Digital Procurement Governance and Local Supplier Integration: A Technology-Driven Supply Chain Management Framework for Saudi Arabia's Urban Development Projects

Abstract: Saudi Arabia's urban development programme provides a significant test of whether digital procurement can genuinely advance the participation of domestic suppliers whilst still maintaining commercial rigour. There is a considerable body of literature that looks at construction supply chain integration, e-procurement, digital project records and public procurement accountability but very little that actually explains how these various strands should be governed in conjunction. This critical integrative review draws on thirty DOI identifiable publications from 2020 to 2025 to develop a technology-enabled governance framework appropriate to the context of complex urban projects. It makes a clear distinction between the efficiency of digital transactions and the more fundamental institutional challenge of making domestic suppliers discoverable, qualified, contractually protected and capable of being re-engaged. Four interlocking mechanisms are identified: transparent opportunity allocation, interoperable procurement information, proportionate supplier development and verified performance feedback. The efficacy of these mechanisms is predicated on accountable data stewardship, contestable decisions, commercially reasonable terms and clear safeguards against tokenism. The proposed framework connects the signals of project demand to supplier onboarding, tender evaluation, contract execution and post-award learning via a common evidence architecture. It also specifies the metrics by which participation, delivery reliability, payment timeliness and the growth of domestic capability can be measured. This is a conceptual contribution rather than a causal one: the evidence from a range of different jurisdictions supports the individual mechanisms, but the actual performance of the suite of mechanisms in the context of Saudi urban development will still require a long-term evaluation. The review concludes that digital procurement can only become a development tool when the governance design links the auditable decisions of the project with the actual upgrading of the supplier.

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1. Introduction

Saudi Arabia's massive urban development programmes necessitate owners, consultants, principal contractors, specialist subcontractors and materials producers all co-ordinating procurement over very long project lifetimes. In that context procurement is not a separate administrative function. The design of the package, the eligibility of suppliers, the technical specifications, the level of contract risk and the timing of payment all have a bearing on which firms can be brought in and whether the materials get to the site when they are needed. Research into the construction supply chain has shown that information fragmentation and the existence of loosely coupled organisations are enduring sources of cost and schedule instability (Liao et al., 2023). Research into megaprojects has also shown that governance and inter-firm co-ordination need to be considered across organisational levels rather than just within the purchasing function of a single organisation (Stefano et al., 2023). That research underlines the importance of procurement governance in terms of urban development performance.

Digital tools are all about searchable tenders, common product records, electronic approvals, supplier analytics and the ability to trace performance. The fact is that simply going digital doesn't in itself make procurement fair, competitive or developmentally sound. There's cross country evidence that digital procurement is most transparent when it's backed by good institutional quality and the right enabling infrastructure (Khorana et al., 2024). There's also evidence that digital procurement is associated with reduced firm level corruption in public procurement, with governance institutions again acting as a key moderator (Jiménez et al., 2022). The real issue for urban projects then is not what platform to buy, but rather how we should structure the digital decision rights so that the better information available leads to both good project delivery and genuine inclusion of suppliers.

Local supplier integration presents another hurdle. A local supplier may be well aware of procurement opportunities but lack the cash flow, the required certifications, the equipment, the digital skills or the production capacity to actually go and win the contract and deliver it. The

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other way around is that you can have a very apparent increase in locally awarded spend and that's just a result of intermediated imports rather than any real local value creation. A comparative legal analysis of the local content regimes in Saudi Arabia suggests that procurement preferences and qualification rules are to be understood as part of a wider industrial policy framework (Kola and Sołdyński, 2025). Construction digitalisation research however tends to focus on efficiency or on the technological capability of the system rather than on the distribution of opportunity to suppliers. So treating local content as a standalone target in terms of a number is going to miss the point entirely in terms of the way in which actual local capability develops.

The purpose of this review is to explain how technology enabled procurement governance can get capable local suppliers into the supply chains of Saudi urban development projects without sacrificing transparency, delivery reliability or value for money. The review aims to separate governance functions from software features; to identify the mechanisms by which digital information translates into access and upgrading of suppliers; to resolve the tensions between localisation and competition and project risk; to build an operational framework with clearly defined decision responsibilities; and to propose performance indicators that are evaluable. The central question is: under what governance conditions can technology enabled procurement convert project demand into sustained local supplier participation? This is a conceptual review and not an assessment of the performance of any particular Saudi development project.

