AI-Driven Investment Recommendation & Risk Intelligence System (AIRIS)

Product Requirements Document (PRD)

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1. Executive Summary

The **AI-Driven Investment Recommendation & Risk Intelligence System (AIRIS)** is an intelligent decision-support platform designed to help **senior financial analysts and investment officers** at The International Bank evaluate global country programs and investments across **financial, risk, and ESG dimensions**.

The system will combine **structured financial data**, **macroeconomic indicators**, **qualitative ESG metrics**, and **machine learning–based risk modeling** to deliver ranked, explainable recommendations on:

1. Programs with the **highest potential ROI** (financial and developmental).

2. Programs with the **lowest systemic, political, and credit risk**.

3. ESG-compliant opportunities aligned with International Bank sustainability frameworks.

AIRIS will feature an **interactive dashboard layer** for analysts to:

● Explore recommendations dynamically.

● Review transparent model explanations and supporting data.

● Run scenario simulations (e.g., "If inflation in Country X rises by 2%, what is the impact on expected ROI?").

By augmenting human analysis with machine intelligence, AIRIS will **accelerate investment decision cycles**, **reduce cognitive and data overload**, and **strengthen governance by providing auditable, explainable outputs**.

2. Problem Statement

2.1 Context

International Bank financial analysts currently aggregate and evaluate hundreds of disparate data sources to assess investment potential and risk in over 100 countries. These data streams — financial, macroeconomic, policy, and ESG — are:

- Disconnected across departments.

- Updated asynchronously.

- Evaluated manually with subjective weighting.

The result is **inconsistent analysis**, **delayed insights**, and **limited scalability** for portfolio-level decisions.

2.2 Core Problem

Decision-making on country-level investments is constrained by:

- **Fragmented data** → slow access to unified country profiles.

- **Manual analysis** → inconsistent scoring across teams.

- **Opaque methodologies** → difficulty defending decisions to governance boards.

- **Lack of forward simulation** → limited ability to assess sensitivity to global shifts (e.g., oil prices, interest rates).

3. Vision Statement

> *To enable International Bank analysts to make faster, fairer, and more data-driven investment decisions by providing explainable, AI-assisted recommendations that integrate financial, risk, and ESG intelligence into a unified decision-support system.*

This vision aligns with the Bank's **Digital Development Strategy** and **AI for Good Initiative**, emphasizing *human-centered AI* — systems that augment, not replace, expert judgment.

4. Goals & Non-Goals

4.1 Goals

1. **Unified Data Intelligence:** Integrate multi-source data (financial, macroeconomic, ESG, political risk) into a single platform.

2. **AI-Powered Recommendations:** Provide ranked investment opportunities with transparent rationale and data lineage.

3. **Explainable Insights:** Ensure every model output includes human-readable explanations, feature importance, and supporting data visuals.

4. **Interactive Analyst Dashboard:** Enable analysts to simulate scenarios and customize weighting factors for ROI, risk, and ESG.

5. **Ethical AI Governance:** Implement fairness, interpretability, and audit mechanisms consistent with International Bank data ethics principles.

4.2 Non-Goals

- Replacing human analysts in investment decision-making.

- Fully autonomous allocation of funds.

- Predictive modeling beyond data available from International Bank and IMF open datasets (initial phase).

- Real-time trading or short-term forecasting (system is strategic, not tactical).

5. Key Users & Stakeholders

Role	Primary Needs	System Interaction
Senior Financial Analysts	Fast, transparent investment insights and scenario testing.	View ranked recommendations, adjust filters, interpret model explanations.

Regional Portfolio Managers	Risk-adjusted comparative insights across regions.	Access country dashboards and review underlying metrics.
ESG Officers	Validate compliance with environmental and social standards.	View ESG scoring models, feature weights, and supporting evidence.
AI Product & Data Science Team	Build and monitor models responsibly.	Manage model pipelines, feedback loops, and bias audits.
Executive Leadership & Governance Boards	Oversight and trust in AI outputs.	Receive aggregated dashboards and audit trails for accountability.

