



Appendix 3: Digital Platform Specifications

Architectural Vision for the GSI Dashboard

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GLOBAL SUBSIDIARITY INDEX (GSI) DIGITAL PLATFORM

Technical Specifications & Architecture v3.0

EXECUTIVE SUMMARY: THE GOVERNANCE OPERATING SYSTEM

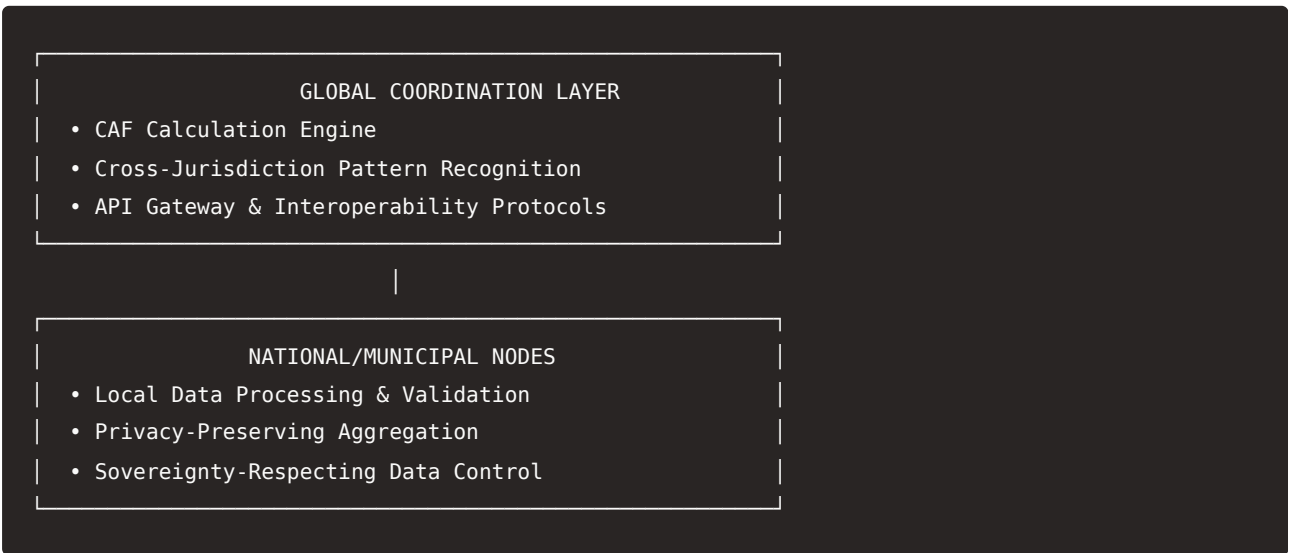
The GSI Digital Platform is **Bloomberg Terminal meets GitHub for governance**—a real-time decision support system that visualizes, analyzes, and simulates governance architecture across 150+ jurisdictions. It transforms abstract subsidiarity principles into **actionable intelligence** through three core innovations:

1. **Live Governance Mapping:** Continuous monitoring of decision flows and resource allocation
2. **Predictive Resilience Modeling:** AI-powered simulation of governance responses to shocks
3. **Peer-to-Peer Learning Network:** Direct connection between similar communities facing similar challenges

Design Philosophy: *"Radical Traceability meets Practical Utility"*—every data point is sourced, every visualization is actionable, every insight is sharable.

1. PLATFORM ARCHITECTURE OVERVIEW

1.1 The Federated Data Mesh



Key Innovation: No centralized database—instead, a **federated mesh** where each jurisdiction maintains sovereignty over its data while participating in aggregated analysis.

1.2 Technology Stack

Frontend Layer:

- **Framework:** SvelteKit + TypeScript (for type safety at scale)
- **Visualization:** Deck.gl (geospatial) + D3.js (analytical) + Three.js (3D models)
- **Design System:** Custom GSI Design Tokens with accessibility-first principles
- **Mobile:** Progressive Web App (PWA) with offline capabilities

Backend Layer:

- **Compute:** Python FastAPI microservices + Rust for performance-critical calculations
- **Data Processing:** Apache Spark for large-scale CAF calculations
- **Machine Learning:** PyTorch for anomaly detection and prediction models
- **Caching:** Redis for real-time dashboard updates

Data Layer:

- **Structured Data:** PostgreSQL + TimescaleDB (time-series analysis)
- **Document Storage:** MongoDB for policy documents and reports
- **Immutable Records:** IPFS + Filecoin for citizen-submitted evidence
- **Streaming:** Apache Kafka for real-time data ingestion

Identity & Security:

