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CENTRO DE INFORMÁTICA E SISTEMAS DA UNIVERSIDADE DE COIMBRA

Linked Open Democracy

The Digital Contract for Auditable Civic Participation in Europe

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Keywords: Digital Democracy, Knowledge Graphs, Semantic Web, NLP, Provenance, Trustworthy AI

1. Research Problem

Digital participation systems collect civic input at scale, but often fail to preserve auditable links between contributions, evidence, procedures, and public decisions. This weakens accountability and long-term institutional learning [7, 10]. Linked Open Democracy addresses two coupled deficits: *trust* in digital participation infrastructures and *sustained participation* over time.

In Europe, this need is timely. Regulation (EU) 2024/1183 and democratic-resilience policies reinforce requirements for trustworthy, interoperable, and privacy-preserving public digital infrastructures [2, 1].

2. State of the Art and Gap

Civic-tech and AI participation tools remain fragmented across four levels: identity assurance, semantic records, policy argument traceability, and integrated validation [8, 9]. In parallel, LLM+KG and RAG research highlights strong potential, but also the need for grounding and provenance in high-stakes domains [6, 13]. The gap is a cumulative architecture that unifies identity, participation, reasoning, and simulation-based validation.

3. Goal, Questions, and Hypotheses

3.1 Main goal

Design, implement, and evaluate a provenance-aware semantic infrastructure that transforms civic and policy material into institutionally actionable knowledge.

3.2 Research questions

1. How can identity, participation, argumentation, and governance processes be represented in one provenance-aware framework?
2. How can multilingual civic and policy text be transformed into structured, queryable knowledge graphs?
3. How should the integrated architecture be validated technically and socio-technically before wider deployment?

3.3 Working hypotheses

- H1: Provenance-rich modelling improves traceability and auditability of participation flows.
- H2: Trust-aware identity layers increase perceived legitimacy of digital participation.
- H3: KG-grounded AI and simulation-assisted evaluation improve deployment readiness.

4. Methodological Design

The project follows Design Science Research with iterative cycles of requirements analysis, artefact design, implementation, and evaluation [3]. The stack combines ontology engineering (RDF/OWL/SHACL), provenance modelling (PROV-O), trust/identity standards (DID/VC/NIST), NLP and argument mining, and KG-grounded retrieval/explanation services [4, 11, 12, 5].

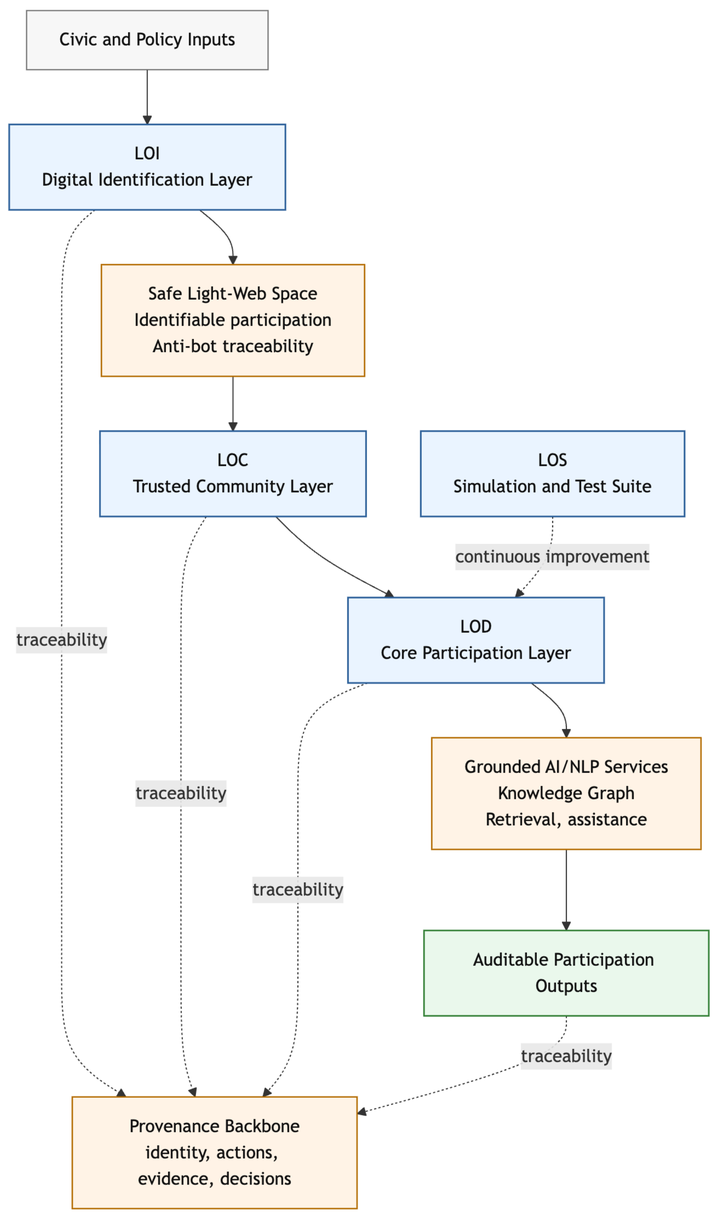

Figure 1: Macro overview of the Linked Open Democracy stack.

