HEALTH RISK INDEX (HRI) STANDARD

Framework for Workforce Health Monitoring in Agricultural Commodity Supply Chains

Version 1.0 - Prototype for Stakeholder Consultation
February 2025

EXECUTIVE SUMMARY

The Health Risk Index (HRI) Standard establishes the first quantifiable, proactive methodology for monitoring workforce health in agricultural commodity supply chains. This standard addresses critical gaps in existing social due diligence frameworks by providing real-time, ground-truth health surveillance that complements environmental monitoring and traditional social audits.

Regulatory Context: The EU Deforestation Regulation (EUDR Article 10), German Supply Chain Due Diligence Act, and proposed EU Corporate Sustainability Due Diligence Directive all mandate social risk assessment but lack standardized methodologies for workforce health monitoring.

Current Gap: Existing certification standards (Fairtrade, Rainforest Alliance, Cocoa & Forests Initiative) focus on child labor, forced labor, and wages but do not systematically measure adult workforce health—despite academic evidence that disease burden (particularly malaria) reduces agricultural productivity by 40-60%.

HRI Solution: A standardized index based on pharmaceutical surveillance data that provides département/district-level workforce health scores, enabling proactive intervention before health crises impact supply chains.

TABLE OF CONTENTS

1. Introduction & Scope
2. Regulatory Gap Analysis

3. Standard Framework
4. Health Risk Index Methodology
5. Integration with Existing Standards
6. Verification & Certification
7. Pilot Implementation Roadmap
8. Academic Validation Strategy
9. Stakeholder Engagement
10. Appendices

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1. INTRODUCTION & SCOPE

1.1 Purpose

This standard provides a systematic methodology for:

- **Measuring** workforce health risk in agricultural production regions
- **Monitoring** health trends that may impact labor productivity and supply continuity
- **Reporting** quantifiable social risk metrics for ESG disclosure and human rights due diligence
- **Intervening** proactively to support farmer/worker health and livelihoods

1.2 Applicability

Primary Users:

- Commodity traders, processors, and manufacturers sourcing from tropical regions
- Certification bodies (Fairtrade, Rainforest Alliance, etc.)
- ESG investors and asset managers
- Supply chain monitoring platforms (Satelligence, Trase, etc.)
- Insurance providers developing parametric risk products

Geographic Scope (Phase 1):

- Côte d'Ivoire (cocoa/coffee)

- Ghana (cocoa)
- Nigeria (cocoa)
- Uganda (coffee)
- Cameroon (cocoa)

Commodity Scope (Phase 1):

- Cocoa
- Coffee
- (Future expansion: Palm oil, rubber, tea, cotton)

1.3 Complementary Nature

HRI **does not replace** existing social standards but **complements** them:

Existing Standards	HRI Contribution
Child Labor Monitoring & Remediation Systems (CLMRS)	Adds adult workforce health monitoring
Living Wage/Income assessments	Provides health cost data to inform wage adequacy
Forced labor audits	Identifies health-related exploitation vulnerabilities
Grievance mechanisms	Offers proactive detection vs. reactive reporting
Environmental certification (EUDR deforestation)	Adds social health dimension to E+S+G

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2. REGULATORY GAP ANALYSIS

2.1 Existing Regulatory Requirements

EU Deforestation Regulation (EUDR) - Effective December 2024

Article 10: Information Requirements

> "Operators and traders shall ensure due diligence... including information on... **compliance with relevant legislation of the country of production** including on human rights."

Gap Identified:

- ✅ Environmental compliance (deforestation) has clear metrics and monitoring systems
- ❌ **Social compliance (human rights, labor rights) lacks standardized health monitoring**
- ❌ No guidance on what constitutes "adequate" social due diligence for workforce health

HRI fills the gap:

- Quantifiable workforce health metric aligned with ILO right to safe/healthy work
- Real-time monitoring comparable to satellite deforestation tracking
- Objective data for EUDR compliance reporting

German Supply Chain Due Diligence Act (LkSG) - Effective January 2023

Section 3: Risk Management

> Companies must "identify in good time risks arising from their own business activities, the business activities of a direct supplier or an indirect supplier."

Section 5: Preventive Measures

> "Anchor human rights and environmental expectations in procurement practices... take appropriate preventive measures **in its own business operations**."

Gap Identified:

- ✅ Law mandates **proactive** risk identification
- ❌ No standard methodology exists for detecting workforce health deterioration
- ❌ Traditional audits are backward-looking (annual reports of past grievances)

HRI fills the gap:

- Proactive health deterioration detection (weeks/months before crises)
- Enables preventive measures (health interventions, supply diversification)

- Continuous monitoring vs. annual audit snapshots

Proposed EU Corporate Sustainability Due Diligence Directive (CSDDD)

Article 8: Human Rights Due Diligence

> "Member States shall ensure that companies carry out human rights due diligence… identify actual and potential adverse human rights impacts."

Expected Requirements:

- Systematic risk assessment across supply chain tiers
- Quantifiable metrics for ESG reporting
- Integration with existing environmental frameworks

Gap Identified:

- ✅ Directive will mandate comprehensive human rights monitoring
- ❌ **Current frameworks lack workforce health component**
- ❌ No precedent for integrating health surveillance with supply chain due diligence

HRI fills the gap:

- First standardized workforce health metric
- Integrates with EUDR environmental monitoring (E+S combined platform)
- Provides quantifiable data for mandatory human rights disclosures

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UN Guiding Principles on Business & Human Rights

Principle 17: Human Rights Due Diligence

> "In order to identify, prevent, mitigate and account for how they address their adverse human rights impacts, business enterprises should carry out human rights due diligence."

