

DIGITAL ECOSYSTEMS AS A TOOL FOR ENSURING TRANSPARENCY AND INCLUSIVITY IN POST-WAR RECONSTRUCTION PROCESSES

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Introduction. As of early 2026, the Kyiv School of Economics (KSE) Institute estimates that over 160,000 residential buildings, 3,800 educational institutions, 1,450 healthcare facilities, 340 bridges, and 27,000 km of roads have been damaged or destroyed. The World Bank's latest RDNA4 report places the direct damage at \$152 billion, with economic losses exceeding \$300 billion. More than 5.4 million internally displaced persons (IDPs) and 2.1 million returnees require housing, social services, and livelihoods. The Ukrainian government, in partnership with the EU, G7, and international financial institutions, has committed to a decade-long recovery plan requiring \$500–750 billion. However, history warns that large aid flows without transparency breed corruption, elite capture, and public disillusionment.

The Human Cost: Three Stories.

Olena, 68, from Mariupol: Her apartment building was destroyed. She fled to Lviv and lives in a crowded dormitory. She does not own a smartphone. She has no idea how to apply for compensation or whether her neighborhood will ever be rebuilt.

Serhiy, a veteran who lost both legs near Bakhmut: He uses a wheelchair and screen-reading software. The current Diia app is not fully accessible. He cannot independently check the status of his adapted housing application.

Nadia, a single mother and IDP from Kherson: She wants to participate in deciding whether to rebuild the local school or the community clinic first. But all town meetings are in person, and she cannot travel back to Kherson.

These stories illustrate why inclusivity is not an add-on but a core requirement.

The Transparency Trap in Post-Conflict Reconstruction. Post-Iraq, post-Haiti, and post-2004 tsunami reconstruction saw massive corruption: contractors overcharged for simple materials, ghost projects were funded, and vulnerable communities were ignored. In Ukraine, even before the war, corruption in public procurement and construction was endemic (Transparency International ranked Ukraine 122nd out of 180 in 2020). The post-war period amplifies risks:

Emergency procedures bypass standard oversight. Multiple donors (EU, USA, Japan, IMF, World Bank, EBRD) use different reporting standards and currencies. Local authorities may lack capacity or face political pressure. Military secrecy may be used as an excuse to hide information. Without a radical transparency mechanism, Ukraine risks squandering billions and losing public trust.

The Inclusivity Gap. Vulnerable groups—women-headed households (over 60% of IDP households), persons with disabilities (an estimated 2.7 million in Ukraine), elderly (over 30% of rural population), Roma communities, war veterans, and IDPs—often remain invisible in reconstruction planning. Traditional town hall meetings exclude those who have fled or have limited mobility. Paper-based grievance systems are slow and easily ignored. Without deliberate digital inclusion, reconstruction may replicate pre-war inequalities or create new ones, such as rebuilding only wealthier areas or designing inaccessible infrastructure.

Why Digital Ecosystems? A digital ecosystem goes beyond a single app or database. It is an open, interoperable network of platforms, data sources, and stakeholders (government, civil society, private sector, donors, citizens) governed by shared rules (APIs, standards, ethics). Key characteristics: Decentralization – No single point of failure or control; data is replicated and verified. Interoperability – Data flows seamlessly between systems (land registry, social protection, procurement, donor portals). User-centricity – Multiple access channels (web, mobile, SMS, offline kiosks, voice assistants, paper forms with barcodes). Verifiability – Every transaction is logged with an immutable audit trail (blockchain for critical records). Resilience – Even if one region is attacked or loses internet, other nodes continue functionin. Such ecosystems have been proven in Estonia (X-Road, serving 99% of public services), Georgia (digital land registry reduced disputes by 90%), and Taiwan (participatory budgeting engaged 200,000+ citizens). Ukraine already possesses foundational elements: Diia (digital ID and services, 20 million+ users), Prozorro (public procurement transparency, saved \$6 billion since 2016), Diia.City (legal and tax digital environment for IT). The challenge is to integrate and extend these for reconstruction.

Research Questions: What architectural components form a digital ecosystem for transparent and inclusive post-war reconstruction? How can such an ecosystem prevent corruption and ensure real-time accountability? What mechanisms guarantee participation of vulnerable groups, including those without internet access? What are the implementation barriers (legal, technical, social) and mitigation strategies?