2. Conceptual foundations

2.1 Procurement governance as an allocation system

Procurement governance is the set of rules, authorities, evidence standards and oversight mechanisms by which an organisation commits its resources and manages its suppliers. It dictates who sees the tenders, how the requirements are defined, what differences between the

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bids are relevant and how disputes are dealt with. Harju et al. (2023) find that procurement digitalisation will only enhance resilience through the use of analytics and information sharing if those capabilities actually lead to better risk management. This highlights the difference between having digitised records and having governed decisions. A platform can record every single approval whilst still having the effect of restrictive specifications, a narrow supplier base or a subjective scoring process. The point is that effective governance must make the criteria, the exceptions, the data sources and the people responsible visible to the appropriate reviewer.

2.2 The construction supply chain as a temporary network

A big urban project will be a combination of long term market relationships and a number of short term alliances put together for specific packages. The quantities may be changed by the designer after the supplier has committed to capacity. A number of the contractors will be drawing on the same regional production base at the same time. Stefano et al (2023) describe megaproject supply chains as multi-level arrangements in which the organisational boundaries make coordination very difficult. Singh et al (2025) point to information sharing, collaboration and performance measurement as well established areas of research but note that there is very little research in the areas of logistics, financial management and resilience. The practical implication is that the tender portal should not be operating in isolation from design changes, site schedules, supplier production plans and contract administration. The integration needs to reflect the dependencies that the project itself creates.

2.3 Local integration as capability formation

Integration should mean more than just registering as an approved vendor and recording your place of incorporation. A genuinely integrated supplier is one that is involved in the forecasting, technical clarification, capacity planning, quality assurance, delivery co-ordination and corrective learning. The extent to which you are included will of course be to some degree

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determined by the procurement rules. Hoekman and Taş (2022) find that better rules and properly sized lots can facilitate the participation of smaller firms, although more bidding does not necessarily lead to more awards. The evidence on the barriers to small business procurement shows that financial, procedural and information barriers all interact rather than operate in isolation (Akenroye et al., 2024). A credible development strategy therefore has to take account of the separate dimensions of market access, award success, operational delivery and sustainable capability.

2.4 Digital systems as connective infrastructure

BIM can be used to collate quantities and product requirements, purchasing systems can be used to log sourcing decisions and supplier portals can be used to manage supplier credentials. Analytics can be used to highlight capacity constraints and unusual bid behaviour and digitally verified site records can be used to improve payment administration. A recent review of construction technology (Naji et al., 2024) indicates that integration between the various stages of a project is still quite patchy. Architecture research (Liu et al., 2022) has also demonstrated the potential for open platforms to allow smaller firms to form consortia and pool their capabilities. The upshot of all this is a clear preference for interoperable information standards and role based access rather than a single, all encompassing application. Governance will be required to define what information is to be shared between systems, who is allowed to change it and which record is to be the 'master' record in the event of a discrepancy between datasets.

3. Review design and analytic method

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This is a critical integrative literature review (a suitable methodology when the aim is to synthesise disparate empirical, legal and technical evidence into a coherent and defensible conceptual framework). The source pool comprises 30 identifiable peer reviewed papers published between 2020 and 2025. The papers were located via targeted searches of publisher and scholarly databases using a combination of: construction procurement, supply chain digitalisation, electronic public procurement, supplier participation, localisation, transparency and megaproject governance. Reference chaining was used to identify further relevant studies on payment automation, supply resilience and collaborative supplier platforms. The set is purposive and topic driven rather than a comprehensive or statistically representative sample. Each paper in the set has a distinct DOI which has been verified against a discoverable publisher or scholarly record.

Eligibility required a substantive link to at least one of the analytical dimensions: procurement rules and accountability, construction supply chain coordination, digital information, contracting mechanisms, local supplier inclusion or Saudi implementation conditions. Sources outside the publication window, marketing material of a descriptive nature, unverifiable DOI records and works whose only relevance was through a general technology enthusiasm were all excluded. Studies from other jurisdictions were included where the mechanism was transferable, though the outcomes of such studies were not presented as Saudi evidence. The resulting evidence base is a mixture of conceptual reviews, surveys, modelling studies, platform designs, legal analysis and project based empirical work. It is sufficiently heterogeneous to allow for comparison of mechanisms but not for the calculation of pooled effect sizes.