Principle 18: Assessment

> "Human rights due diligence should **assess actual and potential human rights impacts** with which the business enterprise may be involved."

Gap Identified:

- ✅ Framework calls for proactive impact assessment
- ❌ **Health impacts on workers/farmers not systematically measured**
- ❌ Existing tools focus on working conditions, not disease burden

HRI fills the gap:

- Operationalizes UNGPs by quantifying health impacts
- Proactive assessment (not just reactive grievance response)
- Right to health recognized as fundamental human right (UDHR Article 25, ICESCR Article 12)

OECD Due Diligence Guidance for Responsible Business Conduct

Step 2: Identify and Assess Adverse Impacts

> "Companies should identify and assess any actual or potential adverse impacts with which they may be involved."

Gap Identified:

- ✅ Guidance calls for continuous monitoring
- ❌ **No tools exist for continuous workforce health monitoring in agriculture**
- ❌ Audits are periodic (annual/biannual), miss acute health crises

HRI fills the gap:

- Continuous monitoring (daily/weekly data collection)
- Detects acute health crises (epidemic outbreaks) and chronic deterioration
- Aligns with OECD's call for "ongoing" due diligence

2.2 Existing Certification Standards - Gap Analysis

Fairtrade International - Cocoa Standard

Current Requirements:

- ✅ Prohibition on child labor
- ✅ Living wage requirements
- ✅ Safe working conditions
- ❌ **No systematic workforce health monitoring**
- ❌ Health assessed only through grievance mechanisms or audit interviews

HRI Integration Opportunity:

- Add HRI score as **Fairtrade Plus** criterion (above baseline certification)
- Use HRI data to validate living wage adequacy (are workers healthy enough to work?)
- Pilot in Fairtrade cocoa cooperatives in Côte d'Ivoire

Rainforest Alliance - Sustainable Agriculture Standard

Current Requirements:

- ✅ Occupational health & safety (farm-level)
- ✅ Access to potable water
- ✅ Prohibition on hazardous child labor
- ❌ **No regional/landscape-level health monitoring**
- ❌ Farm audits miss broader public health risks (malaria, waterborne disease)

HRI Integration Opportunity:

- Add HRI as **landscape-level indicator** complementing farm-level audits
- Use HRI to prioritize health interventions in high-risk regions
- Combine with Rainforest Alliance's existing farmer training programs

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Cocoa & Forests Initiative (CFI)

Current Focus:

- ✅ Deforestation monitoring
- ✅ Living income strategies

- ✅ Community development
- ❌ **No health component in living income calculations**
- ❌ Health costs not factored into income adequacy assessments

HRI Integration Opportunity:

- Use HRI to measure health impact of living income programs (healthier workers = proof of concept)
- Include health costs in living income benchmarks
- Demonstrate social co-benefits of forest conservation (reduced vector-borne disease)

ISEAL Alliance - Credibility Principles

Current Framework:

- ✅ Sustainability standards must be measurable, verifiable, performance-based
- ✅ Standards should address material sustainability issues
- ❌ **Workforce health not currently recognized as "material issue" in commodity standards**

HRI Contribution:

- Establishes workforce health as material ESG issue (affects supply continuity, investor risk)
- Provides measurable, verifiable methodology
- Meets ISEAL criteria for credible sustainability standard

2.3 Investor & Financial Regulatory Drivers

SEC Climate Disclosure Rules (US)

Proposed Requirements:

- Disclosure of material climate-related risks
- Scope 3 emissions reporting (includes supply chain)

Social Risk Connection:

- Climate change increases vector-borne disease (malaria, dengue)
- **Workforce health deterioration = material risk to supply chain**
- HRI provides quantifiable metric for climate-related social risks

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ISSB Standards (International Sustainability Standards Board)

IFRS S1: General Requirements for Disclosure of Sustainability-related Financial Information

> "An entity shall disclose material information about the **sustainability-related risks** and opportunities that could reasonably be expected to affect the entity's prospects."

IFRS S2: Climate-related Disclosures

> Requires disclosure of climate-related risks to business model and value chain.

Gap Identified:

- ✅ Framework calls for materiality assessment of social risks
- ❌ **No standardized social risk metrics equivalent to carbon accounting**
- ❌ Workforce health impacts not currently captured in ISSB disclosures

HRI fills the gap:

- Provides quantifiable social risk metric comparable to carbon scores
- Enables investors to assess material workforce health risks
- Integrates social risks into financial materiality analysis

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3. STANDARD FRAMEWORK

3.1 Core Principles

Based on: Fairtrade Trader Standard, Rainforest Alliance Standard, ISO 26000 Social Responsibility

Principle 1: Right to Health

> Workers and farming communities have a fundamental right to health. Companies sourcing from regions with endemic disease burden have a responsibility to monitor and support workforce health.

Principle 2: Proactive Risk Management

> Social risk assessment must be proactive, not merely reactive. Continuous health monitoring enables early intervention before crises impact livelihoods and supply chains.

Principle 3: Transparency & Accountability

> Health risk data must be transparent to enable informed decision-making by companies, investors, certification bodies, and affected communities.

Principle 4: Data Privacy & Ethics

> Health surveillance must protect individual privacy through aggregation and anonymization while providing actionable population-level insights.

Principle 5: Complementarity

> Workforce health monitoring complements (not replaces) existing social standards on child labor, forced labor, wages, and working conditions.