Methodology. This is a conceptual policy paper based on: (a) literature review of post-conflict reconstruction and e-governance; (b) case studies of digital ecosystems in Estonia, Georgia, Taiwan, and Ukraine's existing systems; (c) stakeholder interviews (simulated or actual) with government officials, NGOs, IDP representatives, and tech experts; (d) legal analysis of Ukrainian laws ("On Public Procurement", "On Electronic Trust Services", "On Data Protection").

Digital Ecosystem: Definition and Properties.

A digital ecosystem (DE) is a socio-technical system of interconnected digital platforms, data repositories, users, and governance rules that co-evolve to produce collective value. Drawing on Moore's (1996) business ecosystem concept and the OECD's (2020) digital government framework, we define seven essential properties for reconstruction: Openness – APIs allow third-party applications (e.g., civil society monitoring tools, independent audit dashboards). Resilience – Redundant nodes; data replication across geographically distributed servers (including in EU countries as backup). Trustlessness (optional but recommended) – Blockchain reduces need for a central authority; trust is placed in code and consensus. Inclusive by design – Multi-channel access (web, mobile, SMS, offline kiosks, voice, paper) and adherence to WCAG 2.1 AA. Interoperability – Standardized data schemas (e.g., IATI for donors, INSPIRE for geospatial data). Privacy-preserving – Pseudonymization, differential privacy, user consent management. Auditability – Every change is logged with timestamp and digital signature [1.2]

Real Cases of Digital Tools Improving Social Services in Ukraine. Ukraine's digital transformation has accelerated during the war, making social services more accessible and efficient. Here are some **real-world examples** of how digital tools are helping citizens:

Case 1: Financial Aid for War-Affected Citizens. Through **Diia**, Ukrainians can apply for IDP status and receive monthly state financial aid (2,000–3,000 UAH per person); **eDopomoga**, a government-backed initiative, provides direct financial assistance from international donors via Diia. Over 1.5 million people have received digital payments through this platform.

Case 2: Housing Compensation for Destroyed Homes. Citizens can apply for **compensation for destroyed housing** through Diia, avoiding bureaucracy and long waits. As of 2023, thousands of applications have been processed digitally.

Case 3: Ensuring Internet Access for Displaced Persons. Starlink terminals, provided by **SpaceX**, have been deployed in hospitals, social service centers, and refugee shelters. This ensures continued access to online applications for aid, pensions, and healthcare services, even in frontline areas.

Case 4: Remote Pension Applications for Elderly and Displaced Persons. The **ePension** system allows elderly citizens to apply for pensions, track payments, and update documents online. This is critical for **IDPs** who lost access to their local Pension Fund offices due to the war. Over **1 million retirees** have used ePension since 2022.

Case 5: On-the-Go Social Services in War-Affected Areas. Ukraine has deployed mobile administrative service centers (**ACII**) equipped with internet and digital devices. These mobile centers help people in **liberated areas** register for IDP aid, social benefits, and legal assistance.

Case 6: Transparent Financial Aid Distribution. The Ukrainian government partnered with UNICEF and blockchain company Everstake to distribute humanitarian aid transparently. Aid payments are made via blockchain-based smart contracts, reducing corruption risks and ensuring money reaches recipients instantly.

Case 7: Remote Healthcare Access for War Victims. The eHealth system allows displaced persons to access their medical records and prescriptions online. **e-prescriptions** help patients receive medicine in any pharmacy in Ukraine without needing paper documents.

Case 8: Telegram Chatbots Helping Citizens Access Services. Several Telegram chatbots, like **@eDopomoga_bot**, guide people in applying for aid and benefits. The **"Tell Me" chatbot**, launched by the Ministry of Social Policy, helps victims of domestic violence find shelters and legal support.

Case 9: Mental Health Support for War-Affected Citizens. Digital mental health platforms like **"How Are You?"** provide free online therapy sessions for Ukrainians suffering from war trauma.

Ukraine's innovative use of **Diia, blockchain, mobile centers, Starlink, ePension, and chatbots** has significantly improved social service accessibility during the war. These solutions ensure that **millions of Ukrainians, especially displaced and vulnerable groups, continue to receive the help they need.**

Key Trends in Digitalization of Social Services in Ukraine. Ukraine's social services sector is undergoing rapid digital transformation, driven by government initiatives, technological advancements, and the necessity of wartime resilience. Here's a look at **key trends** shaping the digitalization of social services, along with **future perspectives**.

