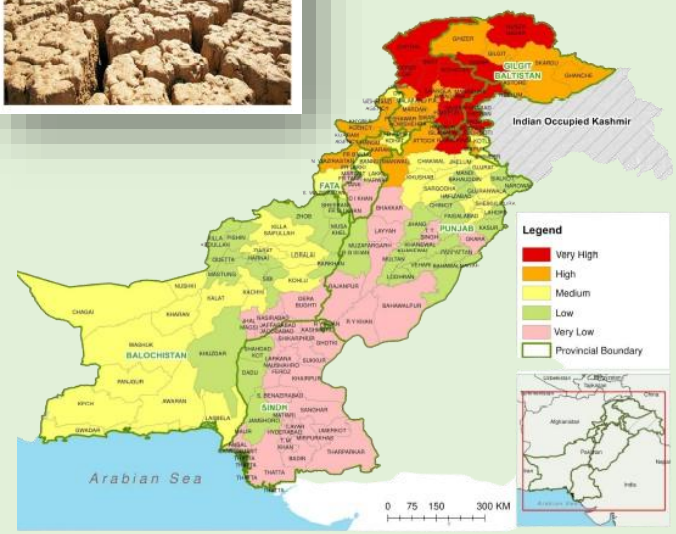
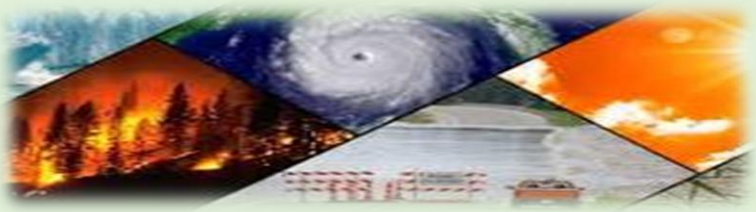
Design Document:

Climate Change and Gender-Based Institutions Assessment Tools in iPAS





Implement automated climate and disaster risk screening in iPAS

Ministry of Planning, Development and Special Initiatives, Pakistan

2025-26

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Abbreviations

CARA	Climate Adaptation and Resilience Assessment
CHIRA	Climate and Hazard Initial Risk Assessment
CMA	Climate Mitigation Assessment
iPAS	Intelligent Project Automation System
NatCat	Natural Catastrophe
PITB	Punjab Information Technology Board

Executive Summary

This document presents the strategic thematic areas of **Climate Change and Vulnerability** and **Gender-Based Institutional Frameworks**, underscoring their importance in enhancing organizational efficiency, governance, and digital transformation. It establishes a structured approach for embedding these cross-cutting themes into institutional systems and analytical platforms to strengthen decision-making, transparency, and long-term sustainability.

Central to this document is a **production-ready integration architecture and methodology** designed to connect the **NatCat (Natural Catastrophe) API** with the **iPAS (Intelligent Project Automation System)**. This integration enables seamless interoperability between environmental and institutional data systems, facilitating real-time information sharing and improved analytical capabilities. The architecture supports both **synchronous and asynchronous data flows**, ensuring system scalability, resilience, and operational continuity.

The framework also incorporates robust **governance and security mechanisms**, including standardized API contracts, data mapping protocols, and authentication and authorization controls. In addition, it provides detailed guidance on **testing**, **performance monitoring**, and **automated deployment**, supporting consistent delivery and alignment with institutional compliance standards.

Through this initiative, the organization advances its commitment to digital transformation and evidence-based governance. By leveraging technology to streamline data integration and operational processes, this effort enhances institutional agility, promotes accountability, and strengthens the organization's capacity to respond effectively to emerging environmental and social challenges.

Key Outcomes

- **Enhanced Efficiency:** Streamlined integration between NatCat and iPAS enables faster data processing, reduces manual intervention, and improves responsiveness across operational workflows.
- **Strengthened Governance:** Clear data governance frameworks and security controls ensure compliance with institutional standards and promote transparency in information management.
- **Improved Decision-Making:** Real-time data interoperability supports more accurate forecasting, risk assessment, and policy development related to climate and institutional planning.
- **Accelerated Digital Transformation:** The adoption of standardized integration practices and automated deployment pipelines advances the organization's modernization agenda and technological resilience.

1. iPAS & NatCat Systems

1.1. Intelligent Project Automation system (iPAS)

iPAS is a core component of the project developed by Ministry of Planning, Development and Special Initiatives (MoPDSI) in coordination with Punjab Information Technology Board (PITB) to strengthen the ministry in the field of Information Technology (IT). iPAS is complete *Development Projects Suite* that is a combination of various systems encompassing automation of core business process covering systems for all project phases from PSDP Formulation and PC-I to PC-V.

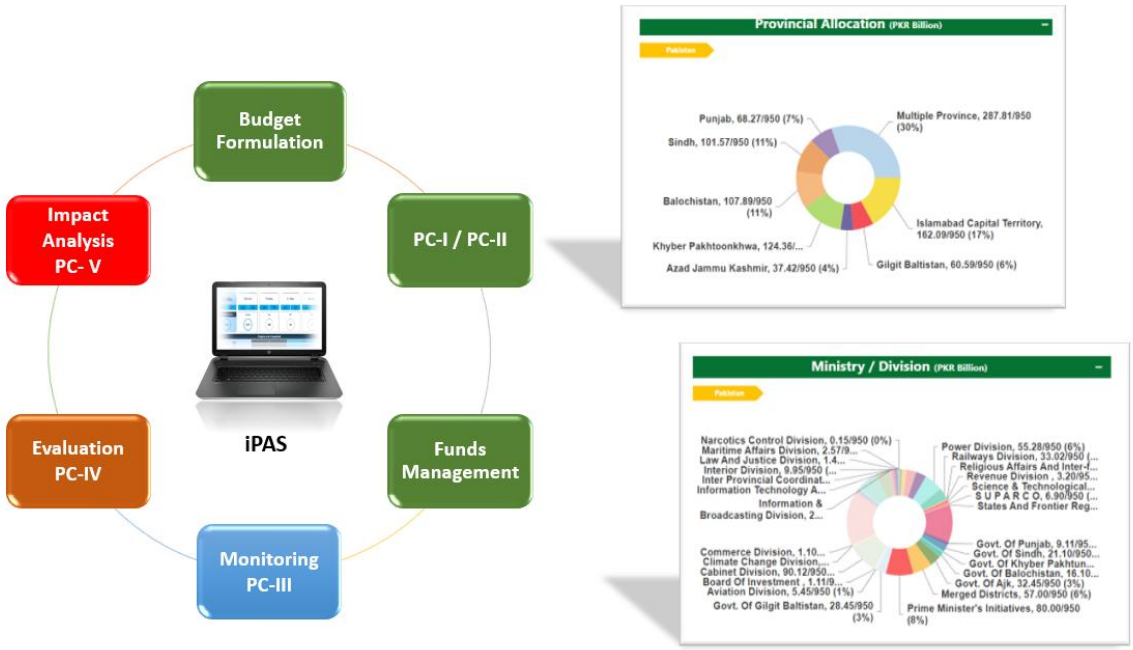

Figure 1: iPAS System Components

1.2. Natural Catastrophe (NatCat)

Natural Catastrophe (NatCat) Modeling system is a probabilistic risk assessment tool designed to evaluate and quantify potential losses arising from major natural hazards such as floods, earthquakes, landslides, droughts, urban and flash flooding, heatwaves, and tsunamis. By integrating scientific data, hazard maps, exposure information, and vulnerability parameters, the NatCat model provides a comprehensive understanding of disaster risks at national and sub-national levels. It supports the generation of disaster risk maps and quantitative estimates of expected damages for different hazard types, intensities, and return periods. This modeling framework enables evidence-based decision-making for risk-informed planning, resource allocation, and climate-resilient infrastructure development, ultimately contributing to enhanced disaster preparedness and resilience across sectors.