- **Authentication:** OIDC with support for national e-ID systems
- **Anonymous Contributions:** Zero-Knowledge Proofs for citizen reporting
- **Data Sovereignty:** Sovereign Data Containers (encrypted, jurisdiction-controlled)

2. CORE FUNCTIONAL MODULES

2.1 Module A: The Governance Anatomy Suite

Submodule A1: Decision Flow Mapper

Features:

- Interactive Sankey diagrams showing decision pathways
- Real-time tracking of policy document movement
- Bottleneck identification through process mining
- "What-if" rerouting simulation

Data Sources:

- Government document management systems (via APIs)
- Meeting minute analysis (NLP)
- Citizen complaint tracking

Submodule A2: Resource Circulation Monitor

Features:

- Financial flow visualization (taxes → services)
- Time-series analysis of local vs. non-local spending
- Supply chain mapping for critical goods (food, medicine)
- Leakage detection algorithms

Innovation: Blockchain-like tracing without blockchain overhead

2.2 Module B: The Resilience Simulator

Submodule B1: Stress Test Engine

Scenarios Library:

- Pandemic surge (healthcare capacity modeling)
- Climate event (infrastructure failure cascades)
- Economic shock (unemployment/service demand)
- Cyber attack (digital governance disruption)

Outputs:

- Failure cascade predictions
- Recovery time estimates
- Optimal intervention points

Submodule B2: Adaptation Velocity Tracker

Metrics:

- Policy response time (from problem identification to action)
- Local innovation adoption rate
- Cross-jurisdiction learning speed
- Institutional memory preservation

Visualization: Network graphs showing knowledge diffusion

2.3 Module C: The Peer Intelligence Network

Submodule C1: Governance Twin Finder

Matching Algorithm:

Input: Jurisdiction profile (CAF components, system scores)

Output: 3-5 "twins" with similar challenges but better outcomes

Features:

- Automated case study extraction
- Policy translation tools (adapting solutions across contexts)
- Direct communication channels between practitioners

Submodule C2: Pattern Library & Repository

Content Types:

- Successful policy implementations (with evaluation data)
- Failed experiments (with post-mortem analysis)
- Toolkits and implementation guides
- Training materials and certification programs

Search: Semantic search across 100+ languages

2.4 Module D: The Citizen Engagement Layer

Submodule D1: Community Dashboard

Features:

- Hyper-local GSI scores (neighborhood level)
- Service performance tracking (response times, quality)
- Participatory budgeting tools
- Issue reporting with automatic escalation tracking

Design Principle: "Show the system working (or not working) for you"

Submodule D2: Citizen Science Toolkit

Tools:

- Decision latency timer app (report problem → track resolution)
- Local resource mapper (skills, spaces, equipment inventory)
- Trust barometer (regular pulse checks on institutional trust)
- Deliberative polling platform

Incentive: Gamification + impact visualization

3. DATA INGESTION & PROCESSING PIPELINE

3.1 Multi-Source Data Integration

Source Tier 1: Official APIs

Integration Targets:

- National statistical offices (JSON/XML APIs)
- Municipal financial systems (OpenFisca compatibility)
- Legislative tracking systems (Popolo standard)
- Public procurement databases (Open Contracting)

Protocol: Automated daily sync with version control

Source Tier 2: Structured Documents

Processing Pipeline:

1. Document ingestion (PDF, DOC, ODF)
2. OCR + structured data extraction
3. Entity recognition (people, organizations, locations)
4. Relationship mapping (who decided what, when)
5. Classification against GSI indicators

Technology: Custom NLP models trained on governance documents

Source Tier 3: Citizen & Community Data

Collection Methods:

- Mobile app reporting (geotagged, timestamped)
- Community survey platform
- Social media monitoring (sentiment analysis)
- Traditional media analysis

Verification: Triangulation across multiple reports

3.2 Quality Assurance & Validation

Automated Validation Rules:

Rule 1: Temporal Consistency Check

- Flag changes >25% without documented policy shift

- Require explanatory documentation

Rule 2: Cross-Source Verification

- Compare official data with shadow sources
- Calculate discrepancy scores
- Escalate high-discrepancy cases for human review

Rule 3: Peer Benchmarking

- Compare with similar jurisdictions (CAF-adjusted)
- Flag statistical outliers

Human Validation Workflow:

Step 1: Automated anomaly detection
Step 2: Assignment to domain expert (jurisdiction-specific)
Step 3: Investigation & documentation
Step 4: Score adjustment with transparency log
Step 5: Validator performance tracking

3.3 The Confidence Scoring System

Tier Definitions with Technical Implementation:

Diamond Tier (90-100% confidence)

Requirements:

- Real-time API integration with automated checksums
- Blockchain-anchored audit trails for all data changes
- Multi-party computation validation (3+ independent sources)
- Public key infrastructure for data signing