1. **Expansion of the Diia Ecosystem.** Current Trend: Diia has evolved from a digital document platform into a full-service e-government ecosystem, providing access to financial aid, social benefits, pension services, and even legal support. Over 19 million Ukrainians use Diia, making it the primary tool for social service access. Future Perspective: Expansion of AI-driven chatbots to assist with applications and reduce bureaucratic delays. Development of Diia.City, a legal framework that supports IT startups, encouraging the creation of digital social service tools.

2. **AI & Big Data for Targeted Social Assistance.** Current Trend: The government is using big data analytics to track displaced persons, pensioners, and low-income families, ensuring aid reaches the right people. AI-based fraud detection systems prevent duplicate applications for benefits and improve service efficiency. Future Perspective: AI-powered personalized social assistance, where digital tools predict citizen needs and offer proactive support. Blockchain-based universal social ID to streamline benefit distribution and eliminate paperwork.

3. **Digital Inclusion for Vulnerable Groups.** Current Trend: Mobile digital service centers provide on-the-ground assistance to people in remote and war-affected areas. Special training programs focus on improving digital literacy among elderly and disabled citizens. Future Perspective: AI-driven voice assistants for visually impaired individuals to access social services. Expansion of mobile digital hubs in rural and frontline areas, ensuring no one is left behind.

4. **E-Health & Telemedicine Integration.** Current Trend: Ukraine's eHealth system enables digital medical records, e-prescriptions, and remote doctor consultations. Online mental health platforms support war-affected individuals. Future Perspective: Full integration of telemedicine with Diia, allowing users to access healthcare services through a single app. Expansion of AI-based diagnostics and remote patient monitoring for vulnerable populations.

5. Strengthening Cybersecurity & Data Protection

Current Trend:

Ukraine has migrated government databases to European cloud services to protect sensitive social service data from cyberattacks.

Collaboration with global tech firms like Microsoft, Google, and Cloudflare has enhanced cybersecurity.

Future Perspective:

Use of decentralized blockchain storage to further secure social service data.

AI-driven cyber threat detection systems to ensure uninterrupted access to digital services.

6. Integration of Blockchain for Aid Distribution

Current Trend:

Ukraine has started using blockchain technology to distribute humanitarian aid and social benefits transparently.

UNICEF and the World Food Program have already tested crypto-based aid transfers in Ukraine.

Future Perspective:

Wider adoption of blockchain-powered smart contracts to automate social benefits payments.

Introduction of a digital social wallet, where citizens can manage pensions, subsidies, and donations in one place.

Transparency in Reconstruction: Four Dimensions

Transparency is not just data disclosure but **actionable transparency**: information is timely, accessible, comparable, and verifiable.

Financial transparency: Donor pledges → disbursement to treasury → allocation to projects → expenditure by contractor → audit trail. All steps public within 24 hours.

Process transparency: Procurement tenders (open calls) → evaluation criteria → winner selection → contract signing → milestone completion certificates (with digital signatures of independent engineers).

Outcome transparency: Damage assessments (pre-war photos, satellite imagery) - reconstruction progress maps (updated weekly) - quality inspection results (including citizen feedback).

Governance transparency: Meeting minutes of reconstruction councils, voting records, conflict of interest declarations.[1,2,11]

Inclusivity in Reconstruction: Five Pillars.

Inclusivity means meaningful participation of all affected groups in decision-making, implementation, and monitoring. The five pillars are:

Accessibility: Interfaces compatible with assistive technologies (screen readers, Braille displays, sign language videos, voice control).

Affirmative outreach: Not just “waiting for citizens to come” but proactive information campaigns via IDP centers, social workers, rural councils, community radio.

Participatory mechanisms: Digital voting for local project prioritization, citizen reporting of damage or poor quality, feedback loops that trigger action.

Representation: Guaranteed quotas for IDPs, persons with disabilities, women, and veterans in reconstruction oversight bodies.

Grievance redress: Anonymous, low-barrier channels (toll-free number, SMS, chatbot, in-person ombudsman) with mandatory response within 15 days.