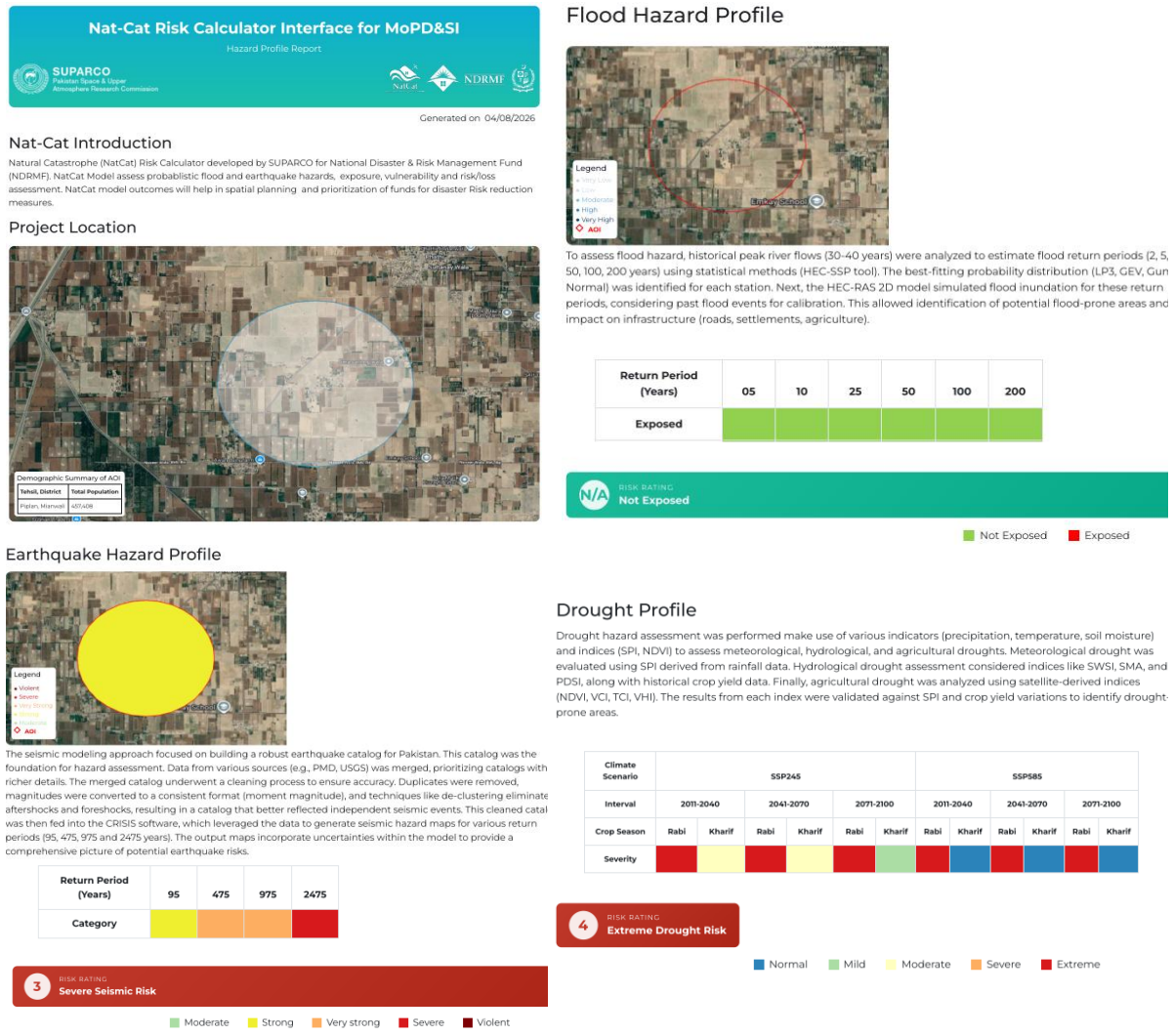

Figure 2: NatCat System

2. Climate Change & Vulnerability Assessment Tools

2.1. CHIRA

The **Climate and Hazard Initial Risk Assessment (CHIRA)** screens all projects for climate and disaster risks at the PCN stage. It assigns **High**, **Moderate**, or **Low** risk ratings based on location-specific hazards and potential impacts. This process guides early adaptation and mitigation measures, supporting evidence-based, resilient project design.

- Climate and Hazard Initial Risk Assessment (CHIRA) aims for robust climate and disaster risk screening.
- It promises significant capacity building across all organizational tiers of national and provincial ministries, propelling early adoption of adaptation and mitigation measures.
- CHIRA screening is required for every project and its activities at PCN to gauge risk levels at preliminary stages, entailing a thorough climate risk evaluation,

beginning with location-specific disaster and climate extremity identification, followed by assigning exposure values, assessing impacts on various project components, and ultimately deriving an overall risk rating.

- This comprehensive assessment aids in discerning the project's viability and its categorization as High, Moderate, or Low risk, steering informed decision-making for project continuation.

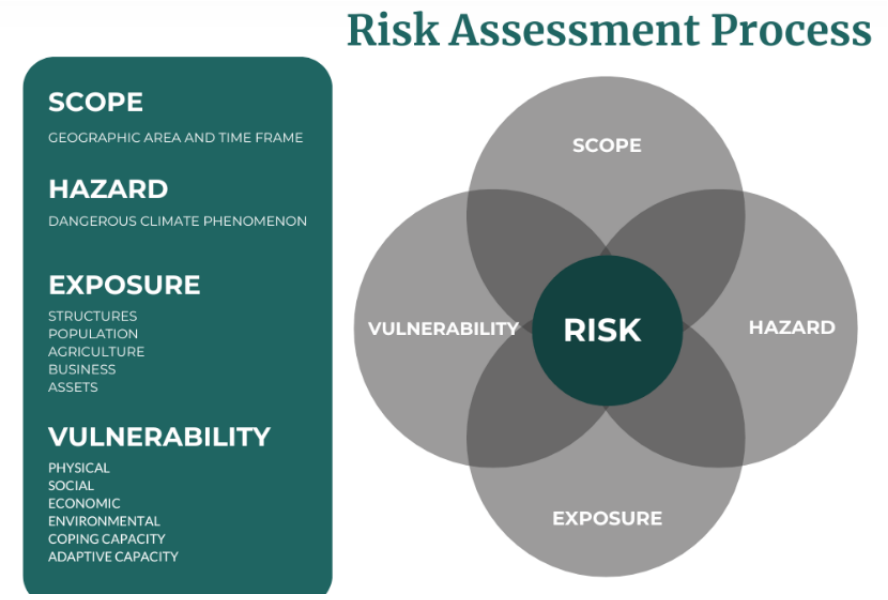

Figure 3: Climate and Hazard Initial Risk Assessment Tool

2.2. CMA

A **Climate Mitigation Assessment** (CMA) is an evaluation of strategies, policies, or technologies aimed at reducing or preventing the emission of greenhouse gases (GHGs) to limit the extent of climate change. It typically forms part of national or regional climate action planning, corporate sustainability reporting, or environmental impact assessments.

The main goals are to:

- Identify sources of GHG emissions.
- Evaluate mitigation options to reduce those emissions.
- Estimate potential emissions reductions from each option.
- Assess economic, social, and environmental impacts.
- Support decision-making on climate policy and investment.

2.3. CARA

The **Climate Adaptation and Resilience Assessment** (CARA) aims to discern, scrutinize, and appraise climate change repercussions on both natural and human systems, including human well-being, and devise suitable adaptation measures to mitigate adverse climatic effects.

- The assessment encompasses a dual perspective: examining the climate change risks to the project objectives (e.g., undermining food security) and evaluating the potential risks the project might impose by amplifying the vulnerability of the adjacent area (e.g., promoting agricultural activities in drought-prone regions).
- CARA is vital for projects identified as medium to high risk by CHIRA.
- Key considerations include whether the project is situated in a climate or natural hazard-sensitive area, its sensitivity to climatic alterations, its criticality to the community, and its national significance in providing economic relief and safeguarding lives and livelihoods during disasters.

