SDG BLOCKCHAIN ACCELERATOR

Impact Measurement Framework – Reloop

1. Project Information

- **Project Name:** _____RELOOP_____
- **Challenge & UNDP Office:** _____UNDP GEORGIA_____
- **Document Version:** _____VERSION 1_____

2. SDG Alignment

(Specify which UN Sustainable Development Goals your project addresses. Include the specific targets and indicators.)

SDG 12: Responsible Consumption Production , SDG 11: Sustainable Cities and Communities and SDG 13: Climate action

SDG 12: Responsible Consumption & Production

- ***E-waste Management (12.4):*** *Track and incentivize proper disposal; measure tons diverted, devices recycled, and reduced informal processing.*
- ***Waste Reduction (12.5):*** *Gamified recycling; target 40% higher recycling, 70% retention, 50+ devices/bin/month.*
- ***Awareness (12.8):*** *Educational content and community engagement; track user engagement, behavior change, and social sharing.*

SDG 11: Sustainable Cities & Communities

- ***Urban Waste Management (11.6):*** *Prevent toxic contamination; target 40% diversion, reduced CO_2, and metals kept out of water.*
- ***Urban-Rural Links (11.a):*** *Connect city recycling with rural collection; track coverage, partnerships, and shared economic impact.*

SDG 13: Climate Action

- ***Policy Integration (13.2):*** *Use blockchain data to support e-waste policies; track government adoption, CO_2 reduction, compliance.*

- ***Education (13.3):*** *Climate awareness via app; target 80% quiz improvement, 25 kg CO_2e/user/year, institutional uptake.*

- ***Finance (13.a):*** *ADA rewards as climate incentives; target $10M annual finance, 60% developing country participation, improved financial inclusion.*

Key Impact Metrics

- ***Environmental:*** *10,000+ devices recycled/month, 500+ tons CO_2 prevented/year, 50+ tons metals processed/month.*

- ***Economic:*** *$50K+ ADA distributed/month, 200+ jobs supported, $100K+ materials value recovered/month.*

- ***Social:*** *80% users recycle more, 50K+ people educated, 100% recycling records verifiable on blockchain.*

3. Key Performance Indicators (KPIs)

Key Performance Indicators (KPIs)
RELOOP Performance Metrics

KPI	Measurement Method	Target / Threshold	Notes
Successful validator transactions	Cardano transaction logs via Ogmios	98%+ success rate	Monitors all 6 action types: SubmitDrop, ClaimReward, ProcessBatch, RegisterWallet, RegisterBin, DeactivateBin
E-waste drops submitted	On-chain DropDatum count	10,000 drops in first year	Each drop represents one recycled device, tracked by device_type and reward_amount
Active recycling users	Unique user_id addresses in WalletInfo UTxOs	5,000 registered users	Monthly active users submitting drops via mobile app
ADA rewards distributed	Treasury UTxO spending transactions	50,000 ADA in first year	Direct payments to Fireblocks consolidated wallets
Batch processing efficiency	BatchDatum processed transactions	90%+ batch success rate	Target: 50 users per batch, reducing individual tx costs by 70%
Geographic coverage	GPS coordinates from bin locations	50+ cities across 10 countries	Bin network expansion tracked via BinDatum registrations

KPI	Measurement Method	Target / Threshold	Notes
E-waste volume processed	Device type weight estimates	500 tons e-waste annually	Based on device categories and average weights
User retention rate	Monthly user activity analysis	70% monthly retention	Users submitting 2+ drops per month
Photo verification accuracy	SHA-256 hash validation	100% hash integrity	All photos stored on IPFS with on-chain hash verification
Location verification accuracy	GPS oracle validation	95%+ proximity accuracy	Users within 1km of bin location, validated by GPS oracle
Bin utilization rate	total_drops per bin analysis	Average 50 drops/bin/month	Monitored via BinDatum total_drops field updates
Carbon footprint reduction	Device lifecycle impact calculations	500 tons CO_2 equivalent prevented	Based on proper recycling vs landfill/incineration
Transaction cost efficiency	Average transaction fees	<0.20 ADA per operation	Gas optimization through batch processing and efficient validators
System uptime	API gateway and services monitoring	99.5% availability	Critical for user experience and real-time validations
Wallet registration growth	New WalletInfo UTxOs created	500 new users monthly	Onboarding rate for consolidated wallet integration
Hazardous waste proper disposal	Battery/hazardous device_type count	2,000 hazardous items annually	Critical for environmental safety compliance
Educational content engagement	App analytics and quiz completion	80% users complete education	Climate awareness and proper recycling education
Cross-chain integration	Fireblocks API transaction success	99% payment delivery rate	Ensuring ADA rewards reach user consolidated wallets
Data integrity compliance	Blockchain audit and verification	100% immutable records	All recycling data permanently recorded on Cardano

