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 Six months)
- **Location:** Islamabad (occasional visits to field)
- **Reports to:** NatCat Team Lead
- **Closing Date:** _____

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.
- Minimum Two years of post-graduation and Three years overall experience with demonstration of minimum Five 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.