3. High-level Architecture

The high-level architecture of the system is as follows:

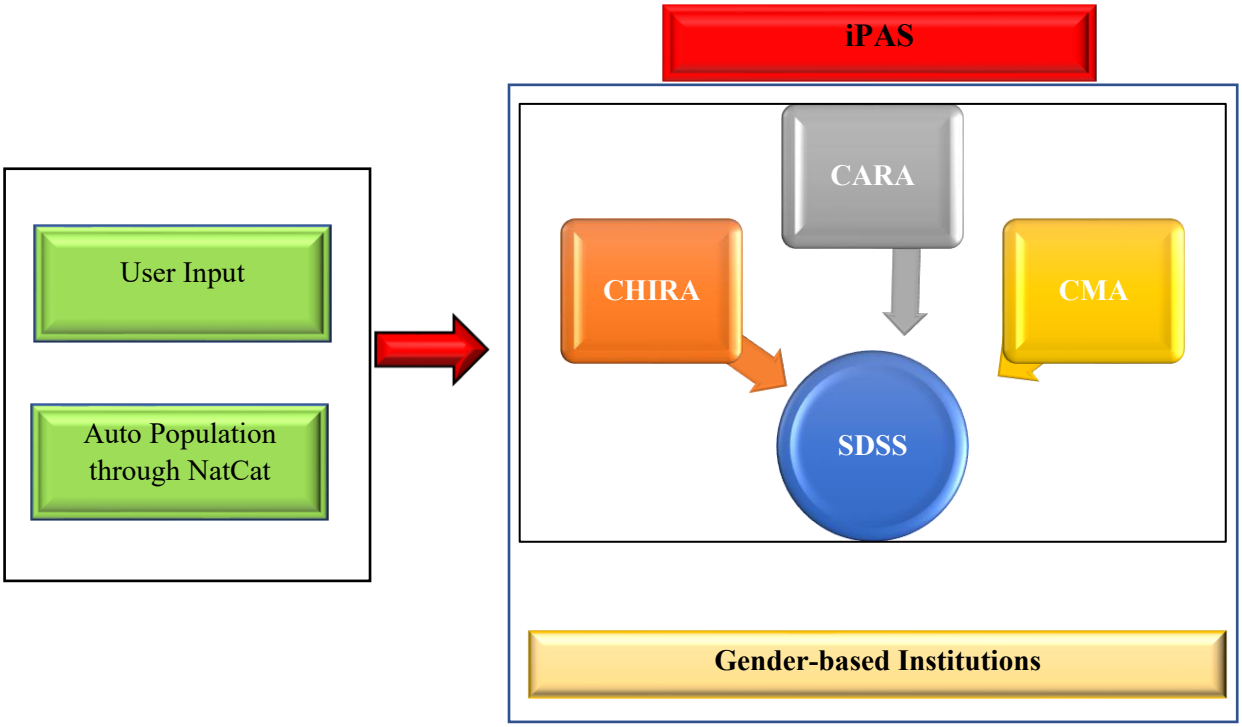

Figure 4: High-Level Design & Implementation of Climate Change Assessment Tools

The integration comprises: iPAS Frontend, iPAS Backend/Integration Service, NatCat API, Database, Queue/Workers, Cache/Object Store, Monitoring, and Security Gateway. The Backend acts as the mediator handling auth, validation, mapping, caching, retries, and persistence.

System Context Diagram:

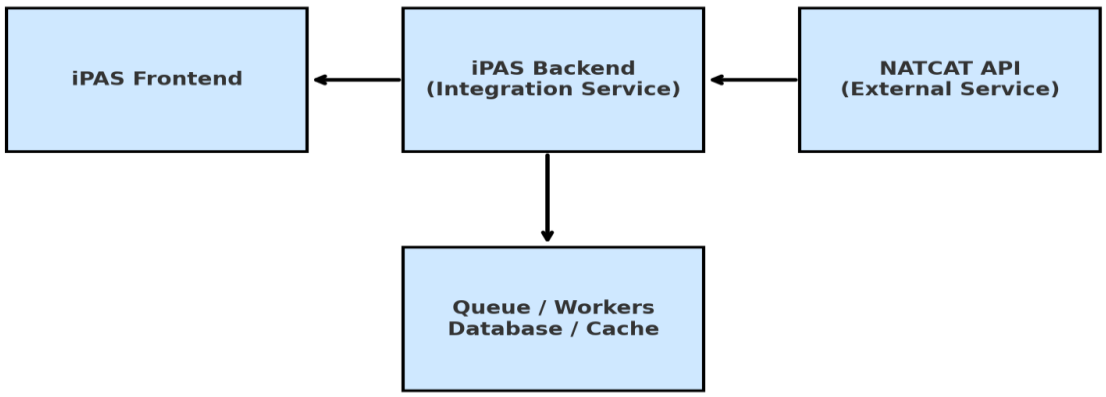

Figure 5: System Context Diagram

4. Integration Patterns & Methodology

Synchronous (direct) flow for small geometries and quick runs; Asynchronous (queued) flow for large polygons or heavy model runs. Prefer async for long-running tasks with job queue, workers, and notification or webhook pattern.

Data Flow Diagram (Sync & Async):

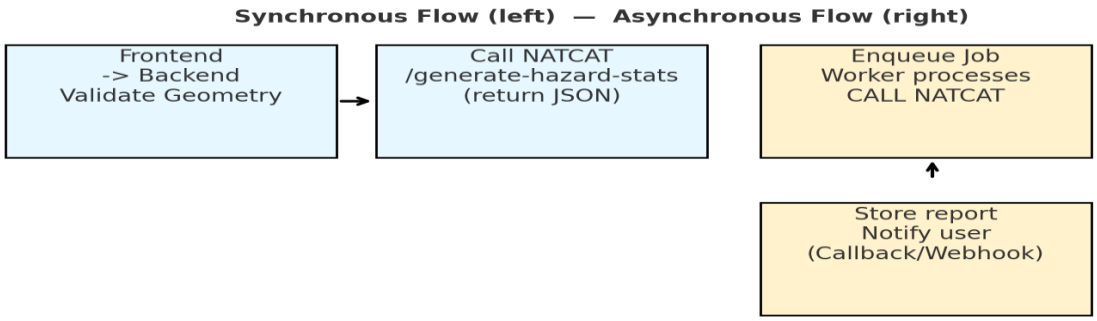

Figure 6: Data Flow Diagram

5. Detailed Architecture & Integration with iPAS

This document describes the architecture design for integrating the Climate Screening Framework (CHIRA, CARA and CMA) with the Intelligent Project Automation System (iPAS). The framework ensures climate risk assessment across the project lifecycle (PC-N to PC-V) with seamless data exchange, risk evaluation, and visualization capabilities.

5.1. System Components

The integration comprises the following components:

- iPAS Frontend and Backend Services
- NatCat API and Climate Tools (CHIRA, CARA, CMA)

- Data Management (PostgreSQL + PostGIS, S3 Object Storage)
- Message Queue and Worker Nodes for Asynchronous Processing
- Monitoring, Security, and CI/CD Infrastructure

5.2. Architecture Diagram

The following diagram represents the overall architecture and component interaction between iPAS and the Climate Screening Framework:

