WebGIS technologies, such as JavaScript libraries (e.g., Node, Leaflet, OpenLayers), mapping third-party APIs (e.g., Google Maps API), and data visualization tools (e.g., D3.js, Chart.js).
- Expertise in linking appropriate AI technologies, frameworks like React, Angular, or Vue.js., and platforms like Google Earth Engine to meet the NatCat requirements and scalability needs.
- Demonstrated skills for developing the frontend components and backend libraries of the NatCat dashboard, while ensuring responsiveness and cross-browser compatibility.
- Expertise in implementing features for data querying, filtering, geoprocessing, charting, and custom map displays.
- Expert in automation of data preparation procedures though linking external databases, models, streams, etc.
- Proficient in establishing private/public cloud computing/virtualization (including ownership, responsibilities and security implications) and the use of tools and systems to manage virtualized environments.
- Experience in deploying OGC web servicers and related open technologies like Geoserver, PostGIS/Postgres, Tiling, and Dockerization.
- Expert in developing and accessing APIs, i.e., linking third-party APIs for NatCat utilization and developing NatCat APIs to be utilized by external organizations
- Expertise in developing custom plugins, extensions, or APIs to seamlessly integrate AI-based functionalities with NatCat.

Terms of Reference (TORs) for

GIS Expert - NatCat Data Center

- **Position Title:**   **GIS Expert - NatCat Data Center**
- **No of Position(s):**   One (01)
- **Type / Duration**:   Project-based Contract (Initially for 06 months, with possibility of further extension)
- **Location:**   Islamabad (Occasional visits to field)
- **Reports to:**   Team Lead NatCat Data Center / Manager DRR, NDRMF

A. Purpose of the role / Scope of Work:

The role of the GIS Expert is to take responsibility pertaining to GIS-related operations of NatCat Risk Modelling Data Centre of NDRMF, including GIS data acquisitions, storage, management, analyses and dissemination, preparing data sets for diverse models and AI / ML elements, efficient running of 'Risk Calculator' (web-based interface for general and specified user), data access to identified partners with all security and access protocols, deployment of quality assurance procedures to ensure data accuracy and logical consistency. The Data Centre service operations based in NUST using best practices and standards and to lead in planning, designing and implementing strategic plans to ensure data center capacity meets the Natural Catastrophe (NatCat) Model existing and future requirements.

B. Duties and Responsibilities

- Work closely with Team Lead to understand stakeholders' requirements for the NatCat dashboard.
- Design and deploy data models, schemas, and databases for storing and retrieving spatial data from all other data centre within and outside the country.
- Implementing data sharing and exchange protocols to facilitate collaboration with external organizations and partners. Understating of data governance policies, standards, and best practices for spatial data management.
- Selecting and implementing GIS software and tools appropriate for NatCat requirements. Configuring and customizing NatCat applications to meet specific organizational needs.
- Implementing quality assurance procedures to ensure data accuracy and reliability. Ensuring data integrity, quality, and consistency through data validation and verification processes. Conducting regular audits and reviews to assess compliance with data quality standards and guidelines.

- Designing and creating maps, charts, and and reports to visualize and communicate analysis results to NatCat users in a clear and understandable format.
- Implementing spatial analysis and queries to support spatial analysis tasks within the NatCat environment, including identifying patterns, trends, and relationships through buffering, overlay analysis, proximity analysis, etc.
- Providing technical support and training to national organizations on NatCat usage and configurations.

C. Knowledge/ Skills / Qualifications/ Experience

- BS/MS in Geoinformatics, GIS & Remote Sensing, Data Science and related fields.
- At least five (05) years of experience with demonstration of minimum three (03) landmark national and international projects of similar nature.
- Proficiency in integrating heterogeneous datasets from multiple sources and formats, including vector data (e.g., shapefiles, GeoJSON) and raster data (e.g., satellite imagery, elevation models) from international data hubs and open data repositories.
- Understanding of spatial DBMSs (e.g., PostGIS, Oracle Spatial) and data interoperability standards (e.g., OGC standards) and experience with data transformation, conversion, and harmonization is essential.
- Expertise in designing GIS database schemas, schema transformations, optimize query performance, generating metadata, and manage large volumes of spatial data efficiently.
- Strong analytical skills for performing spatial analysis, geoprocessing, and spatial statistics using open-source GIS software (e.g., QGIS, GRASS) and programming libraries (e.g., GDAL, GeoPandas).
- Ability to derive meaningful insights from spatial data and apply geospatial analysis techniques to solve complex problems.
- Proficiency in data visualization techniques and tools for creating maps, charts, and interactive visualizations to communicate spatial data effectively. Experience with visualization libraries (e.g., D3.js, Leaflet, Mapbox) and designing user-friendly interfaces for exploring and interacting with spatial data and models.
- Understanding of open data principles, licensing terms, and policies governing the sharing and use of open geospatial data. Working experience with open data initiatives such as OpenStreetMap (OSM), Copernicus Open Access Hub, and government data portals.
- Proficiency in programming languages commonly used in GIS and data management, such as Python, R, SQL, and JavaScript. Ability to develop custom scripts, automation workflows, and web services for data processing, analysis, and dissemination.