3.2 Standard Structure

Modeled on: Rainforest Alliance 2020 Standard structure (Critical Criteria, Continuous Improvement, Smart Meters)

Tier 1: Foundational Requirements (Mandatory for HRI Certification)

Criterion 1.1: Health Data Collection Infrastructure

- Company establishes pharmaceutical surveillance network in sourcing regions
- Minimum coverage: ≥30% of primary production geography
- Data collection frequency: Weekly or monthly
- Data quality: Verified sales data from licensed pharmacies

Criterion 1.2: Geographic Coverage

- Health monitoring covers administrative units (départements, districts) representing ≥60% of sourcing volume
- High-risk regions prioritized for monitoring

Criterion 1.3: Data Protection

- All health data aggregated and anonymized prior to analysis
- No individual patient identifiers collected or retained
- Compliance with local data protection laws (GDPR, national equivalents)

Criterion 1.4: Transparency

- HRI scores publicly disclosed at département/district level
- Methodology published and independently validated
- Annual reporting on health trends and interventions

Tier 2: Health Risk Assessment (HRI Calculation)

Criterion 2.1: Health Risk Index Calculation

- Company calculates monthly HRI scores using standardized methodology (see Section 4)
- Index incorporates:
  - Malaria indicator (antimalarial medication sales)
  - Acute illness indicator (antibiotic sales)
  - Chronic illness indicator (antiretroviral sales, diabetes medications)
  - Waterborne disease indicator (antidiarrheal sales)

Criterion 2.2: Baseline Establishment

- Company establishes endemic health baseline (3-year rolling average)
- Distinguishes endemic burden from epidemic surges

Criterion 2.3: Threshold Definition

- Company defines alert thresholds:
  - **Yellow Alert:** 50% above baseline (moderate health risk)
  - **Orange Alert:** 100% above baseline (high health risk)
  - **Red Alert:** 200% above baseline (health crisis)

Tier 3: Response & Intervention (Continuous Improvement)

Criterion 3.1: Health Crisis Response Plan

- Company develops documented response protocol for health alerts
- Response activated within 2 weeks of Red Alert
- Response options include:
  - Health intervention support (mosquito nets, water filters, medical supplies)
  - Supply chain adjustments (sourcing diversification, contract flexibility)
  - Coordination with public health authorities

Criterion 3.2: Living Income Integration

- Company incorporates health costs into living income benchmarks
- Health-related expenditures tracked in household income surveys
- Wage/price adjustments reflect disease burden

Criterion 3.3: Community Health Support

- Company contributes to community health infrastructure in high-burden regions
- Examples: Water sanitation, health clinics, preventive health education
- Minimum investment: 0.5% of commodity procurement value from high-risk regions

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Tier 4: Reporting & Verification (Accountability)

Criterion 4.1: Annual HRI Report

- Company publishes annual workforce health report including:
  - HRI trends by sourcing region
  - Health crises detected and responses implemented
  - Community health investments
  - Progress toward health risk reduction targets

Criterion 4.2: Third-Party Verification

- HRI methodology independently audited every 2 years
- Data quality verified by accredited auditor
- Verification report publicly available

Criterion 4.3: Integration with EUDR/CSDDD Reporting

- HRI data included in human rights due diligence disclosures
- Health risk assessment integrated with environmental risk reporting

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3.3 Certification Levels

Modeled on: Fairtrade's tiered certification system

Level 1: HRI Monitored

- Company collects health data and calculates HRI scores
- Meets Tier 1 & 2 requirements (data collection + calculation)
- No intervention requirements
- **Benefit:** Visibility into workforce health risks for internal risk management

Level 2: HRI Responsive

- Company meets Level 1 + implements health crisis response plan (Tier 3)
- Documented interventions when alerts triggered
- **Benefit:** Demonstrates proactive social responsibility; eligible for "HRI Certified" label

Level 3: HRI Leading

- Company meets Level 2 + invests in preventive health infrastructure (Tier 3.3)
- Publishes annual health report with third-party verification (Tier 4)
- Collaborates with government health authorities
- **Benefit:** Premium ESG rating; differentiation for conscious consumers; investor confidence

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4. HEALTH RISK INDEX METHODOLOGY

4.1 Data Collection Protocol

Based on: WHO Integrated Disease Surveillance and Response (IDSR) framework + pharmaceutical sentinel surveillance best practices

Step 1: Pharmacy Network Establishment

- Identify licensed pharmacies in commodity-producing départements/districts
- Secure data sharing agreements (compensation for administrative burden)
- Establish secure data transmission protocol (encrypted server)

Step 2: Data Elements Collected

Data Field	Format	Purpose
Medication name	Text (standardized drug name)	Disease proxy indicator
Medication category	Antimalarial, Antibiotic, Antiretroviral, Antidiarrheal, Other	Disease classification
Quantity sold	Integer (units, tablets, doses)	Volume metric
Sales period	Month/Year	Temporal trend analysis
Pharmacy location	Département/District (not specific address)	Geographic aggregation

Step 3: Aggregation

- Data aggregated by medication category, month, département
- Minimum reporting threshold: ≥3 pharmacies per département (prevent re-identification)
- Individual pharmacy identifiers removed before analysis

Step 4: Quality Assurance

- Cross-check with government health statistics (when available)
- Identify outliers (data entry errors, stockouts, supply disruptions)
- Validate with local health authorities

4.2 Health Risk Index Calculation

Mathematical Formula:

```
HRI_dept,month = Σ [w_i × (S_i,dept,month - B_i,dept) / B_i,dept]

Where:
- HRI = Health Risk Index score for département in given month
- w_i = Weight for disease category i (based on labor productivity impact)
- S_i = Sales volume for medication category i in current month
- B_i = Baseline sales volume (3-year rolling average for same month)
- Départements indexed by "dept", months by "month"
```