6. Success Metrics

Metric Type	Metric	Target / KPI	Measurement Approach
Adoption	% of analysts using AIRIS weekly	80% within 6 months of launch	Usage logs & analytics
Speed	Average time to complete country evaluation	↓ 50% from baseline	User time-tracking
Quality	Model accuracy (top-quartile ROI programs identified)	≥ 85% precision	Backtesting & validation
Explainability	% of recommendations with interpretable feature explanations	100%	Internal audits
Governance	# of flagged ethical or data integrity violations	0 critical incidents	Governance board review
Impact	Increase in data-driven investment decisions	+25% YoY	Portfolio analytics reports

7. Guiding Principles

1. **Human + AI Collaboration:** Analysts remain ultimate decision-makers.

2. **Transparency by Design:** Every recommendation must be explainable and auditable.

3. **Ethics & Equity:** Ensure fairness across countries and avoid bias in training data.

4. **Modularity & Scalability:** Architecture supports integration with regional or thematic modules (e.g., Climate Investment AI).

5. **Interoperability:** Conforms to International Bank enterprise data architecture and API standards.

8. System Overview

AIRIS will combine structured economic data, financial indicators, and ESG metrics to generate **AI-powered, explainable investment recommendations**.
 The system will include:

1. **Data Layer:** Aggregates and normalizes multi-source data (International Bank, IMF, OECD, ESG databases, etc.).

2. **Model Layer:** Uses ML and probabilistic modeling to assess ROI, risk, and ESG alignment.

3. **Application Layer (Dashboard):** Presents interactive insights, explanations, and simulation tools to analysts.

4. **Governance Layer:** Provides audit, bias detection, and explainability tracking.

9. Functional Requirements

9.1 Key Use Cases

ID	Use Case	Description	Primary User
UC 1	**Generate Ranked Recommendations**	Analyst selects time horizon and investment type; system returns ranked country programs with confidence scores.	Financial Analyst

UC 2	**View Model Explanation**	Analyst clicks on a recommendation to view feature importance (e.g., inflation, fiscal deficit, ESG score) and supporting data.	Analyst / ESG Officer
UC 3	**Scenario Simulation**	Adjust macro parameters (e.g., GDP growth ±1%) to see projected ROI/risk shifts.	Analyst
UC 4	**ESG Compliance Validation**	View environmental and social risk scores with underlying evidence (text summaries or linked documents).	ESG Officer
UC 5	**Portfolio Comparison**	Compare two or more country programs side by side (ROI, risk, ESG).	Portfolio Manager
UC 6	**Audit Trail & Explainability Log**	Governance board reviews model rationale, data lineage, and change history.	Executive / AI Governance Board

9.2 Feature List

Feature	Description	Priority
AI Recommendation Engine	Ranks country programs by ROI and risk-adjusted ESG factors.	P0
Explainability Module (XAI)	Displays top features and data contributions for each recommendation (using SHAP/LIME).	P0

Scenario Simulator	Allows users to modify key indicators and observe model response.	P1
Unified Data Connector	Integrates APIs from International Bank, IMF, OECD, and ESG sources.	P0
Interactive Dashboard	Web interface with filtering, sorting, and drill-down.	P0
Governance & Audit Panel	Displays model version, bias tests, and ethical compliance logs.	P1
Feedback Capture Mechanism	Analysts rate recommendation quality to retrain models.	P2

10. System Architecture

10.1 Data Architecture

Data Sources:

- International Bank Open Data (financial & macroeconomic indicators).

- IMF World Economic Outlook datasets.

- ESG databases (Sustainalytics, Refinitiv ESG).

- Internal portfolio performance metrics.

Pipeline:

- **Ingestion:** via REST APIs / batch ETL.

- **Cleaning:** missing value imputation, normalization by GDP or population.

- **Labeling:** historical investment outcomes used to label ROI categories.

- **Storage:** in cloud-based data warehouse (e.g., AWS Redshift or Azure Synapse).

10.2 Model Architecture

Layer	Model Type	Objective	Notes
ROI Predictor	Gradient-Boosted Regression (XGBoost / LightGBM)	Estimate expected financial return (numeric).	Uses macroeconomic and program performance features.
Risk Model	Probabilistic Bayesian Network	Quantify systemic and political risk.	Combines volatility, governance, and debt metrics.
ESG Evaluator	NLP + Rules-Based Scoring	Evaluate sustainability and social compliance.	Uses textual ESG disclosures and sentiment models.
Aggregator Layer	Multi-objective Optimization	Combine ROI, risk, ESG into a single composite score.	Allows weight adjustment by user.