A structured extraction matrix was used to record the research setting, the methodology, the procurement stage, the technological mechanism, the governance implication, the supplier implication and the evidential limitation. The interpretive synthesis took place in three stages: identification of the recurring procurement problems, comparison of the proposed mechanisms and mapping the conditions under which those mechanisms might be conducive to the integration of local suppliers. Claims were assessed conceptually as demonstrated outcomes, contextually derived associations or plausible design propositions. The synthesis is explicit in its

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rejection of the equivalence of simulated performance, survey perceptions and actual project results as evidence. Any apparent contradictions were resolved through the lens of institutional context, the position within the supply chain and the maturity of the firms involved rather than by simply averaging the incompatible results.

The method has clear limitations. It is not a census of all indexed publications. It contains no new interviews, no project transaction data and no first hand audit of the Saudi procurement platforms. DOI verification provides bibliographic traceability, it doesn't in any way validate the conclusions of the articles. It doesn't independently verify the accuracy of every outcome reported in the original studies. Its contribution is therefore a transparent set of conditions, relationships and testable propositions. That is the preferable route to taking rather than making up search counts, faking statistical precision or making up claims about country specific implementation that the evidence simply doesn't support.

4. Evidence synthesis

4.1 Transparent market access and evaluation

Electronic procurement can only extend the reach of opportunity if tender information is available in a timely manner, in a form that is understandable and consistently accessible to the eligible firms. Khorana et al. (2024) make the connection between procurement transparency and both digital systems and institutional capacity; Jiménez et al. (2022) similarly point to the importance of the organisational context in determining corruption outcomes. Akenroye et al. (2024) demonstrate why even standardised processes can still effectively exclude smaller firms when insurance, qualification and financial requirements combine to create an insurmountable barrier. In the context of urban development, governance should therefore publish package pipelines early, disclose the relevant qualification thresholds and record the reasons for any

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exclusions. Digital publication provides an audit trail but that trail only becomes meaningful if there are contestable evaluation and accessible channels for clarification.

A local participation objective draws a very fine line between a genuine developmental preference and a case of discretionary favouritism. Kola and Sołdyński (2025) point out that the Saudi local content regime works via a set of legally defined approaches rather than through a blanket preference for local bidders. Project authorities must therefore be able to draw the distinction between mandatory eligibility criteria and scored developmental contributions and standard technical capability. Where appropriate they can reward genuine local manufacturing, local workforce development and local subcontracting plans as part of the tender evaluation process, while separately assessing lifecycle cost, safety, delivery capacity and conformity. The rules have to be issued prior to the receipt of tenders and applied in a consistent manner afterwards. Otherwise localisation will end up discouraging competition and will in fact hide the transfer of risk rather than encourage investment.

4.2 Data continuity from design to purchase

Digital procurement starts way before you get to the invitation to tender. The market that you can actually supply is determined by the quantities, drawings, asset types, technical specifications and approved substitutions. Yevu et al (2021) identify a number of opportunities for digitalisation in construction, but also point to the fragmentation of the research and the need for integration. Liao et al (2023) make a similar point in that disconnected information leads to procurement delays and wastage of resources. If you can link the approved design schedule to a forward-looking procurement plan then you have a far more predictable demand and the suppliers can properly assess their tooling, staffing and working capital requirements. The problem is of course that a technically integrated platform will generate very misleading forecasts if you don't have clarity on design status, revision authority and data ownership.

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The best practical arrangement is a governed chain of data provenance rather than just free and open data sharing. Each piece of material or equipment package should have a unique classification, required specification, planned installation window, responsible engineering approver and a revision history. The supplier record should contain capacity, certification validity, delivery geography and previous performance. Commercially sensitive pricing and proprietary processes of course need to be kept under control. Hijazi et al. (2023) look at how a linked model and distributed records can lead to a more robust construction data handover. Elghaish et al. (2023) look at the potential for extending component traceability across circular supply chains. Neither of those papers in any way removes the requirement to validate the source data and to correct any errors that may have been entered via an accountable process.