The digital ecosystem aligns with the Open Government Partnership (OGP) principles: transparency, accountability, citizen participation, technology & innovation. It operationalizes the “follow the money” approach of the International Aid Transparency Initiative (IATI) and the “open contracting” data standard (OCDS). For Ukraine, which joined OGP in 2011, the reconstruction ecosystem can become a flagship commitment.

Global Best Practices and Lessons for Ukraine.

Estonia: X-Road and the Once-Only Principle[3]

Estonia’s X-Road is a decentralized data exchange layer connecting over 3,000 public and private sector databases. For reconstruction, a similar layer would link:

StateGeoCadastre (land and property rights)

Population register (residents, IDPs)

Construction permit system (e- Ehitusregister)

Donor databases (EU, USAID, etc.)

Prozorro (procurement)

The “once-only” principle means citizens and contractors submit data once; the system reuses it across services. This reduces bureaucracy and fraud. Estonia also uses blockchain (KSI technology) to verify the integrity of all registry entries without revealing data. Lessons for Ukraine: strong legal basis (Digital Agenda 2030), robust cybersecurity (mandatory logging, penetration testing), and continuous digital literacy campaigns (e-citizen academy).

Georgia: Transparent Land and Property Registration[4]

After the 2008 war, Georgia used a digital land registry (NAPR) with public online access to reduce property disputes. For Ukraine, where millions of property titles were destroyed or disputed due to occupation, a blockchain-backed immutable registry can prevent fraudulent claims. Georgia’s success required political will and simplification of procedures (reducing registration time from 30 days to 1 day).

Taiwan: Join Platform and Participatory Budgeting[6]

Taiwan’s “Join” platform(join.gov.tw)uses AI-driven deliberative polling and open discussion forums to engage citizens in policy making. For reconstruction, a similar module allows communities to vote on local projects (e.g., rebuild school vs. clinic vs. water treatment). In 2020, Taiwan used “civic tech” to coordinate mask distribution during COVID-19 – an analogy to coordinating building materials and labor post-war. Key lessons: iterative design (start small, scale fast), government commitment to implement top-voted projects, and integration with existing ID systems (Taiwan’s digital ID). Ukraine’s Diia could host a “Reconstruction Referendum” module.

Colombia: Post-Conflict Land Restitution with Digital Tools[5]

After the 2016 peace agreement, Colombia created a digital land restitution system to return stolen land to displaced peasants. The system used GIS mapping, public registries, and mobile apps for claimants to upload evidence. While imperfect (backlog remains), it digitized 100,000+ claims and reduced physical travel to courts. For Ukraine, this offers a model for returning property to IDPs from occupied territories.

Ukraine’s Existing Digital Assets – A Detailed Inventory[7-9]

Ukraine is not starting from zero. Key assets:

Diia (State app): 20.5 million users (as of Jan 2026). Services include digital passport, driver’s license, tax ID, business registration, and COVID certificates. For reconstruction, Diia can be extended to show status of one’s damaged property, receive e-vouchers for housing repair, vote on local projects, and report corruption.

Prozorro: Public procurement system covering \$30 billion+ since 2016. Open data API. Saved over \$6 billion through competition. For reconstruction, it must integrate e-catalogues for construction materials (preventing overpricing) and unit price benchmarks (e.g., cost per square meter of roofing).

Diia.City: A special legal and tax regime for IT companies (lower corporate tax, simplified hiring). Can host reconstruction-related digital services (e.g., project management SaaS for small contractors, digital quality inspection apps).

What's Missing? Critical Gaps

Despite these assets, the following are absent:

Interoperability layer: Diia, Prozorro, and social registries do not fully share data due to legacy technical debt and privacy silos.

Blockchain for critical logs: No immutable record of land titles, donor fund disbursement, or quality assurance certificates.

Offline-first design: Rural areas (20% of population) have unstable or no internet.

Accessibility standards: Current Diia app fails WCAG 2.1 AA (screen reader issues, lack of sign language).

Grievance module: No standardized, transparent complaint system for reconstruction.

Donor coordination portal: Each donor uses its own reporting; no single dashboard for citizens.

Proposed Digital Ecosystem Architecture for Reconstruction

Core Principles (Repeated for emphasis)

Open by default – All non-personal data is public via API.

API-first – Every module exposes machine-readable endpoints with versioning.

Privacy-preserving – Personal data pseudonymized; analytics use differential privacy.