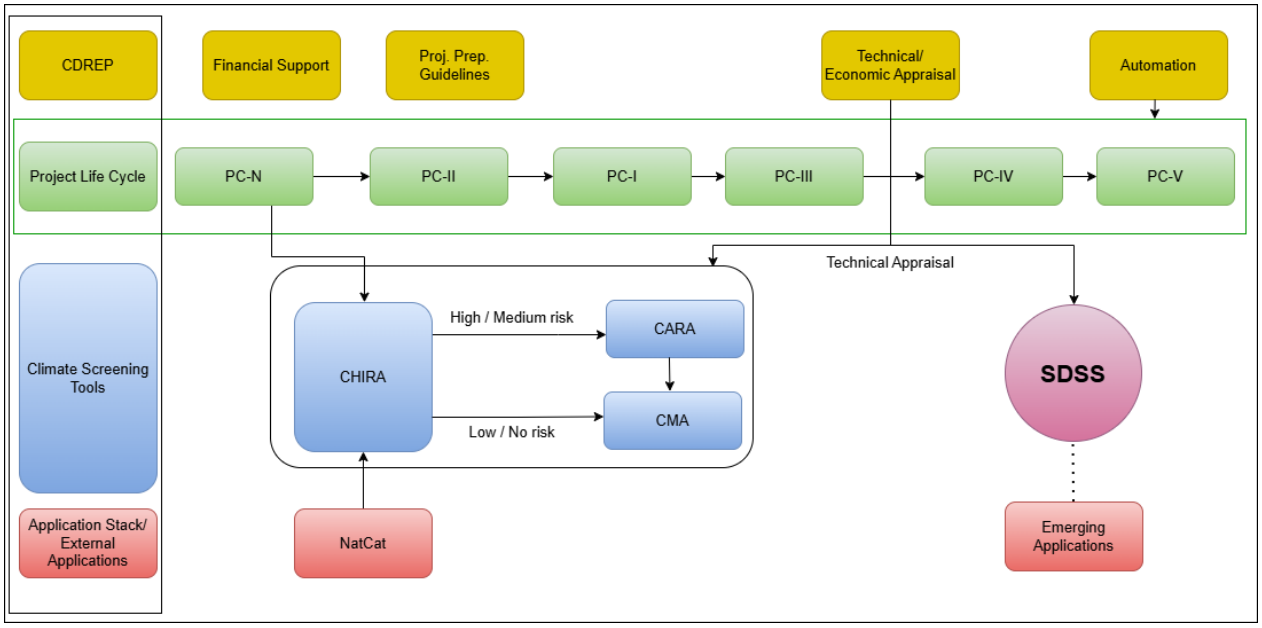

Figure 7: Architecture Diagram

5.3.4. System Flow

The system flow describes how the user initiates a project screening process and how data flows through various integrated systems for risk evaluation.

High-level flow:

1. User submits project data via iPAS frontend.
2. iPAS Backend validates geometry and sends it to NatCat through CHIRA.
3. NatCat returns hazard profiles (flood, drought, etc.) and populates the CHIRA in iPAS.
4. For medium/high risk projects, CARA analyses are triggered.
5. For all projects CMA to be filled by the executing agency.
6. SDSS visualizes results with geographic mapping.
7. Final reports are stored and visualized in iPAS.

5.4.5. Sequence Diagram

Below is a simplified sequence diagram outlining the communication between iPAS, NatCat, and Climate Tools.

[User] → [iPAS Frontend] → [iPAS Backend] → [NatCat API] → [Climate Tools] → [Storage] → [Visualization]

Each step involves validation, job management, and status updates to ensure a complete risk assessment process.

5.5.6. Use Cases

Key use cases include:

- Climate Risk Assessment (CHIRA)
- Climate Adaptation and Risk Analysis (CARA)
- Climate Mitigation Assessment (CMA)
- Site Suitability and Visualization (SDSS)

5.6.7. Data Flow Diagram

The Data Flow Diagram (DFD) illustrates the movement of data between users, iPAS subsystems, and external climate tools.

1. User Inputs → Project Lifecycle (PC Stages)
2. Validation and Climate Screening (CHIRA)
3. Technical Appraisal (CARA, CMA, SDSS)
4. Report Generation and Visualization (iPAS Dashboard)

5.7.8. Integration and Security

Integration is achieved through RESTful APIs and message queues. Security is enforced using JWT tokens, HTTPS, role-based access control, and encrypted credentials stored in a secure vault.

5.8.9. Monitoring and Scalability

The system uses Prometheus and Grafana for monitoring, with autoscaling workers to handle load spikes. Caching and message queues improve system performance and resilience.

5.9.10. Conclusion

The integrated architecture provides a robust, secure, and scalable framework for climate risk assessment within iPAS, ensuring efficient project lifecycle management and informed decision-making based on climate intelligence.

6. API Contracts (NatCat)

Authentication: API Key (query param) + JWT token obtained via /login and sent in Authorization

header.

Login Endpoint: POST /login Request JSON:

{"username":"your_username","password":"your_password"}

Response: {"success":true,"message":"Authentication successful","token":"<JWT>"}

Validate Geometry: POST /validate-geometry Request JSON:

{"geometry":"{...GeoJSON...}"} Response:

{"success":true,"isValid":true,"message":"Valid GeoJSON geometry"}

Generate Hazard Stats: POST /generate-hazard-stats?key=YOUR_API_KEY Headers: Authorization: Bearer

YOUR_JWT_TOKEN Request JSON:

{"ProjectTitle":"...","ProjectDescription":"...","ProjectGeometry":"<GeoJSON>"}

Response: JSON payload with report_metadata, demographics, land_cover_distribution, elements_at_risk, hazard_profiles (flood, earthquake, drought, heatwave, cyclone_wind, landslide).

Generate Flood Stats: POST /generate-flood-stats?key=YOUR_API_KEY (similar structure focused on

flood outputs).

Error Responses: {"success":false,"message":"Error description"} with standard HTTP codes

200,400,401,403,500.

7. Data Mapping (NatCat → iPAS)

Top-level mapping: report_metadata → report headers; demographics → population;

land_cover_distribution → land cover table; elements_at_risk → elements summary; hazard_profiles →

normalized hazard tables. See appendix for JSON examples.

8. Hazard Profiles Mapping

Each hazard contains nested arrays; map arrays to DB normalized tables. Examples: Flood:

exposure_status[], health_facilities_exposure[], schools_exposure[], crop_exposure_hectares[],

crop_loss_million_rs.rabi[], crop_loss_million_rs.kharif[]. Earthquake: hazard_level[],

health_facilities_exposure[], schools_exposure[]. Drought: scenarios[] → projections[].

Heatwave/Cyclone/Landslide: severity[].

9. Sequence Diagrams (Sync Request)

Sequence Diagram:

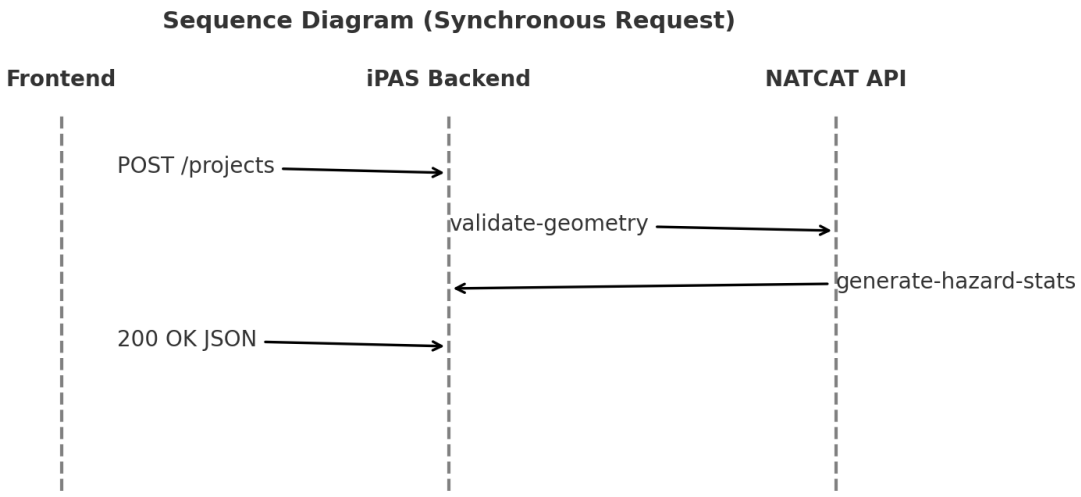

Figure 8: Sequence Diagram

10.Error Handling & Retry Strategy

Client errors (4xx): return actionable messages. Auth errors (401/403): attempt token refresh and re-auth once. Server errors (5xx): retry with exponential backoff and jitter up to configurable

attempts, then persist failure. Enforce idempotency using request_id/job_id.

11.Authentication & Security

TLS 1.2+, store API keys in secret vault, JWT stored server-side only. Apply least-privilege service

accounts, rate limiting, and audit logging. Mask PII and encrypt data at rest.

12. Scalability & Resilience

Autoscale backend and workers, use job queues, cache repeated reports, implement circuit breaker and

backpressure. Use S3 for large report blobs and Redis for caching.