Terms of Reference (TORs) for

Senior System & Network Administrator - IT Expert NatCat Data Center

	Position Title:	Senior System & Network Administrator - NatCat Data Center
	No of Position(s):	One (01)
	Type / Duration:	Project-based Contract (Initially for 06 months, with possibility of
	Location:	further extension)
	Reports to:	Islamabad (Occasional visits to field)
	Closing Date:	Team Lead NatCat Data Center / Manager DRR, NDRMF

_____

A. Purpose of the role / Scope of Work:

The role of the Senior System & Network Administrator is to take responsibility for the system and network operationalization of NatCat Risk Modelling Data Centre of NDRMF, perform all the activities including day-to-day operations and maintenance of all hardware and networking equipment within the data center, deploying different cyber security tools, implementing back and recovery procedures, monitor storage performance, allocate storage resources, and optimize data storage efficiency, and perform regular inspections, troubleshooting, and upgrades as needed to optimize performance and reliability. The Data Centre service operations based in NUST using best practices and standards and to lead in planning, designing and implementing system and network resources to ensure data center capacity meets the Natural Catastrophe (NatCat) Model existing and future requirements.

B. Duties and Responsibilities

- Installation and management of servers, storage systems, Cisco/Sangfor Firewalls, routers, WLC, TOR/Access Switches, power distribution units, Network security infrastructure to ensure optimal performance and security.
- Installation and configuration of Windows and Linux-based (Suse Enterprise) systems performing routine tasks, such as systems monitoring, OS patching and upgrading, upgrading administrative tools, performing security tasks, troubleshooting and root-cause analysis
- Managing and troubleshooting virtualization platforms, site-to-site and remote access VPNs, VMware virtualization environments, including vCenter, ensuring system availability and reliability.
- Administering backup and recovery solutions using Veeam/VMware Site Recovery Manager to safeguard critical data and ensure business continuity.
- Configure and maintain network infrastructure, including firewalls, routers, switches, and load balancers, to ensure reliable connectivity and data transmission within the data center and to external networks. Implement network security measures, such as

access controls, encryption, and intrusion detection/prevention systems (IDS/IPS), to protect against cyber threats.

- Manage storage resources, such as SANs and NAS systems, to provide adequate storage capacity, data redundancy, and data protection mechanisms (e.g., RAID, backups, snapshots).
- Implement backup and disaster recovery solutions to protect critical data and ensure business continuity in the event of data loss, hardware failures, or natural disasters. Develop and maintain backup schedules, data retention policies, and recovery procedures to minimize downtime and data loss.
- Implement and enforce security policies, procedures, and controls to safeguard sensitive data, infrastructure assets, and intellectual property within the data center. Conduct regular security audits, vulnerability assessments, and penetration tests to identify and mitigate security risks.

C. Knowledge/ Skills / Qualifications/ Experience

- BS/Master's degree in computer science, information technology, electrical engineering, or a related field.
- Advanced degrees or certifications in relevant areas such as network engineering, systems administration, or cybersecurity may be preferred. Relevant certifications of Windows/Linux/VMware/Cisco will be preferred.
- Minimum 05 year's hands-on experience with Windows and Linux Systems, network designing and implementation, and VMware technologies. Previous experience working in data center operations, IT infrastructure management, or related roles is highly desirable.
- Experience with cloud computing platforms (e.g., AWS, Azure, Google Cloud) and hybrid cloud deployments is beneficial.
- Proficiency in server administration, including operating systems such as Linux, Windows Server, and virtualization platforms like VMware or Hyper-V.
- Experience with storage management technologies, such as SANs, NAS, RAID configurations, and data deduplication.
- Familiarity with backup and disaster recovery solutions, including backup software, tape libraries, replication, and snapshot technologies.
- Understanding of security principles, best practices, and tools for securing data center infrastructure, including firewalls, IDS/IPS, VPNs, and endpoint security solutions.
- Experience of deploying different cyber security tools and knowledge of information security standards, frameworks and policy implementation.