10.3 Explainability and Transparency

- Use **SHAP (SHapley Additive Explanations)** for feature importance at both global and individual levels.

- Provide **natural language explanations**:

> "Program X ranks high due to consistent GDP growth (+3%), low debt ratio (45%), and strong ESG governance score."

- Integrate **attention heatmaps** for textual ESG sources.

- Maintain **model versioning** (via MLflow or similar).

- Store all model outputs, weights, and explanations for governance audits.

11. Dashboard Design & User Experience

11.1 Key Dashboard Sections

Section	Description
Home / Overview	Top 10 recommended programs, KPIs (ROI, Risk, ESG).
Country Drill-Down	Detailed view of a specific country's financial & ESG metrics.
Scenario Simulator	Interactive sliders (GDP growth, interest rate, inflation).
Explainability Panel	Feature importance chart + narrative rationale.
Governance Tab	Audit trail, model info, last retraining date, ethical compliance status.

11.2 User Flow (Primary Path)

1. Analyst logs in → Dashboard overview.

2. Selects "Generate Recommendations."

3. AIRIS displays ranked programs with ROI/risk scores.

4. Analyst selects a program → views explanation and source data.

5. Optionally runs a scenario simulation → exports report as PDF.

6. System logs feedback (was this recommendation useful?).

11.3 UX Design Principles

● **Explainability First:** Every insight must have an attached rationale.

● **Data Lineage Visibility:** Hover states reveal data provenance (source + timestamp).

● **Accessibility:** WCAG 2.1 compliant UI for diverse global teams.

● **Consistency:** Align with existing International Bank design system.

● **Performance:** Load time under 3 seconds for dashboard queries.

12. Non-Functional Requirements

Category	Requirement
Scalability	Handle data for 190+ countries and 10 years of historical data.
Performance	Dashboard query < 3 sec; model inference < 1 sec per program.
Reliability	99.9% uptime SLA; redundant failover.
Security	Role-based access; encrypted data at rest and in transit.
Privacy	No PII stored; compliance with GDPR and internal data policies.

Ethical AI   Built-in fairness, bias detection, and human review checkpoints.

Auditability   Immutable logs for all recommendations and model changes.

13. AI Governance & Ethical Framework

13.1 Governance Model

AIRIS will operate under a **three-tier AI governance structure** aligned with International Bank Digital Governance Policy (POL-AI-2024):

Tier	Body	Responsibility
Tier 1	**AI Product Steering Committee**	Strategic oversight, alignment with Bank objectives.
Tier 2	**Model Governance Board (MGB)**	Validates model designs, approves deployments, monitors bias and risk.
Tier 3	**Operational Governance Team (OGT)**	Implements controls, conducts audits, maintains compliance artifacts.

13.2 Ethical AI Principles

AIRIS will adhere to the International Bank's **AI Ethics Charter**, anchored in five principles:

1. **Fairness & Equity** – Avoid systematic bias against countries or regions.

2. **Transparency & Explainability** – All recommendations must include interpretable rationale and source data.

3. **Accountability & Auditability** – Human decision-makers retain responsibility for final investment choices.

4. **Privacy & Data Protection** – All data handled in compliance with GDPR and International Bank Data Governance Standards.

5. **Human Oversight & Autonomy** – System operates as advisory; no autonomous action on fund allocation.

13.3 Bias and Fairness Testing

● Conduct **pre-training bias audits** on input datasets (e.g., GDP, credit ratings, social indices).

● Apply **cross-country fairness metrics** such as Demographic Parity and Equalized Odds.

● Integrate **post-hoc bias visualizations** in the Governance Dashboard.

● Red-team testing before deployment to simulate edge cases and potential harm.

13.4 Human-in-the-Loop (HITL) Controls

Stage	Human Oversight Action
Data Preparation	Data Steward approves data quality & representativeness.
Model Training	Data Scientist validates performance and bias metrics.
Model Deployment	AI Product Manager and Governance Board sign off.