Resilience – Data replicated across three regions (Kyiv, Lviv, and an EU member state) with offline sync for field use.

Inclusive by design – Meet WCAG 2.1 AA, support SMS and voice, provide paper fallback.

Logical Layers and Components[10]

Data layer:

Components - Unified Reconstruction Registry (URR) – distributed ledger storing asset, project, transaction, complaint registers.

Transparency Function: Single source of truth; public API for auditors, journalists, NGOs.

Inclusivity Function: IDP registration linked; disability markers; language preferences (Ukrainian, Crimean Tatar, Romani).

Transaction layer

Components - Smart contracts (e.g., on Hyperledger Besu) for fund release, milestone verification.

Transparency Function: Automated, auditable; no manual intervention to release funds.

Inclusivity Function: Micro-grants to small local contractors (incl. women-led, veteran-led businesses) via smart contract templates.

Interaction layer

Components - Diia extension, web portal(reconstruction.gov.ua), SMS bot, offline kiosks (in community centers), toll-free voice bot (IVR).

Transparency Function: Citizens view reconstruction progress in real time, download audit reports.

Inclusivity Function: Voice navigation for blind users; offline mode with sync when internet returns; large-print paper forms with QR codes.

Monitoring layer

Components - Satellite imagery (Sentinel-2, Planet Labs) + citizen reports (via Diia or SMS) + drone inspections (by independent engineers).

Transparency Function: Geo-tagged before/after photos; AI anomaly detection (e.g., “contractor reported roof done but satellite shows blue tarp”).

Inclusivity Function: Crowdsourced feedback from displaced persons via chatbots; field agents with tablets assist illiterate users.

Governance layer

Components - Multi-stakeholder council (govt, donors, NGOs, tech community, IDP reps). Smart contract for voting on rule changes.

Transparency Function: Public minutes, open voting on protocol upgrades; all votes recorded on ledger.

Inclusivity Function: Quotas: at least 30% IDP, 30% women, 15% persons with disabilities, 15% veterans.

Unified Reconstruction Registry (URR)

The URR is a permissioned distributed ledger (Hyperledger Fabric 2.5) with four sub-registers:

Asset Register

Each damaged asset (building, bridge, power line) gets a unique ID (UUID). Fields:

Type (residential, school, hospital, road, etc.)

Geo-coordinates (WGS84, plus address)

Pre-war condition (photo hash, inspection report hash)

Damage level (0-100% based on official commission or satellite AI)

Ownership (pseudonymized: e.g., hash of taxpayer ID; only tax authority can map to real person)

Status (not started / in progress / completed)

Project Register

Each reconstruction project linked to one or more asset IDs. Fields:

Budget (by donor, in USD and UAH)

Contractor(s) (legal entity name, registration code)

Timeline (start, planned end, actual end)

Milestones (each with description, completion %, inspector digital signature, payment amount)

Quality inspection results (pass/fail, report hash)

Transaction Register

Every financial flow: donor → state treasury → escrow smart contract → contractor. Fields:

Amount, currency, timestamp

Smart contract condition (e.g., “release 30% after milestone A signed by inspector”)

Blockchain transaction hash (for external verification)

Complaint Register

Anonymous or attributed complaints. Fields:

Complaint text (or voice transcription)

Related asset/project ID

Status (received / investigating / resolved / rejected)

Resolution timestamp and explanation

Escalation flag (if unresolved >30 days)

All registers are append-only; data cannot be deleted or altered. Tamper-evident logs. Public access: anyone can query non-personal fields via REST API or web dashboard. Example query: “Show all schools in Kharkiv oblast with damage >50% and reconstruction <30% complete.”

Inclusivity Mechanisms Embedded in Detail

Digital identity for all, including offline users

Ukraine’s Diia already provides electronic ID. For those without smartphones (elderly, rural, homeless):

Physical “Diia cards” with QR codes and NFC tags, issued at administrative service centers (TsNAPy).

These can be scanned at offline kiosks or by social workers.

For displaced persons, temporary digital ID linked to Unified Information System of Social Sphere. The ID works even if they have lost all documents; biometric verification (fingerprint at mobile registration points) creates a unique hash.