13. Deployment Architecture

Deployment Diagram:

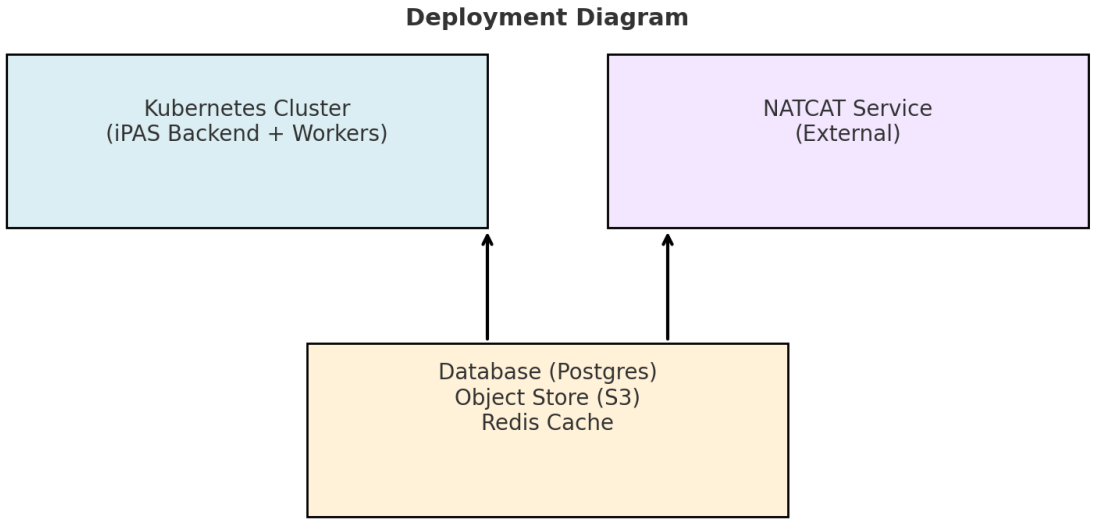

Figure 9: Deployment Diagram

14. Testing Plan

Unit tests for mappers/auth; contract tests validating NatCat JSON against JSON Schema; integration

tests against staging NatCat endpoints; e2e tests for frontend flows; load tests focusing on

queue/backpressure behavior.

15. Monitoring, Logging & Observability

Metrics: request rates, latencies, error rates, queue length. Use Prometheus + Grafana, ELK for

logs, OpenTelemetry for tracing. Alert on NatCat 5xx spikes, token expiry, and long-running jobs.

16. Risk Assessment & Mitigation

Risks: NatCat downtime or slow responses, token expiry, large payload timeouts, schema changes.

Mitigations: async queue, caching, circuit breaker, contract tests, version negotiation.

17. Rollout Strategy & Operational Runbook

Staged rollout: dev → staging → canary → production. Pilot with limited users. Monitor metrics; have support contacts for NatCat endpoints.

Annexure-I: NatCat Database for CHIRA, JSON File and CHIRA Source Document

Using the NatCat Database for Climate and Hazard Initial Risk Assessment (CHIRA) of PC-I Projects

Context

The Planning Commission of Pakistan is integrating climate and disaster risk considerations into future PC-1 projects through Climate and Hazard Initial Risk Assessment (CHIRA). To ensure evidence-based decision-making, the NatCat (Natural Catastrophes) database can be utilized to assess the exposure of proposed projects to major hazards, including droughts, riverine floods, urban floods, heatwaves, tropical storms, tsunamis, landslides, and earthquakes. GLOFs and Smog shall be added in the NatCat in the near future.

Hazards Covered by NatCat

- Riverine Floods
- Urban Floods
- Droughts
- Heatwaves
- Tsunamis
- Landslides
- Earthquakes
- Tropical Storms
- Glacial Lake Outburst Floods (GLOFs) **(In the near future)**
- Smog (In the near future)

How NatCat Supports CHIRA

- **Hazard Layers**: NatCat provides spatially-referenced datasets of multiple natural hazards (mentioned above).
- **Spatial Overlay Analysis**: By overlaying proposed project locations with hazard layers, the level of exposure to each hazard can be systematically identified.
- **Risk Screening**: This process highlights whether the project site falls in **high, medium, or low exposure zones**, enabling risk-sensitive planning and design.
- **Decision Support**: Results inform whether mitigation measures (e.g., flood-proofing, slope stabilization, heat-resilient design) are required in the PC-1 project proposal.

Required Inputs from the Planning Commission

To operationalize this approach, the Planning Commission must provide:

1. Geospatial Coordinates of Proposed Projects:
    - **Point data** for small-scale projects (e.g., a single building, facility).
    - **Polygon boundaries** for large or linear projects (e.g., roads, industrial zones, irrigation networks).
2. **Project Profile Information**: Purpose, size, type, and anticipated beneficiaries, to assess how hazards may influence development outcomes.

Outputs Generated through NatCat-CHIRA Analysis

- **Exposure Map & Report**: Showing whether the project area overlaps with hazard-prone zones (e.g., floodplains, seismic zones).
- **Hazard-specific Exposure Levels**: Identification of which hazards are relevant at the project location.
- **Vulnerability Implications**: Assessment of how the project may **reduce** (e.g., flood protection, drought resilience) or **increase** (e.g., construction in high-risk floodplains) community vulnerability and risks.
- **Policy Recommendation**: Whether to proceed, revise design, or integrate additional safeguards into the PC-1.

Key Benefits

- **Effectiveness of NatCat**: Provides standardized, multi-hazard, and spatially detailed datasets that ensure consistent and scientifically robust risk assessments across all PC-1 projects.
- Enhances **climate and disaster-proofing** of national investments.
- Reduces future **economic losses** from hazards by avoiding high-risk siting.
- Strengthens compliance with Pakistan's **National Climate Change Policy** and international resilience commitments (Sendai Framework, SDGs).
- Supports **cost-effective planning**, ensuring that limited public resources are invested in projects that are both resilient and sustainable.

JSON FILE FOR CLIMATE SCREENING

Context

The NatCat model uses the geocoordinates of the different areas of interest to perform probabilistic modelling and return a detailed report regarding the different possible natural disasters that may or can occur in that area of interest. The area of interest can be defined by three types

- Point
- LineString
- Polygon

Point:

```
{
  "type": "Point",
  "coordinates": [longitude, latitude]
```

LineString:

```
{
  "type": "LineString", "coordinates": [
    [longitude1, latitude1], [longitude2,
    latitude2],
    ...
  ]
```

Polygon:

```
{
  "type": "Polygon", "coordinates": [
    [
      [longitude1, latitude1],
      [longitude2, latitude2]
```

```
        ...
        [longitude1, latitude1] // The last point must be the same as the first to close the
polygon
      ]
  ]
```

Authentication

The API uses a two-factor authentication system:

- **API Key:** Required as a query parameter with each request
- **JWT Token:** Obtained through login and passed in Authorization header

Login Endpoint

```
POST /login
Content-Type: application/json

{
  "username": "your_username", "password":
  "your_password"
```

Response:

```
{
  "success": true,
  "message": "Authentication successful",
  "token": "eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9..."
```

This token must be included in the Authorization header for subsequent requests:

Authorization: Bearer eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9...

API Endpoints

i. Validate GeoJSON Geometry

```
POST /validate-geometry
```

```
Content-Type: application/json

{
   "geometry": "{\"type\":\"Point\",\"coordinates\":[ 75.5566642,35.3215959]}"
}
```

Response:

```
{
   "success": true, "isValid": true,
   "message": "Valid GeoJSON geometry"
}
```

ii. Generate Hazard Impact Stats

```
POST /generate-hazard-
stats?key=YOUR_API_KEY Content-Type:
application/json Authorization: Bearer
YOUR_JWT_TOKEN

{
   "ProjectTitle": "Test Project",
   "ProjectDescription": "This is a test project description", "ProjectGeometry":
"{\"type\":\"Point\",\"coordinates\":[75.5566642,35.3215959]}"
```

