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Does Institutional Middleware Reduce Rent-Seeking in Smart Cities? Evidence from EU Digital Procurement

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INTRODUCTION & AIM

Urban Digital Twins and algorithmic urban systems promise efficiency in city management.

Yet rapid digitalisation can also generate socio-technical frictions, especially algorithmic opacity and vendor lock-in.

In procurement, these frictions may narrow competition, exclude smaller firms, and increase rent-seeking risks.

This study introduces "Institutional Middleware" as a regulatory-technical buffer composed of interoperability clauses, open APIs, open standards, data portability, and algorithmic transparency requirements.

Aim: to test whether stronger institutional middleware in digital procurement reduces single-bidder outcomes and improves SME access.

METHOD

Data: EU Tenders Electronic Daily (TED), contract-level digital procurement notices, 2016–2025.

Sample focus: high-complexity IT and software contracts relevant to smart cities and Urban Digital Twins.

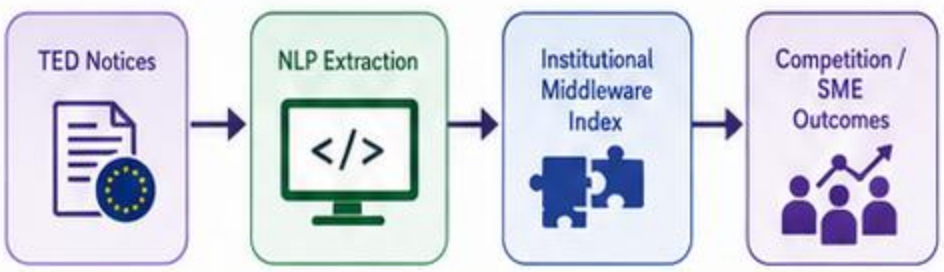
NLP: text mining and clause extraction from unstructured procurement notices.

Key explanatory variable: Institutional Middleware Intensity Index.

Index components: interoperability clauses (e.g., MIMs), open APIs, open standards, data portability, algorithmic transparency.

Outcomes: single-bidder rate and SME market-entry / award success.

Empirical strategy: high-dimensional two-way fixed effects with contract-level controls and country/year or sector/year adjustments.



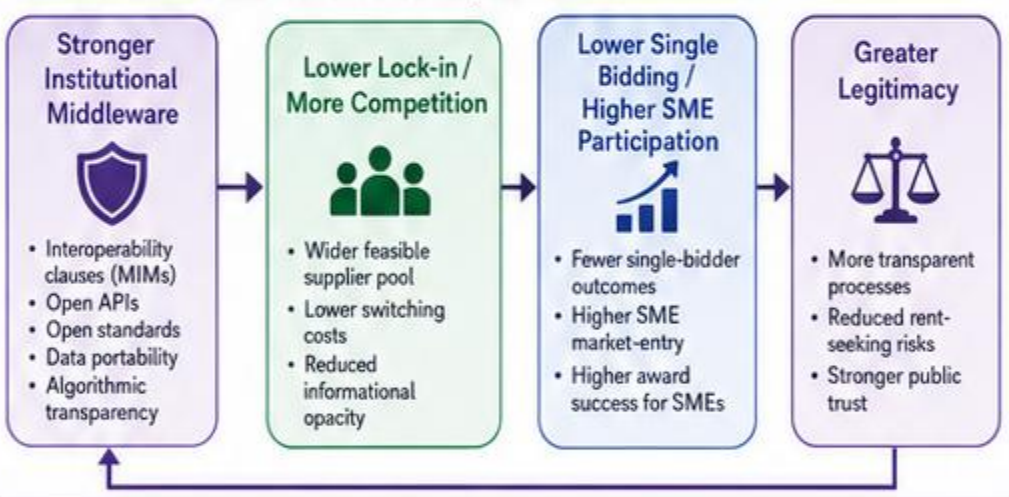
From procurement text to institutional design and market outcomes

RESULTS & DISCUSSION

Preliminary / Expected Findings

1. **Stronger institutional middleware** is associated with **fewer** single-bidder anomalies.
2. **Open standards and interoperability** reduce vendor lock-in by widening the feasible supplier pool.
3. Contracts with stronger middleware clauses are more accessible to SMEs, improving market inclusiveness.
4. **Interoperability and transparency** function not only as technical specifications, but as ex-ante anti-corruption mechanisms.

These patterns suggest that procurement design shapes the efficiency-legitimacy balance in smart-city digitalisation. By standardising interfaces, lowering switching costs, and reducing informational opacity, institutional middleware can help build more contestable and resilient urban digital markets.



CONCLUSION

Institutional middleware should be treated as governance infrastructure, not merely a technical add-on.

Procurement clauses on interoperability, openness, and transparency can mitigate rent-seeking risks in digital urban governance.

Better procurement design can support a more inclusive and resilient twin transition.

FUTURE WORK / REFERENCES

Future Work

- Extend the analysis to heterogeneity across countries, buyers, and CPV sectors.
- Distinguish between notice-level wording and full tender-document requirements.
- Strengthen causal identification and validation of the NLP-based index.

References

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