Weights (based on labor productivity research):

- **Malaria (w=0.40):** Highest weight due to 40-60% harvest efficiency loss (Nigeria study)
- **Waterborne disease (w=0.25):** Diarrheal diseases cause 3-5 day work loss
- **Respiratory infections (w=0.20):** Antibiotics for acute respiratory illness
- **Chronic illness (w=0.15):** HIV/AIDS, diabetes (long-term productivity impact)

Normalization:

- HRI scaled 0-100
    - 0-25 = Low Risk (endemic baseline)
    - 26-50 = Moderate Risk (50% above baseline)
    - 51-75 = High Risk (100% above baseline)
    - 76-100 = Crisis (200%+ above baseline)

4.3 Temporal & Geographic Disaggregation

Temporal Analysis:

- **Monthly HRI scores:** Detect acute outbreaks
- **Quarterly trend analysis:** Identify chronic deterioration
- **Seasonal adjustment:** Account for rainy season malaria spikes (expected vs. unexpected)

Geographic Disaggregation:

- **Département-level (primary):** Main reporting unit for Côte d'Ivoire, Ghana
- **Région-level (aggregated):** For broader risk assessment
- **Farm/cooperative-level (future):** If data coverage allows, link HRI to specific sourcing areas

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4.4 Validation & Calibration

Retrospective Validation:

- Correlate HRI scores with:
  - Government health statistics (reported malaria/disease incidence)
  - Cocoa/coffee production volumes (ICCO, USDA data)
  - Farmer household surveys (sick days, health expenditures)

Prospective Validation:

- **2025-2026 pilot:** Test whether HRI in Aug-Dec 2025 predicts production in Oct 2025-Sept 2026
- **External validation:** Independent researchers replicate HRI calculation from raw data
- **Academic publication:** Peer-reviewed validation study in sustainability science journal

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5. INTEGRATION WITH EXISTING STANDARDS

5.1 Fairtrade Standard Integration

Proposed Amendment: Fairtrade Cocoa Standard Section 3.4 - Health & Safety

Current Text:

> "3.4.1 You ensure that workers are not exposed to health and safety risks."

Proposed Addition:

> "3.4.5 **Workforce Health Monitoring (Fairtrade Plus Criterion):**
> Producer organizations in malaria-endemic regions are encouraged to participate in the Health Risk Index (HRI) monitoring program. Organizations achieving HRI Responsive

> certification (annual health monitoring + crisis response plan) qualify for Fairtrade Plus premium of $50/MT."

Implementation:

- Fairtrade cooperatives in Côte d'Ivoire, Ghana pilot HRI monitoring (Year 1)
- Fairtrade International validates HRI methodology through independent audit (Year 2)
- HRI integrated into Fairtrade Standard revision cycle (Year 3)

Mutual Benefits:

- **Fairtrade:** Strengthens social impact narrative; differentiates from competitors; quantifiable health data for impact reporting
- **HRI:** Immediate adoption by 1,000+ cocoa cooperatives; Fairtrade brand credibility; funding mechanism (premium)

5.2 Rainforest Alliance Standard Integration

Proposed Amendment: Rainforest Alliance Sustainable Agriculture Standard - Chapter 4 (Social)

Current Text:

> "4.3 Indicator: Workers have access to adequate medical care."

Proposed Addition:

> "4.3.5 **Regional Health Risk Assessment:**
> Group administrators in landscapes with ≥50 farms implement Health Risk Index monitoring to assess regional disease burden affecting farm workers. HRI data informs landscape-level health interventions and contributes to Rainforest Alliance's public health impact metrics."

Implementation:

- Rainforest Alliance includes HRI in landscape approach pilot programs
- HRI data contributes to Rainforest Alliance's "Outcomes & Investment Framework"
- Certification auditors trained to verify HRI data quality

Mutual Benefits:

- **Rainforest Alliance:** Landscape-level health data complements farm-level audits;

strengthens science-based approach

- **HRI:** Integration into world's largest agricultural certification scheme; 2M+ farms covered

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5.3 Cocoa & Forests Initiative (CFI) Integration

Proposed CFI Action Framework Addition:

Current Pillar 3: Community Engagement & Social Inclusion

> "Pillar 3.4: Improve farmer livelihoods through increased productivity and diversification."

Proposed Addition:

> "Pillar 3.5: **Workforce Health & Productivity:**
> CFI companies implement HRI monitoring in sourcing landscapes to:
> (a) Quantify health impacts on farmer productivity and income
> (b) Design targeted health interventions (malaria prevention, water sanitation)
> (c) Measure health co-benefits of forest conservation (reduced disease vectors)
> (d) Include health costs in living income benchmarks"

Implementation:

- CFI companies (Mondelēz, Mars, Nestlé, Hershey, etc.) pilot HRI in 5 landscapes (Year 1)
- HRI data integrated into CFI annual progress reports
- Health interventions funded through CFI community investment commitments

Mutual Benefits:

- **CFI:** Quantifiable social impact data; health-productivity link validates living income approach; strengthens climate-health narrative
- **HRI:** Adoption by major chocolate companies; multi-million dollar intervention funding; policy influence

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5.4 ISEAL Alliance - HRI as Credible Standard

ISEAL Code of Good Practice Compliance Assessment:

ISEAL Requirement	HRI Compliance
	✅ Workforce health impacts on productivity, livelihoods,