Response:

```
{
   "report_metadata": {
      "report_title": "RISK PROFILE FOR AREA",
      "area_of_interest": "AREA NAME",
      "generated_on": " YYYY-MM-DD",
      "generated_by": "NatCat", "developed_by": {
         "organization": "SUPARCO",
         "client": "NDRMF"
      },
      "disclaimer": "The findings are derived from probabilistic models and
statistical methods, which are subject to inherent uncertainties. The analyses and
results are intended for informational purposes only and are not to be construed as
legal evidence. [cite: 402, 403, 404]"
   },
```

```
        "area_name": "AREA NAME", "total_population":
        "POPULATION (INTEGER)"
      }
  ],
  "land_cover_distribution": [
      {
        "class": "Class A", "area_sq_km": "SQ
        KM (INTEGER)"
      },
      {
        "class": "CLASS B",
        "area_sq_km": "SQ KM (INTEGER)"
      },
      {
        "class": "CLASS C",
        "area_sq_km": "SQ KM (INTEGER)"
      },
      {
        "class": "CLASS D",
        "area_sq_km": "SQ KM (INTEGER)"
      },
      {
        "class": "CLASS E",
        "area_sq_km": "SQ KM (INTEGER)"
      },
      {
        "class": "CLASS F",
        "area_sq_km": "SQ KM (INTEGER)"
      }
  ],
  "elements_at_risk": { "health_facilities": "VALUE
    (INTEGER)",
    "educational_institutes": "VALUE (INTEGER)", "roads_km":
    "VALUE (DOUBLE)",
    "crops_hectares": {
        "cotton": "VALUE (DOUBLE)",
        "rice": "VALUE (DOUBLE)",
        "sugarcane": "VALUE (DOUBLE)",
        "wheat": "VALUE (DOUBLE)"
    }
  },
  "hazard_profiles": { "flood": {
        "exposure_status": [
            {"return_period_years": "VALUE (INTEGER [5,25,50,100,200])", "status": "VALUE
(STRING)"}
```

```
        ],
        "health_facilities_exposure": [
            {"type": "VALUE (STRING)", "return_period_years": "VALUE (INTEGER
[5,25,50,100,200])", "count": "VALUE (INTEGER)"}

        ],
        "schools_exposure": [
            {"level": "VALUE (STRING)", "return_period_years": "VALUE (INTEGER
[5,25,50,100,200])", "count": "VALUE (INTEGER)"}

        ],
        "crop_exposure_hectares": [
            {"crop": "VALUE (STRING) [CROP NAME]", "return_period_years": "VALUE
(INTEGER [200])", "area": "VALUE (INTEGER)"}

        ],
        "crop_loss_million_rs": { "rabi": [
                {"return_period_years": "VALUE (INTEGER [5,10,25,50,100,200])",
"value":"VALUE (INTEGER)"}

            ],
            "kharif": [
                {"return_period_years": "VALUE (INTEGER [5,10,25,50,100,200])",
"value":"VALUE (INTEGER)"}

            ]
        }
    },
    "earthquake": { "hazard_level":[
            {"return_period_years": "VALUE (INTEGER [95,475,975,2475])", "category":
"VALUE (STRING)"}
        ],
        "health_facilities_exposure": [
            {"return_period_years": "VALUE (INTEGER [95,475,975,2475])", "pga_class":
"VALUE (STRING)", "count": "VALUE (INTEGER)"}
        ],
        "schools_exposure": [
            {"return_period_years": "VALUE (INTEGER [95,475,975,2475])", "pga_class":
"VALUE (STRING)", "count": "VALUE (INTEGER)"}

        ]
    },
    "drought": {
```

```
        "scenarios": [
          {
            "scenario_name": "VALUE (STRING) [SSP245, SSP585]",
            "projections": [
              {"interval": "VALUE (STRING)", "rabi": "VALUE (STRING)",
"kharif": "VALUE (STRING)"}
            ]
          }
        ]
      },
      "heatwave": {
        "severity": [
          {"return_period_years": "VALUE (INTEGER [5,10,25,50,100,200,500])",
"level": "VALUE (STRING)"}
        ]
      },
      "cyclone_wind": { "severity": [
          {"return_period_years": "VALUE (INTEGER [25,50,100,500,1000,5000])",
"level": "VALUE (STRING)"}
        ]
      },
      "landslide": {
        "severity": [
          {"return_period_years": "VALUE (INTEGER [5,10,25,50,100,250,500])",
"level": "VALUE (STRING)"}
```


iii. Generate Flood Impact Stats


```
POST /generate-flood-
stats?key=YOUR_API_KEY Content-Type:
application/json Authorization: Bearer
YOUR_JWT_TOKEN

{
  "ProjectTitle": "Test Project",
  "ProjectDescription": "This is a test project description", "ProjectGeometry":
"{\"type\":\"Point\",\"coordinates\":[75.5566642,35.3215959]}"
```

Response:


```
{
  "report_metadata": {
    "report_title": "RISK PROFILE FOR AREA",
    "area_of_interest": "AREA NAME",
    "generated_on": " YYYY-MM-DD",
    "generated_by": "NatCat", "developed_by": {
      "organization": "SUPARCO",
      "client": "NDRMF"
    },
    "disclaimer": "The findings are derived from probabilistic models and statistical methods, which are subject to inherent uncertainties. The analyses and results are intended for informational purposes only and are not to be construed as legal evidence. [cite: 402, 403, 404]"
  },
  "demographics": [
    {
      "area_name": "AREA NAME", "total_population":
      "POPULATION (INTEGER)"
    }
  ],
  "land_cover_distribution": [
    {
      "class": "Class A", "area_sq_km":
      "SQ KM (INTEGER)"
    },
    {
      "class": "CLASS B",
      "area_sq_km": "SQ KM (INTEGER)"
    },
    {
      "class": "CLASS C",
      "area_sq_km": "SQ KM (INTEGER)"
    },
```

```
        {
          "class": "CLASS F",
          "area_sq_km": "SQ KM (INTEGER)"
        }
    ],
    "elements_at_risk": { "health_facilities": "VALUE
      (INTEGER)",
      "educational_institutes": "VALUE (INTEGER)", "roads_km":
      "VALUE (DOUBLE)",
      "crops_hectares": {
        "cotton": "VALUE (DOUBLE)",
        "rice": "VALUE (DOUBLE)",
        "sugarcane": "VALUE (DOUBLE)",
        "wheat": "VALUE (DOUBLE)"
      }
    },
    "hazard_profiles": { "flood": {
          "exposure_status": [
            {"return_period_years": "VALUE (INTEGER [5,25,50,100,200])", "status": "VALUE
(STRING)"}

          ],
          "health_facilities_exposure": [
            {"type": "VALUE (STRING)", "return_period_years": "VALUE (INTEGER
[5,25,50,100,200])", "count": "VALUE (INTEGER)"}

          ],
          "schools_exposure": [
            {"level": "VALUE (STRING)", "return_period_years": "VALUE (INTEGER
[5,25,50,100,200])", "count": "VALUE (INTEGER)"}

          ],
          "crop_exposure_hectares": [
            {"crop": "VALUE (STRING) [CROP NAME]", "return_period_years": "VALUE
(INTEGER [200])", "area": "VALUE (INTEGER)"}

          ],
          "crop_loss_million_rs": { "rabi": [
              {"return_period_years": "VALUE (INTEGER [5,10,25,50,100,200])",
"value":"VALUE (INTEGER)"}

            ],
            "kharif": [
```

```
                {"return_period_years": "VALUE (INTEGER [5,10,25,50,100,200])",
"value":"VALUE (INTEGER)"}

            ]

        }

    }
```


iv. Error Handling

All API responses include a success field indicating whether the request was successful. In case of errors, the response will include an error message:


```
{
   "success": false,
   "message": "Error description"
}
```


Common HTTP status codes:

Status Code	Description
200	Success
400	Bad Request (invalid parameters or geometry)
401	Unauthorized (missing or invalid API key)
403	Forbidden (invalid or expired JWT token)
500	Internal Server Error

Annexure-II: CMA Design Document and Source Document

CMA Design Document

1. Project Details (User Input)

- **Project Title** *(Text field)* – Name of the project.
- **Project Type** *(Dropdown)* – Infrastructure, Energy, Transport, Industrial, Agricultural, etc.
- **Project Life (Years)** *(Number field)* – Expected operational duration.
- **Location** *(Text / Geolocation field)* – City/District/Province.