Visual Representation: Solid colors with "verified" badge

Gold Tier (75-89% confidence)

Requirements:

- Official published data with digital signatures
- One independent verification source
- Complete metadata (methodology, collection dates)
- No unresolved data quality flags

Visual Representation: Solid colors with source citations

Silver Tier (50-74% confidence)

Requirements:

- Official data only
- Partial metadata
- Some methodological concerns noted
- Potential gaming risks identified

Visual Representation: Hatched patterns, hover warnings

Bronze Tier (0-49% confidence)

Characteristics:

- Estimates or proxy data
- Significant methodological limitations
- Single source without verification
- High manipulation risk

Visual Representation: Blurred/desaturated, requires click-to-view

4. VISUALIZATION & USER EXPERIENCE SPECIFICATIONS

4.1 The GSI Dashboard Design System

Core Visualization: The Subsidiarity Radar

Technical Specifications:

- 12-axis radar chart (one per primary indicator)
- Dual-layer visualization: Current vs. Target (CAF-derived)
- Interactive tooltips with source citations
- Export as SVG/PDF with full metadata

Innovation: "Gap Analysis" mode highlights specific improvement areas

Geospatial Visualization: Decision Distance Heatmap

Features:

- Multi-scale rendering (global → national → municipal)
- Time slider for historical comparison
- Layer toggles for different systems (health, education, etc.)

- Click-through to decision chain diagrams

Technology: WebGL-based rendering for performance

4.2 User Role Customization

Policymaker View:

Default Dashboard:

- Transition Simulator (primary)
- Peer Comparison Matrix
- Risk Assessment Panels
- Implementation Roadmap Generator

Features: Scenario saving, team collaboration, report generation

Citizen View:

Default Dashboard:

- Local Service Tracker
- Community Resource Map
- Issue Reporting Portal
- Participatory Budgeting Interface

Features: Mobile-first, offline capability, low-bandwidth optimization

Researcher View:

Default Dashboard:

- Advanced Data Explorer
- Statistical Analysis Tools
- API Access Manager
- Dataset Download Center

Features: Jupyter Notebook integration, custom query builder

4.3 Accessibility & Internationalization

Accessibility Standards: • WCAG 2.1 AA compliance • Screen reader optimization for all visualizations • Keyboard navigation for complex interfaces • Colorblind-friendly palettes • Multiple language support (50+ languages) • Right-to-left script support • Low-literacy interface options

5. API & INTEGRATION ECOSYSTEM

5.1 Public API Specification

Core Endpoints:

```
GET /api/v1/jurisdictions/{id}/gsi
• Returns current GSI scores with confidence ratings
• Supports historical queries (?year=2024)

POST /api/v1/simulate
• Accepts indicator adjustments
• Returns predicted outcomes with confidence intervals

GET /api/v1/patterns
• Searchable repository of governance solutions
• Filter by CAF components, system type, outcome
```

Webhook System:

```
Events:
• data_update: When new data is available
• anomaly_detected: When validation issues arise
• peer_match: When new "twin" jurisdictions identified

Use Case: Municipal systems can subscribe to updates
```

5.2 Integration Targets

Government Systems: • National statistics portals (JSON-stat compatibility) • Municipal ERP systems (SAP, Oracle, custom) • Legislative information systems (Akoma Ntoso standard) • Budget visualization platforms (OpenSpending)

Civil Society Tools: • Citizen engagement platforms (Consul, Decidim) • Transparency portals (Open Data platforms) • Accountability trackers (International Budget Partnership tools)

Academic Infrastructure: • Research data repositories (Dataverse, Zenodo) • Statistical analysis tools (R, Python packages) • Publication systems (Overleaf integration for reports)

6. SECURITY, PRIVACY & GOVERNANCE

6.1 Data Sovereignty Framework

Sovereign Data Containers:

Architecture:

- Each jurisdiction controls its own encrypted data container
- Data never leaves jurisdiction without explicit consent
- Aggregated analysis happens through federated learning
- Jurisdiction can revoke data access at any time

Technology: Confidential Computing + Homomorphic Encryption where possible

6.2 Privacy-Preserving Analytics

Citizen Reporting Protection:

Protocol:

1. Zero-knowledge proofs verify residency without identity
2. Differential privacy adds statistical noise to aggregate data
3. k-anonymity ensures individuals cannot be re-identified
4. Local differential privacy for mobile app data

Guarantee: "Your data helps your community without exposing you"

6.3 Platform Governance

Technical Governance Board:

Composition:

- 3 Infrastructure experts (appointed)
- 3 Participating jurisdiction representatives (elected)
- 3 Civil society technical experts (selected)
- 1 Security auditor (independent)