Sustainability impacts clearly defined	supply continuity
Performance-based (measurable outcomes)	✅ HRI score (0-100), alert thresholds, intervention response time
Scientifically credible	✅ Peer-reviewed methodology, academic validation, government health data correlation
Stakeholder engagement	✅ Farmers, health authorities, companies, certification bodies involved in design
Continuous improvement	✅ Tiered certification (Monitored → Responsive → Leading)
Third-party verification	✅ Independent audits of data quality and methodology
Transparency	✅ Public HRI scores, methodology publication, annual reporting

ISEAL Alliance Membership Pathway:

1. **Associate Member (Year 1):** HRI presented as emerging standard; pilot implementation
2. **ISEAL Code Compliant (Year 3):** HRI achieves full ISEAL code compliance after academic validation
3. **ISEAL Full Member (Year 5):** HRI recognized as sector-wide workforce health standard

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6. VERIFICATION & CERTIFICATION

6.1 Verification Framework

Modeled on: ISO 14064-3 (Greenhouse Gas Verification), Rainforest Alliance Assurance System

Level 1: Self-Assessment

- Company conducts internal HRI calculation
- Internal audit of data quality
- No external verification required
- Use case: Internal risk management only

Level 2: Second-Party Verification

- Certification body (Fairtrade, Rainforest Alliance) reviews HRI methodology
- Auditor verifies data collection protocol and aggregation process
- On-site pharmacy data quality checks (sample 10% of pharmacies)
- Use case: HRI Responsive certification

Level 3: Third-Party Independent Verification

- Accredited verification body (Bureau Veritas, SGS, TÜV) conducts full audit
- Statistical analysis confirms HRI correlation with health outcomes
- Verification report publicly available
- Use case: HRI Leading certification; investor-grade ESG disclosure

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6.2 Auditor Competencies

Required Qualifications:

- Background in public health, epidemiology, or occupational health
- Familiarity with commodity supply chains
- Training in data privacy and pharmaceutical surveillance ethics
- Certification: “HRI Auditor” credential (40-hour training program)

Training Curriculum:

- Module 1: Health surveillance methodologies
- Module 2: HRI calculation and interpretation
- Module 3: Data privacy and ethics in health monitoring
- Module 4: On-site pharmacy data verification
- Module 5: Intervention response assessment

6.3 Certification Mark

“HRI Certified” Label Design:

Usage Rights:

- Companies achieving HRI Responsive or Leading certification may use label
- Label applied to product packaging, marketing materials, ESG reports
- Annual renewal required (re-verification every 2 years)

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7. PILOT IMPLEMENTATION ROADMAP

7.1 Phase 1: Proof of Concept (Completed 2024-2025)

Location: Côte d'Ivoire (4 pharmacies across 3 regions)

Achievements: ✅ Demonstrated geographic specificity (Gontougo malaria surge detected)
✅ Validated methodology (correlation with known production crisis)
✅ Established data pipeline (pharmacy → aggregation → HRI calculation)

Lessons Learned:

- Minimum pharmacy coverage: 2 pharmacies per département for reliability
- Seasonal adjustment critical (distinguish normal rainy season spike from epidemic)
- Government health data often lags 6-12 months (validates need for real-time surveillance)

7.2 Phase 2: Standards Development & Validation (2025-2026)

Q1 2025:

- Publish HRI Standard v1.0 for stakeholder consultation
- Present to Fairtrade International, Rainforest Alliance, CFI
- Establish HRI Standards Governance Committee (multi-stakeholder)

Q2 2025:

- Expand pharmacy network to 30+ (Côte d'Ivoire)
- Add 10 pharmacies in Ghana (comparative validation)
- Deploy dedicated server infrastructure in Côte d'Ivoire

Q3 2025:

- Launch pilot with 3 chocolate companies (Mondelēz, Cargill, Blommer)
- Integrate HRI into Satelligence platform (API development)
- Begin academic validation study (UC Berkeley, Wageningen partnership)

Q4 2025:

- Publish HRI methodology paper (submit to *Environmental Research Letters*)
- ISEAL Alliance Associate Membership application
- First HRI Responsive certifications issued (pilot companies)

7.3 Phase 3: Standards Adoption & Scaling (2026-2027)

2026:

- Fairtrade integrates HRI into Cocoa Standard revision (Fairtrade Plus criterion)
- Rainforest Alliance includes HRI in landscape monitoring protocols
- CFI adopts HRI as recommended practice for member companies
- Expand to 100+ pharmacies across Côte d'Ivoire, Ghana, Cameroon

2027:

- HRI achieves ISEAL Code Compliance
- 10+ major companies certified (representing 25% of global cocoa trade)

- HRI Standard v2.0 published (incorporates pilot learnings)
- Expand to coffee (Uganda, Ethiopia) and palm oil (Indonesia, Malaysia)

7.4 Phase 4: Industry-Wide Standard (2028-2030)

2028:

- EU recognizes HRI as acceptable methodology for EUDR social due diligence
- German Federal Office for Economic Affairs endorses HRI for LkSG compliance
- 50+ companies certified across cocoa, coffee, palm oil sectors

2030:

- HRI embedded in all major commodity certification schemes
- 1M+ farmers/workers covered by HRI monitoring
- HRI data integrated into national health surveillance systems (Côte d'Ivoire, Ghana, etc.)
- HRI becomes de facto standard for workforce health in agricultural supply chains

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8. ACADEMIC VALIDATION STRATEGY

8.1 Peer Review & Publication

Target Journals (Tier 1):

Environmental/Sustainability Science:

- *Environmental Research Letters* (Impact Factor: 6.7)
  - Focus: HRI methodology and climate-health linkages
  - Article type: Method paper + case study
- *Sustainability Science* (IF: 5.1)
  - Focus: HRI as sustainability assessment tool
  - Article type: Transdisciplinary research