Section	Fields	Scenario
Project Details (User Input)	• **Project Title** *(Text field)* – Name of the project. • **Project Type** *(Dropdown)* – Infrastructure, Energy, Transport, Industrial, Agricultural, etc. • **Project Life (Years)** *(Number field)* – Expected operational duration. • **Location** *(Text / Geolocation field)* – City/District/Province.	Already in available in iPAS
Emission Scenarios (User Input + System Calculation)	• **Baseline Emissions** (without project) ***(Numeric input, tons CO_2e/year)*** • **Projected Emissions** (with project) ***(Numeric input, tons CO_2e/year)*** • **Net Emissions** (difference) ***(Auto-calculated by system)***	Needs to be included in iPAS
Emission Estimates by Project Life	□ **Input by User:** • Project Stage *(Dropdown: Construction / Operation / Decommissioning)* • Activity Type *(Text / Dropdown: Energy Use, Transport, Waste, etc.)* • Estimated Emissions *(Numeric input, tons CO_2e)* □ **System Action:**	Needs to be included in iPAS

	• Organize into lifecycle categories.	

Calculated Emissions (System-Generated)	• **System will calculate:**
	  ○ Annualized emissions across project life.
	  ○ Cumulative emissions (tons CO_2e).
	  ○ Comparison with baseline.
	
	(No manual input required here – depends on Table 6.2 values.)
		Needs to be included in iPAS

Net Emissions (System-Generated)	**Auto-calculated values:** • Net Emissions (With Project – Baseline). • % Increase/Decrease from Baseline.	Needs to be included in iPAS

Mitigation Options (User Input + Predefined Options)	• **Mitigation Strategy** *(Dropdown + Multi-select)*:
	  ○ Renewable Energy Integration
	  ○ Energy Efficiency Measures
	  ○ Carbon Capture & Storage
	  ○ Afforestation / Reforestation
	  ○ Waste Management Improvements
	  ○ Fuel Switching
	  ○ Other *(Text field)*
	• **Expected Reduction (tons CO_2e/year)** *(Numeric input)*
	
	(System may later compare projected reductions with net emissions.)
		Needs to be included in iPAS

Data Sources (User Input)	□ **Data Source Type** *(Dropdown)* – Government Report, Feasibility Study, Emission Factor Database, IPCC Guidelines, Other. □ **Reference / Document Link** *(Text/Upload field)* – Citation or file upload for validation. □ **Reliability Rating** *(Dropdown: High / Medium / Low)*	Needs to be included in iPAS

Annexure-III: CARA Design Document and Source Document

CARA Design Document

Section	Fields	Scenario
Project Details (User Input)	• **Project Title** *(Text field)* – Name of the project. • **Project Type** *(Dropdown)* – Infrastructure, Energy, Transport, Industrial, Agricultural, etc. • **Project Life (Years)** *(Number field)* – Expected operational duration. • **Location** *(Text / Geolocation field)* – City/District/Province. • **Project Summary** *(Textarea – short narrative)*	Already in available in iPAS
Climate Hazard Identification & Exposure		
Overall Exposure & Impacts (User Input + System Calculation)	• **Outcome/Service Delivery** *(Textarea)* • **Component 1 Risk Score** *(Numeric input)* • **Component 2 Risk Score** *(Numeric input)* • **Total Risk Value** *(Auto-calculated = Sum of components)* • **Risk Category (Current/Future)** *(Dropdown, system may suggest based on total risk)*	Needs to be included in iPAS
Vulnerability Assessment		
Likelihood of Occurrence (User Input, fixed scale)	• **Likelihood** *(Dropdown: Almost Certain / Likely / Possible / Unlikely / Rare)*	Needs to be included in iPAS
Climate Extremes & Hazards Table (User Input)	• **Hazard Name** *(Text field)* • **Description** *(Textarea)* • **Likelihood (scale)** *(Dropdown)*	Needs to be included in iPAS

Drivers of Vulnerability (User Input + Notes)	• **Environment** *(Textarea – description, with option to attach data)* • **Economic** *(Textarea – description, costs, damages)* • **Social** *(Textarea – description, livelihoods, health impacts)* • **Physical** *(Textarea – infrastructure, materials)*	Needs to be included in iPAS
Consequences/Impacts (User Input)	• **Consequence Category** *(Dropdown: Environment / Economic / Social / Physical)* • **Severity Level** *(Dropdown: Insignificant / Minor / Medium / Major / Catastrophic)* • **Impact Description** *(Textarea)*	Needs to be included in iPAS
Overall Risk Assessment		
Risk Evaluation (System Assisted)	• **Likelihood of Occurrence** *(Dropdown)* • **Consequences** *(Dropdown, multi- select possible)* • **Risk Level** *(Auto-calculated from matrix: VH, H, M, L, VL)* • **Color Code** *(Auto-filled: Red/Orange/Yellow/Green/None)*	Needs to be included in iPAS
Adaptation Options		
Structural & Non-Structural Options (User Input)	• **Key Vulnerability** *(Dropdown: Water / Ecosystem / Materials / Location / Health & Safety / Livelihood / Infrastructure)* • **Structural Option** *(Textarea)* • **Non-Structural Option** *(Textarea)*	
Prioritized Adaptation Options (User Input)	• Key Vulnerability (Dropdown as above) • Prioritized Option (Textarea)	

Multi-Criteria Analysis (User Input + System Calculation)	For each indicator: • **Indicator** *(Auto-filled list: Policy Consistency, Acceptability, Capacity, Sustainability, Returns, Environmental fit, etc.)* • **Rating (1–5, N/A)** *(Dropdown/Radio)* • **System Total Score** *(Auto-calculated sum)*	
Decision-Making		
	• **Decision Type** *(Dropdown: No-regret / Low-regret / High-regret / Co-benefits / Future investment / Monitor & adapt)* • **Decision Justification** *(Textarea)*	
Overall Action Plan		
	• Adaptation Option (Text/Dropdown – from section 5) • Responsible Party/Person (Text/Dropdown: WAPDA, PDMA, NDMA, MoH, Planning Commission, etc.) • Schedule/Timeline (Date/Duration input) • Expected Results (Textarea) • Indicators (Textarea – measurable outcomes) • Cost/Budget (PKR) (Numeric input)	

Annexure-IV: Gender-based Institutions

GOVERNMENT OF PAKISTAN
PLANNING COMMISSION
MINISTRY OF PLANNING, DEVELOPMENT & SPECIAL INITIATIVES
GENDER UNIT

****

Islamabad, 10th October, 2025

Subject: GENDER EQUALITY, CHILD RIGHTS, CLIMATE & SOCIAL INCLUSION CENTERED PROGRAMMING CHECKLIST FOR PROJECTS – PUBLIC SECTOR DEVELOPMENT PROJECTS-CDREP

In reference to meetings conducted for CDREP policy clauses 2.4i the Gender, Child Rights & Social Inclusion Centered Programming Checklist developed by the Gender Unit at Ministry of Planning, Development & Special Initiatives (MoPD&SI) with the technical support of UNWOMEN, provides a structured tool to operationalize gender equality , climate, child right and inclusion across the Public Sector Development Programme (PSDP). The checklist requires projects to demonstrate how they address thematic areas such as climate change and vulnerability, social protection, women's economic empowerment, and gender-based violence. It captures both quantitative and qualitative indicators, ranging from gender-responsive budgeting and sex-disaggregated beneficiary data to the participation of women, girls, transgender persons, and persons with disabilities in decision-making and implementation. By integrating these parameters into IPAS, the checklist institutionalizes gender accountability in project planning and monitoring, aligning national development priorities with global commitments on gender equality and social inclusion.

Further deliberations and feedback from line ministries may lead to changes and revisions, allowing for iterative development based on feedback.