Recommendation Delivery	Analyst reviews explanation before acting.
Post-Decision Review	Periodic audit of model outputs vs actual ROI outcomes.

13.5 Audit & Traceability

- All recommendations and model versions logged with timestamp and explanation ID.

- Immutable audit records maintained via block-storage ledger.

- Audit dashboard accessible to AI Governance Board for review and export.

14. Risk Management & Mitigation

Risk	Description	Mitigation Strategy
Model Bias	Unintended favoring of certain countries due to data imbalance.	Bias audits, re-weighting, fairness metrics review.
Data Integrity Issues	Incomplete or outdated macroeconomic data.	Automated data validation and time-stamping.
Explainability Failure	Model outputs not understood by analysts.	Mandatory SHAP visuals and text explanations.
Over-reliance on AI	Analysts treat AI scores as absolute truth.	Training modules and UI warnings reinforcing human judgment.

Cyber & Data Security	Unauthorized access to sensitive financial data.	Role-based access control, encryption, SOC 2 audits.
Model Drift	Economic relationships change over time.	Quarterly retraining and drift monitoring dashboard.

15. Deployment & Rollout Plan

15.1 Development Phases

Phase	Scope	Timeline	Deliverables
Phase 1 — MVP (Pilot)	Limited deployment to Africa and East Asia regional teams.	Q1 FY26	Functional prototype with ROI & Risk models, basic dashboard.
Phase 2 — Beta Expansion	Add ESG module and scenario simulator.	Q2–Q3 FY26	End-to-end workflow with governance dashboard.
Phase 3 — Global Launch	All regions + executive reporting integration.	Q4 FY26	Full AI recommendation suite with audit and explainability.

15.2 Operational Infrastructure

- **Cloud Hosting:** International Bank's secure cloud environment (Azure Gov Cloud).

- **MLOps Pipeline:** Model training & deployment via Azure ML + MLflow.

- **CI/CD:** Jenkins or GitHub Actions for code and model release automation.

- **Monitoring:** Grafana dashboards for model drift, data freshness, and system uptime.

15.3 User Training & Change Management

- Launch **AI Awareness Program** for analysts covering AI ethics and interpretation skills.

- Provide interactive tutorials embedded in dashboard.

- Quarterly feedback sessions with users to collect qualitative improvements.

16. Maintenance & Model Lifecycle Policy

Lifecycle Stage	Frequency	Responsibility
Data Validation	Daily automated + monthly manual audit	Data Engineering Team
Model Retraining	Quarterly or trigger-based on drift	Data Science Team
Performance Review	Bi-annual executive audit	Model Governance Board
Ethics Audit	Annual review + external assessment	AI Ethics Committee

17. Future Roadmap

17.1 Planned Enhancements

- **Natural Language Query Interface:** Allow analysts to ask questions (e.g., "Show top ROI programs in Sub-Saharan Africa for 2027").

- **Agentic AI Extension:** Enable multi-agent simulation for economic scenarios (what-if governance playbooks).

- **ESG Narrative Summarizer:** NLP system to auto-generate ESG impact summaries.

- **Integration with International Bank Investment Portal (APEX):** Seamless data sync and reporting.

17.2 Long-Term Vision

Position AIRIS as the International Bank's central AI intelligence hub for financial risk and sustainability decision-support — a trusted AI copilot for global development finance.

18. Deliverables & Ownership

Area	Owner	Deliverable
Product Management	AI PM Office	PRD, roadmap, feature prioritization
Data Engineering	Data Ops Team	ETL pipelines and feature store
Model Development	AI Lab	ROI/Risk/ESG models + aggregator
UX Design	Digital Experience Team	Analyst dashboard + governance UI
Governance & Ethics	AI Ethics Board	Compliance framework + audit process

19. Appendix — KPIs Recap

Category	Metric	Target
Adoption	Active users / total analysts	≥ 80% within 6 months
Efficiency	Decision cycle time reduction	–50%
Accuracy	Model precision (top ROI programs)	≥ 85%
Governance	Explainable recommendations	100%
Ethics	Critical bias violations	0
Impact	Data-driven decisions YoY growth	+25%