Participatory prioritization with weighted voting

In each hromada (community of 10,000–100,000 people), a module on Diia and the web portal allows residents to rank up to five reconstruction projects. Voting is open for 14 days. Weights:

Permanent residents (registered before Feb 24, 2022): 1 vote

IDPs from that hromada who intend to return (based on declaration): 0.8 vote

Residents under 18 (with parental consent): 0.5 vote (to include youth)

Results are public and binding unless overridden by safety/engineering necessity (justification published and subject to complaint).

Accessible interfaces – technical specifications

Mobile app: supports Android TalkBack, iOS VoiceOver; dynamic font sizing up to 200%; high contrast theme; all buttons have descriptive labels.

Web portal: WCAG 2.1 AA certified; includes ARIA landmarks; sign language videos for top 50 instructions (Ukrainian Sign Language).

SMS bot: for feature phones, commands like “STATUS SCHOOL5” to 5656; replies with short status.

Voice bot (IVR): toll-free number 0-800-XXX-XXX. Speech recognition for simple commands (“check my building”, “file complaint”). For complex cases, transfers to human operator during business hours.

Offline kiosks: touchscreens with headphone jacks, Braille keypad, and printer for paper receipts. Located in every TsNAP, library, and IDP center.

Gender and social inclusion in procurement

Smart contracts on the procurement module automatically calculate a “social bonus” of up to 10% for bids from enterprises:

Owned by women ($\geq 51\%$ shares)

Owned by veterans or IDPs

Employing $\geq 30\%$ persons with disabilities

The bonus is applied to the evaluation score (not the price). The ecosystem publishes diversity metrics on a public dashboard: “Contracts awarded to women-led businesses: 18% (target 25%).”

Grievance mechanism – end-to-end tracking

Any citizen can file a complaint via:

Diia app (anonymous option)

SMS to 5656 (text “COMPLAINT [asset ID] [text]”)

Toll-free voice bot

Paper form at kiosk (scanned and tokenized)

The complaint receives a unique tracking hash. The responsible authority (local administration or reconstruction agency) must acknowledge within 72 hours and resolve within 30 days. If not, the complaint is automatically escalated to the Anti-Corruption Bureau and the National Agency for Reconstruction. All complaint resolutions are public (anonymized). In 2025, a pilot in Lviv oblast reduced complaint resolution time from 60 to 18 days.

Donor and Multi-Stakeholder Coordination Portal

The ecosystem includes a “Donor Coordination Portal” (DCP) with these features:

Each donor (EU, USAID, EBRD, World Bank, bilateral aid agencies) gets an API key to push project data using the International Aid Transparency Initiative (IATI) standard.

The system automatically reconciles currencies (using daily exchange rates) and flags overlaps (e.g., two donors funding the same school).

A public dashboard shows: “Total pledged: \$X billion; Total disbursed to treasury: \$Y billion; Total paid to contractors: \$Z billion; Remaining: \$W billion.”

Citizens can filter by donor: “Show me all projects funded by Japan.”

To prevent double funding, smart contracts require that each asset ID can only have one active project at a time. Donors can see in real time which assets are already funded.

Implementation Roadmap with Budget and Responsibilities.

Phase 0: Legal and Institutional Preparation (Months 1-3)

Budget: \$1.2 million (legislative drafting, stakeholder workshops). **Lead: Ministry of Digital Transformation (MDT), Verkhovna Rada Committee on Digital Policy**

Draft and pass Law of Ukraine “On the Digital Ecosystem for Reconstruction” (DER Law). Key provisions: mandatory open data for all reconstruction contracts $> \$10,000$; APIs must be documented; blockchain for land and major contracts; citizens’ right to complaint with mandatory response.

Create National Agency for Digital Reconstruction (NADR) – a 15-member board: 5 government, 5 donors, 5 civil society (including IDP and disability reps).

Amend procurement law (Law “On Public Procurement”) to allow smart contracts and milestone-based payments without separate central approval.

Amend land code to recognize blockchain-stored titles as legally equivalent to paper originals.

Phase 1: Minimum Viable Ecosystem (MVE) – Months 4-9

Budget: \$8.5 million (software development, hardware, training). **Lead: MDT with support from EU5 (Estonia, Finland digital agencies)**

Deploy Unified Reconstruction Registry (URR) on Hyperledger Fabric with 4 validator nodes (Kyiv, Lviv, Warsaw, Tallinn).

Integrate URR with existing Diia and Prozorro via APIs (development sprint).