4. Tracking Methods

On-Chain Tracking Methods

- **Transaction Success Rate**
  - Measured via **Ogmios / cardano-cli** logs of validator outcomes.
  - Tracks all action types (SubmitDrop, ClaimReward, ProcessBatch, etc.).
- **E-waste Drops Submitted**
  - Counted via **DropDatum UTxOs** on-chain.
  - Each UTxO stores `device_type` and `reward_amount`.
- **Active Recycling Users**
  - Unique **user_id addresses** tracked via `WalletInfo` UTxOs.
- **ADA Rewards Distributed**
  - Logged via **Treasury UTxO spending transactions** to Fireblocks wallets.
- **Batch Processing Efficiency**
  - Verified through **BatchDatum** UTxO updates.
  - Ensures correct grouping of 50 users per batch.
- **Bin Utilization Rate**
  - Calculated from `total_drops` field in **BinDatum** state.
- **Photo Verification Accuracy**
  - Stored as **SHA-256 hashes** on-chain, matched against IPFS content.
- **Location Verification Accuracy**
  - Bin coordinates stored on-chain; validated by GPS oracle proofs.
- **Carbon Footprint Reduction**
  - Derived from device recycling data stored on-chain + lifecycle emission tables.
- **Wallet Registration Growth**
  - Count of new **WalletInfo UTxOs** minted.
- **Hazardous Waste Disposal**
  - On-chain tagging of `device_type` for batteries/hazardous devices.
- **Cross-chain Integration**
  - Fireblocks API results recorded on-chain for ADA distribution status.
- **Data Integrity Compliance**
  - Recycling records stored **immutably on Cardano** for audits.

Off-Chain Tracking Methods

- **Dashboard Monitoring**
  - Grafana dashboards track KPIs in real-time.
  - Alerts for anomalies (e.g., drop in success rate, system downtime).
- **User Activity Analytics**
  - Monthly retention and app activity (drops per user, quiz engagement).
  - Verified via mobile app analytics + backend logs.
- **Geographic Coverage**
  - GPS data from bin registrations and user app submissions.
  - Aggregated to monitor expansion across cities/countries.
- **Educational Content Engagement**
  - Measured via quiz completions, app content views, and social sharing logs.
- **System Uptime**

- o **API gateway & backend service monitors (99.5% availability).**
- **Carbon Offset Verification**
  - o **Partner oracles provide quarterly verified CO_2 savings reports.**

- **Surveys & Audits**
  - o **Used to validate behavioral change, government integration, or educational outcomes.**

5. Baseline vs Projected Outcomes

Metric	Baseline	Projected Outcome
Total Registered Users	0	10,000/year
E-waste Items Collected	0	5,000
ADA Distributed	N/A	75,000 ADA
Bins Deployed	2	50
Cities Covered	1	10

6. Monitoring & Reporting Plan

- **Reporting Structure & Responsibilities**

- **Daily Reporting**

- **Frequency: Daily automated reports**

- **Responsible Party: DevOps Team / System Administrator**

- **Format: Automated email alerts + real-time dashboard**

- **Tools: Uptime monitoring, Cardano node health checks, Supabase analytics**

- **Weekly Reporting**

- **Frequency**: Every Monday (previous week summary)

- **Responsible Party**: Product Manager / Data Analyst

- **Format**: Internal dashboard update + Slack summary

- **Tools**: Custom analytics dashboard, Supabase queries, Google Analytics

- **Monthly Reporting**

- **Frequency**: First week of each month (previous month analysis)