5. Integrated Work Packages and Outcomes

The expected work packages form a cumulative, unified pipeline, to support a Linked Open Democracy:

5.1. Linked Open Identification (LOI)

LOI establishes the trust baseline: privacy-preserving identity, credential provenance, assurance semantics, and revocation/consent control.

5.2. Linked Open Communities (LOC)

LOC models communities, participation events, governance constraints, and interaction histories as linked semantic structures.

5.3. Linked Open Democracy (LOD)

LOD is the decision-support layer: policy and participation ontologies, civic text-to-graph transformation, and evidence-linked AI assistance.

5.4. Linked Open Simulation (LOS)

LOS provides simulation to test democratic scenarios and compare policy pathways before broader institutional adoption.

Expected outcomes

- Curated resources and operational software components.
- Reusable ontologies and conceptual models for trustworthy civic participation.
- Provenance-aware AI support services with explicit evidence linkage.
- Reproducible validation protocols for digital democracy infrastructures.

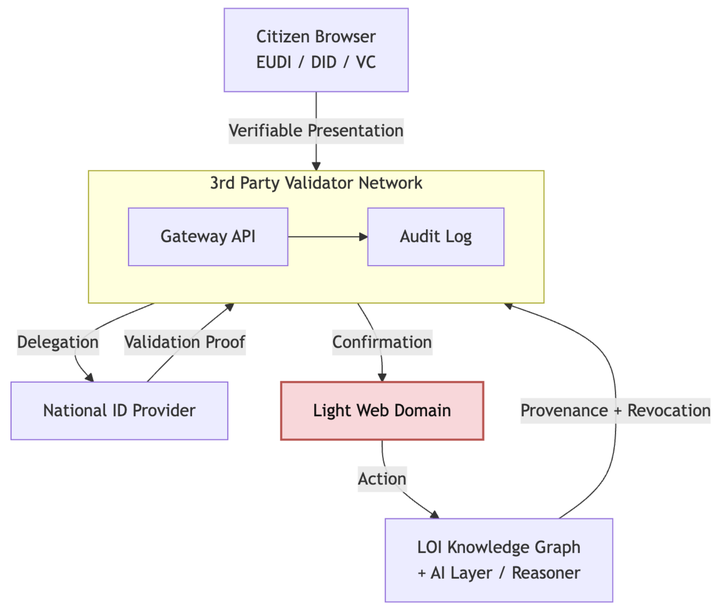

Figure 2: LOI architecture: wallet, validator, IdP, provenance graph.

6. Evaluation and Validation Plan

Evaluation is cumulative and multi-layer:

- **Semantic layer:** ontology consistency, coverage, and provenance expressivity.
- **AI/extraction layer:** precision, recall/F1, retrieval relevance, and factual support.
- **Socio-technical layer:** usability, trust perception, participation willingness, and interpretability.
- **Comparative layer:** structured-vs-unstructured baselines and simulation-based scenario comparisons.

Operationalisation includes benchmark tasks, SHACL and reasoner checks, expert review, controlled user studies, and scenario simulation. Risk and ethics are handled through phased dependencies, data minimisation, proportional disclosure, and explicit provenance for auditability (Figure 3).

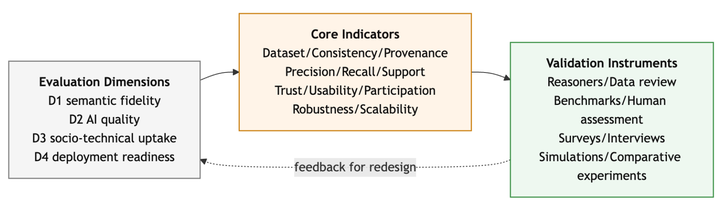

Figure 3: Evaluation layers: semantic, AI, socio-technical, deployment.

7. Conclusion

Linked Open Democracy proposes a cumulative, provenance-aware framework in which LOI, LOC, LOD, and LOS form an integrated stack for trustworthy, auditable, and institutionally actionable civic participation.

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Survey and Mailing List

- Pre-register for Survey 1 (digital identity trust).
- Join our mailing list to follow project progress.

Form: https://forms.gle/KRyhdWYkN3VSfWnXA

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