Key Gender Mainstreaming Actions	Questions	What is this about?	Comments/ Help
Theme	1. Please select which of the following thematic area of gender equality does your project directly address: a. Climate Change and Vulnerability b. Social Protection c. Gender-Based Institutions d. Women Economic Empowerment e. Education & Skills development f. Access to health services g. Gender-Based Violence h. Institutional Capacity for Gender & Climate Mainstreaming	• Defines the thematic area of gender equality, how the project contributes in bridging the gender gap	**iPAS Team Comments** • (Separate tab may be added for gender in all PCs Format) • Drop down of thematic areas may be added in PC-I to PC-V
Outcomes	2. Total number of beneficiaries: 3. Number of female and girl beneficiaries reached through this project: a. Number of female and girl beneficiaries reached through this project: b. Number of Women Educated or Trained (including climate-smart/green skills) c. Number of Women with Improved Access to Health Services (including climate-related health impacts) d. Number of Women Financially Empowered (access to finance, loans, or climate-resilient livelihoods) e. Number of Women with Improved Food Security & Climate-Resilient Nutrition f. Number of Domestic Violence Victims Supported (especially in disaster/climate-stressed contexts) g. Total number of Women Beneficiaries in Disaster-Prone or Climate-Vulnerable Areas h. Number of Women with Improved Access to Climate-Resilient Infrastructure & Services i. Number of Women Benefiting from Early Warning Systems, Disaster Risk Reduction, or Climate Information Services j. Number of Women Participating in Leadership, Governance, and Decision-Making Processes k. Number of Women Benefiting from Green Jobs, Renewable Energy, or Climate-Smart Enterprises	• Captures how many people in total and women/girls the project will benefit directly. State the estimated numbers as per the demographics of the project area if estimates not available	• Quantitative • Questions may be added at PC-I, PC-III, PC-IV, PC -V level. Estimates in case of PC1 and actual figures in PC-III, PC-IV and PC-V cases • Incase NATCAT can provide socio demographic gender - disaggregated data to estimate beneficiaries These are all separate quantitative questions with entries

Key Gender Mainstreaming Actions	Questions	What is this about?	Comments/ Help
Budget and Costing	4. Amount allocated to gender-specific activities (PKFR): 5. Type of gender-specific activities (drop-down, can select multiple): a) Infrastructure (housing, transport, water access & sanitation, ramps, shelters, etc.) b) Skills Development and Capacity Building and Trainings for Women c) Livelihood and Economic Empowerment (soft-loans, grants, land for agriculture, etc.) d) Gender-Disaggregated Data Collection and Surveys e) Stakeholder Engagement of Women f) Climate Resilience, Adaptation and Mitigation Efforts g) Access to Climate Information, Early Warning Systems & DRR Training h) Participation in Leadership, Governance & Decision-Making i) Health & Nutrition Services with Climate-Responsive Focus j) Green Jobs, Renewable Energy & Just Transition Initiatives for Women k) Gender-Responsive Budgeting & Resource Allocation for Climate Action 6. Explain the activities in 100-150 words:	• Proportion of funding specifically targeting gender outcomes • The input will help calculate % of Budget Allocation for gender equality and assist in ranking and coding of the project as GEN 0 to GEN 3 as per Gender Marker Guidelines table	• Quantitative • Questions may be added at PC-I, PC-III, PC-IV, PC -V level. Estimates in case of PC1 and actual figures in PC-III, PC-IV and PC-V cases
Stakeholders & Participation Plan	7. Number of the underrepresented gender (women, girls, transgender individuals) targeted for active participation in all the following aspects of projects? a. **Pre-approval/ Design Phase** Participation (For new projects) i. Total number of persons consulted: 1. Number of Women: 2. Number of Girls: 3. Number of Transgenders: 4. Total number of persons with disabilities (men and women): 5. Number of women with	• Asks if these groups were consulted while designing, planning implementation, and M&E of the project • Percentage of women/girls or underrepresented groups in formal decision roles	• Quantitative • Questions may be added at PC-I, PC-III, PC-IV, PC -V level. Estimates in case of PC1 and actual figures in PC-III, PC-IV and PC-V cases •

Key Gender Mainstreaming Actions	Questions	What is this about?	Comments/ Help
	disabilities: ii. Number of local communities' representatives (men and women): iii. Number of district officials (men and women): iv. Number of CSO, NGOs and development partners (men and women): b. **Implementation Phase Consultation**s (For projects in implementation phase) i. Total number of persons consulted: 1. Number of Women: 2. Number of Girls: 3. Number of Transgenders: 4. Total number of persons with disabilities (men and women): 5. Number of women with disabilities: ii. Number of local communities' representatives (men and women): iii. Number of district officials (men and women): iv. Number of CSO, NGOs and development partners (men and women): c. **Steering Committee/ Decision making** (For projects in implementation phase) i. Total number of persons consulted: 1. Number of Women: 2. Number of Girls: 3. Number of Transgenders: 4. Total number of persons with disabilities (men and women): 5. Number of women with		

Key Gender Mainstreaming Actions	Questions	What is this about?	Comments/ Help
	disabilities: ii. Number of local communities' representatives (men and women): iii. Number of district officials (men and women): iv. Number of CSO, NGOs and development partners (men and women): **d. Monitoring & Evaluation (M&E)** i. Total number of persons part of M&E Committee: 1. Number of Women: 2. Number of Girls: 3. Number of Transgenders: 4. Total number of persons with disabilities (men and women): 5. Number of women with disabilities: ii. Number of local communities' representatives in M&E Committee (men and women): iii. Number of district officials in M&E Committee (men and women): iv. Number of CSO, NGOs and development partners in M&E Committee (men and women): 8. What was the mode of consultation, attach proofs (pictures, meeting minutes, notes etc.) : a) Focus-group discussions b) Round-table consultation c) Workshops d) Surveys e) Others (explain in words). Add proof.		
Capacities	9. Do the project manager and/or other key personnel have key expertise/knowledge on: a. Gender (Yes/No) b. Climate (Yes/No)	• Checks if staff are trained or have knowledge on gender inclusion	• **Part of PC-III**

Key Gender Mainstreaming Actions	Questions	What is this about?	Comments/ Help
	10. If internal expertise is lacking, does the project intend to recruit advisors to provide technical guidance and capacity building? If Yes, number of resource persons: ☐ Gender Advisor: ☐ Social Inclusion Advisor: ☐ Climate Advisor:	• Specify number of resources like Gender Specialist/ Gender Advisor/ Gender Consultant, Climate Consultant etc. hiring in the project	• Quantitative Questions in PC-I (estimates) and Actual numbers in PC-III to PC-V • For PC-I policy/instruction for such expertise may be issued
	11. Will all project staff, partners, and stakeholders receive mandatory training on : a) Gender equality b) child rights, c) Climate justice, DRR, and d) social inclusion (e.g., online or in-person sensitization courses)? 12. Number of staff trained on: ☐ Gender-responsive project design, monitoring & evaluation: ☐ Climate Change, Disaster Risk and Adaptation etc. : 13. Number of stakeholders trained on: ☐ Gender-responsive project design, monitoring & evaluation: ☐ Climate Change, Disaster Risk and Adaptation etc. :	• Asks if teams will undergo or conducted any sensitization or training, specify number of trainings (for new projects and projects in implementation	• Checklist Radio button with remarks field in PC-I (estimates) and PC-III (actual) • Quantitative inputs field in PC-I (estimates) and PC-III (actual)
Data & Statistics	14. Will the project collect, analyze, and use gender-disaggregated data to track gender-related disparities, including the participation, access, and impact of women, men, girls, boys, persons with disabilities, indigenous groups, and other marginalized populations to ensure inclusive programming? if yes what mechanism will be used. 14. How will the project gather and utilize child-specific data, including age-disaggregated statistics on education, health, child protection, and social participation? Please explain in a few words. 15. Will the project integrate gender- and child-disaggregated	• Ensure gender-disaggregated data collection and utilization for effective diverse needs-based inclusive programming	• For PC-I policy/instruction for such expertise may be issued and estimates. • Actual numbers in PC-III and PC-IV

Key Gender Mainstreaming Actions	Questions	What is this about?	Comments/ Help
	data into climate and disaster risk assessments (e.g., vulnerability mapping, early warning systems, resilience indicators)?		
Implementation & ME Arrangements (For the projects in execution phase only)	16. Proportion of women in managerial and technical positions in the project (SDGs indicator):	• Tracks whether women hold key positions in project teams. Add in % of the women in your project team (only for projects in implementation phase) •	• Quantitative inputs field in PC-I (estimates) and PC-III to PC-V (actual)
	17. Number of leadership roles assigned to: a. Women, b. Adolescents c. Young people d. Underrepresented groups e. Transgenders f. PWDs within the project.	• Reflects if youth, women, transgender, PWDs, or minorities lead any part of the project Only for projects in implementation). Specify Number	• Quantitative inputs field in PC-III to PC-V (actual)
	18. Does the results framework incorporate climate resilience and adaptation strategies, ensuring that women, girls, children, transgender, persons with disabilities and other vulnerable populations benefit equitably from environmental interventions? Please explain.		• Qualitative Question for PC-I to PC-V