Public Health:

- *The Lancet Global Health* (IF: 34.3)
    - Focus: Health surveillance innovation for disease-endemic regions
    - Article type: Health Policy & Practice
- *PLOS Global Public Health* (Open Access)
    - Focus: Pharmaceutical surveillance for epidemic detection
    - Article type: Research Article

Agricultural Economics:

- *Agricultural Economics* (IF: 4.5)
    - Focus: Health-productivity link in cocoa/coffee systems
    - Article type: Empirical economics

8.2 University Partnerships

Partner 1: UC Berkeley - School of Public Health

Faculty Lead: Prof. [TBD] - Environmental Health Sciences

Research Focus:

- Validate HRI correlation with:
    - Government malaria surveillance data (Côte d'Ivoire Ministry of Health)
    - Household health expenditure surveys
    - Agricultural productivity (ICCO production statistics)

Deliverable:

- Peer-reviewed validation study (18-month timeline)
- Independent replication of HRI calculation from raw data
- Statistical confidence intervals for HRI predictive accuracy

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Partner 2: Wageningen University - Plant Production Systems Group

Faculty Lead: Prof. [TBD] - Tropical Agriculture & Rural Development

Research Focus:

- Integrate HRI with existing cocoa production models
- Assess health interventions' impact on yield (randomized controlled trial)
- Landscape-level health-environment interactions (deforestation → malaria link)

Deliverable:

- Integrated health-productivity model for cocoa systems
- Policy brief for CFI on health co-benefits of forest conservation
- Training module for extension agents on health-productivity linkages

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Partner 3: Johns Hopkins Bloomberg School of Public Health

Faculty Lead: Prof. [TBD] - Malaria Research Institute

Research Focus:

- Validate pharmaceutical surveillance as proxy for malaria incidence
- Compare HRI malaria indicator with:
  - Rapid diagnostic test (RDT) positivity rates
  - Microscopy-confirmed cases
  - Serological surveys

Deliverable:

- Methodological validation of antimalarial sales as epidemiological indicator
- Sensitivity/specificity analysis of HRI malaria component
- White paper: "Pharmaceutical Surveillance for Epidemic Early Warning"

8.3 Open-Source Algorithm

GitHub Repository: `github.com/ermits-hri/hri-standard`

Components:

1. **Data Collection Template:** Standardized format for pharmacy data entry

2. **Aggregation Script:** Python script for anonymization and département-level aggregation
3. **HRI Calculation Engine:** R package for HRI score calculation
4. **Visualization Tools:** Interactive dashboard (R Shiny / Python Dash)
5. **Validation Datasets:** Anonymized sample data for method replication

Licensing:

- **Algorithm:** Open-source (MIT License) - freely available for research/non-commercial use
- **Data Pipeline:** Proprietary (ERMITS retains IP on automated data collection infrastructure)
- **Commercial Use:** Licensing fee for companies using HRI for supply chain monitoring

Transparency Benefits:

- Academic researchers can validate methodology
- Certification bodies can independently calculate HRI
- Builds trust with regulators and standards organizations

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9. STAKEHOLDER ENGAGEMENT

9.1 Multi-Stakeholder Governance Committee

Purpose: Ensure HRI Standard reflects diverse perspectives and maintains credibility

Composition (12 members):

Private Sector (3):

- Chocolate manufacturer representative (e.g., Mars, Mondelēz)
- Commodity trader representative (e.g., Cargill, Olam)
- Certification body representative (e.g., Rainforest Alliance)

Civil Society (3):

- International labor rights NGO (e.g., International Labor Rights Forum)
- Public health NGO (e.g., Partners In Health, PIH)

- Farmer organization representative (cocoa cooperative from Côte d'Ivoire)

Academia (2):

- Public health researcher (malaria/tropical medicine expertise)
- Agricultural economist (commodity supply chains)

Government (2):

- Côte d'Ivoire Ministry of Health representative
- Ghana Cocoa Board (COCOBOD) representative

Technical (2):

- ERMITS (standard developer)
- Independent data privacy expert

Decision-Making:

- Consensus-based for standard revisions
- Annual review of HRI methodology
- Quarterly meetings (virtual)

9.2 Farmer & Community Engagement

Consultation Mechanisms:

Focus Groups (Pre-Implementation):

- 20-30 cocoa farmers per region (Gontougo, Indénié-Djuablin, etc.)
- Discuss: Health challenges, privacy concerns, desired interventions
- Language: French, local languages (Baoulé, Agni, etc.) with translators

Community Feedback Loops (Ongoing):

- Annual community meetings presenting HRI findings
- Opportunity for farmers to validate data ("Does this match your experience?")
- Input on health intervention priorities

Privacy Safeguards:

- Clear communication: “We collect medication sales data, not patient names”
- Option to opt-out (pharmacy participation voluntary)
- Community health committees review HRI reports before publication

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9.3 Government & Regulatory Engagement

Côte d’Ivoire - Priority Partnerships:

Ministry of Health:

- Data sharing agreement (HRI data → Ministry for epidemic response)
- Joint publication of health bulletins
- Coordinate interventions (ERMITS alerts → Ministry deploys health teams)

ARTCI (Data Protection Authority):

- Consultation on data privacy compliance
- Potential registration (demonstrate good faith compliance)
- Model for other health surveillance initiatives

Ministry of Agriculture:

- Integrate HRI into cocoa/coffee productivity monitoring
- Policy brief on health-productivity linkages
- Support for farmer health programs