Launch public dashboard(reconstruction.gov.ua) with map interface, search, and download as CSV.

Pilot in 5 hromadas: Bucha (Kyiv oblast), Trostianets (Sumy), Mykolaiv city, Chernihiv city, and a rural hromada in Dnipropetrovsk.

Train 500 local officials and 200 civil society monitors on using the system.

Deploy offline kiosks in each pilot hromada (2 per hromada, total 10).

Success criteria at end of Phase 1:

100% of pilot reconstruction projects (approx. 200) are registered in URR with public data.

Average time from damage assessment to contract: reduced from 6 months to 2.5 months.

5,000 citizens use the dashboard; 500 complaints filed and resolved within 30 days.

Phase 2: Scaling and Interoperability – Months 10-18

Budget: \$22 million. Lead: NADR with World Bank funding

Onboard all 136 hromadas with active reconstruction (priority to frontline oblasts: Kharkiv, Donetsk, Zaporizhzhia, Kherson).

Integrate with donor systems: EU's EUSurvey, USAID's DIS, World Bank's DIME, EBRD's client portal.

Add blockchain layer for land titles: migrate 2 million damaged property records to the ledger.

Launch participatory budgeting module on Diia for all hromadas.

Add SMS and voice bot channels.

Train 5,000 additional officials and 1,000 NGO monitors.

Success criteria:

80% of all reconstruction projects (by value) in URR.

30% of adult citizens in pilot regions have used at least one participatory voting feature.

Land title disputes reduced by 50% compared to pre-war baseline.

Phase 3: Full Ecosystem and Continuous Improvement – Months 19-36

Budget: \$35 million (including annual maintenance). Lead: NADR, with ongoing support from international technical partners

AI-based anomaly detection: train model to flag suspicious patterns (e.g., contractor winning >30% of tenders in a region, unit price >20% above benchmark).

Integration with satellite monitoring: automated progress detection (e.g., "foundation visible" → milestone check).

Annual independent audit of transparency and inclusivity metrics by a neutral body (e.g., Transparency International Ukraine).

Feedback loops: user analytics to identify which groups are not using the system (e.g., elderly women in rural areas) and launch targeted outreach.

Expand offline network: 500 kiosks nationwide, 200 mobile registration teams.

Success criteria:

100% of reconstruction projects (all values) in URR.

50% of adult citizens have participated in at least one decision (voting, complaint, feedback).

Ukraine's Corruption Perceptions Index improves by at least 10 points.

The digital ecosystem is recognized by OECD as a global best practice for post-conflict recovery.

Total estimated budget for years 1-3: \$66.7 million.

This is less than 0.02% of total reconstruction needs – a negligible cost for transformative impact.

Challenge - Detailed Mitigation.

Digital divide (rural, elderly, disabled, homeless) - Offline kiosks in every village council; community volunteers as "digital navigators" (paid small stipend); radio/TV announcements with simple instructions; paper-based fallback (forms with barcodes that officials scan). For homeless, mobile registration units (vans with tablets and printers).

Cybersecurity (Russian state-sponsored hacking, data leaks, ransomware) - Zero-trust architecture: every request authenticated, encrypted, logged. Air-gapped backups updated daily. Mandatory penetration tests every 6 months (by EU Cyber Rapid Response Team). Data replication in EU (Poland, Estonia) under GDPR+Ukrainian law. For high-value transactions (e.g., >\$1M), require multi-signature (two officials + hardware key).

Legal fragmentation (donor data protection laws differ from Ukrainian law) - Standard data processing agreement based on GDPR + Ukrainian Law "On Personal Data Protection" (which is already GDPR-aligned). For public dashboards, all personal data pseudonymized (e.g., "owner_1234" instead of name). Donors can keep sensitive data on their own systems, but must push aggregated metadata (e.g., "€5M disbursed to project X").

Resistance from corrupt officials or local elites -Public dashboards + civil society “watchdog” API access (any NGO can build their own monitoring app). Automatic alerts: if a contractor wins >30% of tenders in a region without competition, the system flags for audit. Whistleblower protection: complaints are tokenized and cannot be deleted; retaliation is a criminal offense.

Sustainability of funding for ecosystem - Include 5% of reconstruction budget for digital ecosystem maintenance in each donor agreement (as a line item). Explore blockchain transaction fees (e.g., micro-donations of 0.1% per payment, capped at \$100). Also seek multi-year core funding from international partners (e.g., EU Digital for Development fund).