- **Responsible Party**: Product Manager / Blockchain Operations Team

- **Format**: Comprehensive PDF report + stakeholder presentation

- **Tools**: Data visualization tools, blockchain explorers, environmental impact calculators

- **Quarterly Reporting**

- **Frequency**: End of each quarter (Q1, Q2, Q3, Q4)

- **Responsible Party**: Project Manager / Executive Team

- **Format**: Executive summary + detailed analysis + stakeholder presentation

- **Tools**: On-chain data analysis, comprehensive analytics platform, environmental impact reports

- **Reporting Tools & Infrastructure**

- **Blockchain Data Collection**

- **Primary Tools**: Ogmios, Kupo, Blockfrost API

- **Secondary Tools**: Cardano CLI, custom blockchain monitoring scripts

- **Automation**: Scheduled queries, real-time monitoring, automated alerts

- **Analytics & Dashboard**

- **Primary Platform**: Custom Supabase-powered analytics dashboard

- **Secondary Tools**: Google Analytics, Vercel Analytics, custom event tracking

- **Access Control**: Role-based permissions (Admin, Manager, Analyst, Stakeholder)

- **Report Templates & Formats**

- I've included a structured executive summary template and defined dashboard components for:

- Real-time metrics display

- Historical trend analysis

- Projection tracking

- Environmental impact visualization

- Geographic distribution mapping

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- **FREQUENCY :**On a Monthly basis

- **RESPONSIBLE PARTY:**Project Manager (creative operations)

- **FORMAT :**PDF Reports , Database logs ,   Onchain logs

- **TOOLS:**Systems reports , Clickapp/Trello

7. Risks & Mitigation

Risk Assessment & Mitigation Framework

Data Integrity & Accuracy Risks

Blockchain Data Risks:

- **Delayed oracle updates**: Redundant oracle feeds (Blockfrost, Ogmios, Kupo) with automated alerts
- **On-chain/off-chain inconsistencies**: Weekly reconciliation scripts with 0.1% threshold
- **Smart contract execution failures**: Transaction simulation and retry logic with 95% success rate monitoring

Analytics & Reporting Risks:

- **Google Analytics sampling**: Custom event tracking with BigQuery integration
- **Supabase performance**: Query optimization with 100ms threshold monitoring
- **Image upload failures**: Multi-region storage with 95% success rate tracking

Impact Verification:

- **Partner data inconsistencies**: Certified recycling partners with monthly reconciliation
- **Double-counting**: Unique transaction IDs with blockchain audit trails

Treasury Management:

- **Insufficient balance**: Automated monitoring with 3-month runway requirement
- **ADA price volatility**: Dynamic reward adjustment based on price feeds

- **Transaction fee spikes**: Batch processing during low-fee periods

Security & Fraud:

- **Sybil attacks**: Photo verification, GPS validation, AI fraud detection
- **Wallet connection failures**: Multiple wallet providers with 24/7 support

Technical Infrastructure Risks

System Performance:

- **Vercel deployment failures**: Multi-region deployment with 99.9% uptime requirement
- **Supabase connection limits**: Connection pooling with auto-scaling
- **Storage cost overruns**: Automatic compression with 80% budget alerts

Compliance & Regulatory Risks

Data Protection:

- **GDPR violations**: Data minimization with monthly compliance audits
- **E-waste regulation**: Certified partners with quarterly legal reviews

Financial Regulation:

- **Token distribution issues**: Legal consultation with monthly compliance reviews

User Experience & Adoption Risks

User Engagement:

- **Low retention**: Feedback loops with 65% retention target monitoring
- **Complex onboarding**: A/B testing with live chat support

Technical UX:

- **Mobile performance**: Mobile-first design with 90+ Core Web Vitals target

Risk Monitoring & Response Framework

Monitoring System:

- **Automated alerts** with configurable thresholds
- **Escalation matrix** with 4-hour response time for critical risks
- **Risk metrics dashboard** with composite risk scoring
- **Continuous assessment** with monthly reviews and quarterly updates