Responsibilities:

- Protocol updates and standards maintenance
- Security incident response
- Dispute resolution for data issues
- Roadmap prioritization

Transparency Mechanisms: • All platform changes publicly logged • Regular security audits published • Data processing algorithms open source • Decision-making processes documented

7. DEPLOYMENT & SCALING STRATEGY

7.1 Phased Rollout Plan

Phase 1: MVP (Months 1-6)

Scope: Single country (Sweden), 3 systems (Healthcare, Education, Housing)
Features: Basic dashboard, manual data entry, simple visualizations
Infrastructure: Single region deployment, basic security
Target Users: Pilot municipalities, research partners

Phase 2: Beta (Months 7-18)

Scope: 5 countries, all 10 systems
Features: Automated data ingestion, peer matching, basic simulations
Infrastructure: Multi-region deployment, enhanced security
Target Users: National governments, international organizations

Phase 3: Global (Months 19-36)

Scope: 50+ countries, full feature set
Features: AI-powered insights, real-time monitoring, advanced simulations
Infrastructure: Fully federated, edge-optimized, enterprise-grade security
Target Users: Global deployment, all user types

7.2 Performance Requirements

Scalability Targets: • 10,000 concurrent users • 1M+ data points processed daily • <2 second dashboard load time • 99.9% uptime SLA for core services • Real-time updates within 30 seconds of data change

Cost Optimization: • Serverless architecture for variable workloads • Edge computing for visualization rendering • Data compression and intelligent caching • Open source stack to minimize licensing costs

8. MONITORING, MAINTENANCE & EVOLUTION

8.1 Observability Stack

Metrics Collection: • Platform performance (response times, error rates) • Data quality indicators (completeness, freshness, accuracy) • User engagement metrics (active users, feature usage) • Computational costs (processing time, storage usage)

Alerting System: • Real-time alerts for data anomalies • Performance degradation detection • Security incident alerts • Cost overrun warnings

8.2 Continuous Improvement Framework

A/B Testing Infrastructure: • Test new visualization approaches • Experiment with different algorithm parameters • Validate user interface changes • Measure impact on user comprehension and action

Feedback Integration: • In-platform feedback tools • Regular user testing sessions • Academic research partnerships • Community contributor program

9. SUCCESS METRICS & EVALUATION

9.1 Platform Success Metrics

Technical Metrics: • Data freshness (time from event to dashboard update) • Calculation accuracy (compared to manual verification) • System reliability (uptime, error rates) • Performance benchmarks (load times under stress)

User Impact Metrics: • Policy changes attributed to platform insights • Citizen engagement increases in participating jurisdictions • Cross-jurisdiction learning and adaptation • Research publications using platform data

Governance Impact Metrics: • GSI score improvements in regular users • Decision distance reduction over time • Resilience improvements during actual crises • Trust metric correlations with platform usage

9.2 Evaluation Protocol

Quarterly Reviews: • Technical performance assessment • User satisfaction surveys • Impact case study compilation • Roadmap adjustment based on findings

Annual Audits: • Independent security audit • Data quality assessment • Algorithm fairness evaluation • Governance structure review

10. APPENDICES

Appendix A: Data Schema Specifications

- Complete database schema with relationships • API request/response examples • Data validation rules

Appendix B: Security Protocols

- Detailed encryption standards • Access control matrices • Incident response procedures

Appendix C: Deployment Checklists

- Infrastructure as code templates • Monitoring configuration • Backup and disaster recovery procedures

Appendix D: Contributor Guidelines

- Code contribution process • Data submission standards • Documentation requirements
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CONCLUSION: BUILDING THE GOVERNANCE COMMONS

The GSI Digital Platform represents more than technology—it's **infrastructure for better collective decision-making**. By making governance architecture visible, analyzable, and improvable, we create the conditions for societies to evolve their systems as complexity demands.

Core Innovation: The platform doesn't just measure governance—it creates a **learning loop** where measurement leads to insight, insight leads to action, and action leads to better measurement.

Next Steps:

1. **Prototype Development:** Build MVP focusing on Swedish municipalities
2. **Partner Onboarding:** Engage initial jurisdictions and validators
3. **Funding Strategy:** Secure multi-source funding for sustainability
4. **Governance Establishment:** Form initial technical governance board

The platform succeeds when it becomes **indispensable to local reformers**—the tool they reach for when trying to make their communities more responsive, resilient, and human.

END OF DIGITAL PLATFORM SPECIFICATIONS

Implementation would begin with a minimum viable product focusing on Module A (Governance Anatomy) for Sweden, then expand based on user feedback and partnership development.