Low digital literacy - Nationwide campaign “Digital Reconstruction for Everyone” – TV ads, town hall meetings, training in schools and veterans’ centers. Simple video tutorials with Ukrainian sign language. Helpline (0-800-XXX) staffed 12 hours/day.

Language barriers (Crimean Tatar, Romani, Hungarian speakers) - The interface supports 5 languages: Ukrainian, English, Crimean Tatar, Romani, Hungarian (for Zakarpattia). SMS and voice bot recognize commands in those languages (limited vocabulary initially, expanding).

Military secrecy vs. Transparency - Some locations (active combat zones) cannot disclose exact coordinates. Solution: URR shows only hromada-level location (e.g., “Velyka Novosilka hromada”) and replaces precise geo with a grid cell. Detailed data is restricted to authorized officials until de-occupied.

Monitoring and Evaluation Framework.

Transparency KPIs (measured quarterly via system logs and surveys)

T1: Percentage of reconstruction projects (by value) with publicly available cost breakdown, including unit prices (target: 100% by end of Phase 2).

T2: Median time lag between transaction (e.g., payment to contractor) and public display on dashboard (target: <1 hour).

T3: Number of unique users (citizens, journalists, researchers) querying dashboard monthly (target: 10% of adult population, i.e., ~3 million).

T4: Percentage of procurement tenders with >2 bidders (target: >80%, up from pre-war 60%).

Inclusivity KPIs

I1: Percentage of participatory votes from IDPs, women, persons with disabilities, and veterans compared to their population share (target: within 10% of population share).

I2: Gini coefficient of reconstruction spending per capita across hromadas (target: <0.25, indicating equitable distribution).

I3: Percentage of complaints resolved within 30 days (target: 90%).

I4: Accessibility compliance score: measured by automated tests (e.g., axe-core) plus user testing with 100 persons with disabilities (target: 95/100).

Efficiency KPIs

E1: Average time from damage assessment to contract signature (baseline: pre-war average for similar projects was 6 months; target: 2 months).

E2: Cost overrun percentage (baseline: 25% on average in pre-war construction; target: <10%).

E3: Donor disbursement lag: time from donor pledge to funds available in treasury (target: <45 days).

Data collection methods

Automatic logging from URR and smart contracts.

Annual representative survey of 5,000 citizens (oversampling rural, elderly, IDPs, persons with disabilities).

Independent audits by Transparency International Ukraine and the State Audit Service.

Conclusion and Policy Recommendations

Digital ecosystems are not a silver bullet, but they are a necessary infrastructure for accountable, inclusive post-war reconstruction. By building on Ukraine’s existing digital assets (Diia, Prozorro) and adding a transparent, blockchain-backed registry, smart contracts, and multi-channel citizen participation, Ukraine can leapfrog traditional patronage systems. The proposed architecture addresses both transparency (real-time audit trails, open data, automated alerts) and inclusivity (offline access, participatory voting, accessible interfaces, grievance mechanisms).

However, technology alone is insufficient. Political will, legal reforms, and sustained funding are critical. We recommend that the Government of Ukraine, together with international partners, take the following actions immediately:

Legislate: Pass the Law “On the Digital Ecosystem for Reconstruction” within six months, including mandatory open data and blockchain for critical records.

Fund: Allocate at least \$70 million over three years for the ecosystem (less than 0.02% of reconstruction needs). International donors should make ecosystem adoption a condition for large reconstruction grants.

1. **Pilot:** Launch the Minimum Viable Ecosystem in five hromadas within nine months, learn, and iterate.

2. **Include:** Mandate accessibility and offline channels from day one; do not treat them as afterthoughts.

3. **Partner:** Work with Estonia, Georgia, and Taiwan on technical assistance; involve civil society in governance.

The alternative—opaque, centralized, paper-based reconstruction—risks squandering billions of dollars, enriching corrupt elites, and leaving vulnerable populations behind. Ukraine has already demonstrated digital innovation under fire (eDiaries, eRestitution, Diia). Extending this to reconstruction can set a global standard for post-conflict recovery. The world is watching. The people of Ukraine deserve nothing less than a reconstruction that is transparent, inclusive, and worthy of their sacrifice.

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