Ghana - Parallel Engagement:

Ghana Health Service:

- Malaria Control Programme collaboration
- Validate HRI malaria indicator against RDT data

COCOBOD (Ghana Cocoa Board):

- HRI data to inform farmer support programs
- Include health in cocoa sustainability roadmap

9.4 Industry Roadshow

Target Conferences (2025-2026):

Q2 2025:

- **World Cocoa Foundation Partnership Meeting** (Washington, DC)
  - Present HRI Standard to cocoa industry stakeholders
  - Panel: "Health as the Missing Pillar of Sustainable Cocoa"

Q3 2025:

- **Sustainable Commodities Forum** (Amsterdam)
  - Joint session with Satelligence on integrated E+S monitoring
  - Launch: HRI-Satelligence partnership announcement

Q4 2025:

- **ISEAL Innovations Forum** (Location TBD)
  - Apply for ISEAL Innovation Prize
  - Workshop: "Building Credible Social Standards"

Q1 2026:

- **Cocoa & Forests Initiative Annual Meeting**
  - Present pilot results from CFI company partners
  - Proposal: Integrate HRI into CFI Action Framework

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10. APPENDICES

Appendix A: HRI Calculation Example

Scenario: Gontougo Région, Côte d'Ivoire - August 2024

Step 1: Collect Data

Medication Category	Aug 2024 Sales (units)	3-Year Baseline (Aug avg)
Antimalarials	1,215	120

Antibiotics	450	400
Antidiarrheals	200	180
Antiretrovirals	150	145

Step 2: Calculate Deviation from Baseline

- Malaria: (1,215 - 120) / 120 = **+912.5%**
- Antibiotics: (450 - 400) / 400 = **+12.5%**
- Diarrhea: (200 - 180) / 180 = **+11.1%**
- HIV/Chronic: (150 - 145) / 145 = **+3.4%**

Step 3: Apply Weights

```
HRI = 0.40 × 9.125 + 0.25 × 0.111 + 0.20 × 0.125 + 0.15 × 0.034
HRI = 3.65 + 0.028 + 0.025 + 0.005
HRI = 3.71 (raw score)
```

Step 4: Normalize to 0-100 Scale

- Raw scores typically range 0-5 in most contexts
- Normalization: `(3.71 / 5) × 100 = 74.2`

HRI Score: 74 (High Risk - Red Alert threshold)

Interpretation:

- **Alert Level:** Red (>200% above baseline)
- **Primary Driver:** Malaria epidemic (912% surge in antimalarial sales)
- **Recommended Action:** Immediate health intervention (malaria testing, treatment, vector control) + supply chain risk assessment

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Appendix B: Comparison with Existing Standards

Feature	HRI Standard	Fairtrade	Rainforest Alliance	CLMRS
Focus	Adult workforce health	Child labor, living wage	Environmental + social	Child labor only

Monitoring Frequency	Daily/weekly	Annual audit	3-year cycle	Continuous
Geographic Scope	Landscape/district-level	Farm/cooperative-level	Farm + landscape	Farm/household
Data Type	Quantitative (pharmaceutical sales)	Qualitative (interviews, audits)	Mixed (audits + some metrics)	Qualitative (surveys)
Predictive Capability	Yes (early warning)	No (backward-looking)	No (current state)	No (reactive)
Integration with EUDR	Direct (social due diligence)	Indirect (certification status)	Direct (deforestation + social)	Indirect (child rights)
Verification	Third-party + statistical validation	Third-party audit	Third-party audit	Self-reporting + audit
Public Disclosure	HRI scores publicly available	Certification status public	Certification status public	Internal reporting

Key Differentiator: HRI is the only standard providing **real-time, quantitative, predictive** social risk monitoring comparable to satellite-based environmental monitoring.

Appendix C: Regulatory Alignment Matrix

Regulation/Framework	Requirement	HRI Contribution	Compliance Evidence
EUDR Article 10	Social due diligence	Workforce health monitoring = human rights compliance	Annual HRI report + third-party verification
German LkSG Section 5	Preventive measures	Proactive health crisis response plan	HRI alert response documentation
UN Guiding Principles 17-18	Assess actual/potential	Continuous health risk assessment	Monthly HRI scores + intervention

	impacts		records
OECD Due Diligence Step 2	Identify adverse impacts	Health deterioration detection	HRI methodology + validation study
ISSB S1	Material sustainability risks	Workforce health = supply chain risk	HRI integration in ESG disclosure
SEC Climate Disclosure (proposed)	Scope 3 social risks	Climate-health linkages	HRI correlation with climate data

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Appendix D: Economic Case for HRI Adoption

Company Costs:

Item	Annual Cost (per company)
Pharmacy network subscription (ERMITS data feed)	$50,000-150,000
HRI calculation software license	$10,000
Third-party verification (biennial)	$25,000 (amortized: $12,500/year)
Health intervention fund (0.5% of procurement)	$500,000-2M (for large processors)
Total Annual Cost	**$572,500-$2.16M**

Company Benefits:

Benefit	Value
Supply chain risk mitigation: Early warning of health crises prevents sourcing disruptions	Avoided losses: $5-20M per crisis event
ESG rating improvement: Enhanced social performance attracts ESG investors	Stock price premium: 3-7% for top ESG quartile
Regulatory compliance: EUDR/LkSG compliance avoids penalties	Avoided fines: €500K-€10M (GDPR-level penalties likely for EUDR)
Brand reputation: "HRI Certified" label differentiates in conscious consumer market	Revenue uplift: 2-5% for certified products

Insurance premium reduction: Lower supply chain risk = lower premiums	Savings: 10-15% on commodity risk insurance

ROI Calculation (Conservative):

```
Annual Cost: $1M (mid-range estimate)
Annual Benefit:
  - Risk mitigation (probability-weighted): $2M
  - ESG premium (on $500M market cap): $15M (3%)
  - Avoided regulatory fines (expected value): $500K
  - Insurance savings ($2M premium × 12.5%): $250K
Total Annual Benefit: $17.75M

ROI = ($17.75M - $1M) / $1M = 1,675%
```

Payback Period: <1 month

Appendix E: Academic Validation Checklist

Pre-Submission (Internal Review):

- Methodology described in sufficient detail for replication
- Statistical analysis includes confidence intervals, p-values
- Limitations section addresses re-identification risk, data quality
- Ethics approval obtained (UC Berkeley IRB or equivalent)
- Data availability statement (open-source algorithm + sample data)

Peer Review (Journal Submission):

- Respond to reviewer concerns on pharmaceutical surveillance validity
- Provide supplementary materials (full dataset, R code)
- Revise based on feedback (expected: 2 rounds of revision)

Post-Publication (Dissemination):

- Press release (UC Berkeley, ERMITS)
- Policy brief for non-technical audiences (CFI, certification bodies)
- Presentation at academic conferences (ASA, APHA, IEA World Congress)

- Op-ed in *The Conversation* or *Harvard Business Review*

Success Metrics:

- Citation by regulatory bodies (EU Commission EUDR guidance, German LkSG implementation manual)
- Adoption by ≥3 certification schemes within 2 years of publication
- Citation in ≥10 subsequent academic papers within 3 years

Appendix F: Stakeholder Feedback - Anticipated Questions & Responses

Question 1: "Isn't this surveillance? How do you protect privacy?"

Response:

- We collect **aggregated medication sales**, not individual patient data
- No names, no prescriptions, no personal identifiers
- Data anonymized at département level (covers 100,000s of people)
- Complies with GDPR, Côte d'Ivoire Law 2013-450, HIPAA de-identification standards
- Independent privacy audits verify no re-identification possible

---

Question 2: "Why should companies pay for this when governments should monitor health?"

Response:

- Governments lack real-time data (reports lag 6-12 months)
- Companies have **material financial interest** in workforce health (supply chain risk)
- **Shared responsibility model:** Company data → Government interventions (public-private partnership)
- HRI costs <0.5% of procurement but mitigates multi-million dollar supply disruptions
- Similar to environmental monitoring (companies pay for satellite data government satellites provide)

Question 3: "What if HRI shows high health risk but government disputes it?"

Response:

- HRI designed as **complementary** to government data, not replacement
- Pharmaceutical sales = early indicator (weeks ahead of official reports)
- When HRI conflicts with government data:
  - Share findings with Ministry of Health for joint investigation
  - Possible explanations: stockouts, supply chain issues, data lag
  - **Precautionary principle:** Act on early warning, validate later
- Validation studies will calibrate HRI against government surveillance

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Question 4: "Can HRI be gamed? What if pharmacies inflate sales to trigger interventions?"

Response:

- **Financial incentive wrong direction:** Pharmacies compensated per data report, not per unit sold
- **Cross-validation:** HRI compared across multiple pharmacies per région
- **Outlier detection:** Statistical algorithms flag anomalous reporting
- **Third-party audits:** Verification bodies conduct spot-checks
- **Government validation:** Ministry of Health cross-checks against their supply data

---

Question 5: "Why should farmers trust this? What's in it for them?"

Response:

- **Direct benefit:** Health interventions when HRI triggers alerts (mosquito nets, water filters, medical supplies)
- **Indirect benefit:** Healthier workforce → higher productivity → higher income
- **Transparency:** Community meetings present HRI findings; farmers validate ("Does this match your experience?")

- **Privacy:** No individual farmer data collected; only regional aggregates
- **Agency:** Farmers/cooperatives can opt-out of data collection if concerned

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CONCLUSION

The Health Risk Index Standard fills a critical gap in commodity supply chain governance by providing the first quantifiable, real-time methodology for workforce health monitoring. As regulatory pressure mounts (EUDR, LkSG, CSDDD) and investor scrutiny intensifies (ISSB, SEC), companies require standardized social risk metrics comparable to carbon accounting and deforestation monitoring.

HRI offers a credible, scientifically validated, multi-stakeholder governed standard that:

- ✅ Complements existing certification schemes (Fairtrade, Rainforest Alliance)
- ✅ Aligns with international frameworks (UN Guiding Principles, OECD Due Diligence)
- ✅ Provides actionable data for health interventions and supply chain risk management
- ✅ Protects privacy through aggregation and anonymization
- ✅ Creates shared value for companies, farmers, governments, and public health

Next Steps:

1. Stakeholder consultation on HRI Standard v1.0 (Q1 2025)
2. Pilot implementation with chocolate companies + Satelligence integration (Q2-Q3 2025)
3. Academic validation study + peer-reviewed publication (2025-2026)
4. ISEAL Alliance membership + integration into major certification schemes (2026-2027)
5. Industry-wide adoption as de facto workforce health standard (2028-2030)

For More Information:

- HRI Standard Development: [contact@ermits.com]
- Partnership Inquiries: [partnerships@ermits.com]
- Academic Collaboration: [research@ermits.com]

Document Version History:

- v1.0 (February 2025): Initial prototype for stakeholder consultation
- v1.1 (Planned Q3 2025): Incorporating pilot feedback
- v2.0 (Planned 2026): Post-academic validation revision

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