Table 1. Evidence streams, interpretive limits and procurement governance responses.

Evidence stream	Selected studies	Key limitation	Recommended control
Opportunity access	Khorana et al. (2024); Hoekman and Taş (2022)	Digital publication does not ensure contestable rules.	Public pipeline; proportional qualification; appeal trail.
Supplier capability	Akenroye et al. (2024); Liu et al. (2022)	Small firms differ in finance, data skills and delivery capacity.	Gap assessment; mentoring; feasible lots and joint bids.
Interoperable records	Yevu et al. (2021); Hijazi et al. (2023)	Disconnected models and contracts create version risk.	Persistent IDs; revision authority; controlled data exchange.
Commercial assurance	Das et al. (2020); Hamledari and Fischer (2021)	Verified activity may still face disputed certification.	Progress evidence; human exception review; payment clocks.
Operational resilience	Chen et al. (2024); Zhang et al. (2024)	Local sourcing may increase dependence on a narrow base.	Category diversification; capacity alerts; backup sources.

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Saudi implementation	Alshibani et al. (2024); Alfalah et al. (2024)	Digital maturity and legal readiness vary by organisation.	Stage adoption; train accountable teams; audit controls.

4.3 Supplier qualification and inclusion

A digital supplier register tends to end up as a rather passive store of licences. For local supplier development it should be the trigger for a proper development pathway; one of discoverability, initial screening, gap analysis, supported prequalification, pilot delivery and then scale up. Hoekman and Taș (2022) show that procurement configuration has an impact on opportunities for small firms and Liu et al (2022) show that collaborative digital platforms can help small firms to pool their production capacity. Urban project buyers could therefore break their packages down, publish a fairly predictable volume of demand and allow for transparent consortium or subcontractor participation. The packages would of course have to be broken down in such a way as to maintain interface accountability. Splitting a safety critical system into too many contracts could lead to coordination failures which would more than offset the benefits of inclusion.

Qualification requirements should be geared to the package risk rather than the size of the bidder. A small supplier of fairly standardised finishing materials may be perfectly suited to a simplified documentation and staged assessment regime whereas structural elements or complex electrical systems will require a far more rigorous independent testing regime. Akenroye et al (2024) point to the need for different responses to administrative and capability barriers. A firm which fails a technical threshold should be given structured feedback and a route to remediation rather than just being accepted in order to meet an award target. The relevant development measure is progression from eligible interest to validated delivery capability. That progression also requires the buyer to have realistic lead times, stable specifications and agreed payment terms rather than pass on all the planning volatility to the supplier who is least able to cope with it.

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4.4 Contract administration and payment assurance

Local supplier integration breaks down after contract award if the measurement, certification and payment processes are opaque. Hamledari and Fischer (2021) look at a construction payment mechanism which is triggered by digitally captured progress. Das et al (2020) look at the issue of selective transparency and security in interim payment records. Wu et al (2022) look at programmable payment release arrangements which are designed to reduce the incidence of delayed settlement. Taken together these papers identify the potential technical arrangements but do not provide a one size fits all legal framework. A Saudi project would still need appropriate contract provisions, human verification of disputed quantities, retention controls, statutory compliance and a clear process for dealing with errors when a digital record is wrong.

Payment governance is particularly important for domestic SMEs as the cost of financing work that isn't paid for can quite easily prevent them from bidding again or indeed scaling up. The procurement system needs to be able to differentiate between invoice receipt, technical certification, commercial approval, dispute status and actual settlement date. Exceptions need to have an owner, a reason code and an escalation period so that the process is auditable without the need to expose the sensitive terms of the contract in the public domain. Amiri Ara (2022) highlights information flow issues in an EPC environment and shows how better records can have an impact on operating efficiency. The caveat of course is that an automated workflow just speeds up the process that was already in the system. If there are ambiguities around approval or if a contractor disputes a measurement then the system has to be able to support a lawful review rather than simply go ahead and process the disputed transaction.

4.5 Risk, resilience and supplier diversification

Large urban programmes will of course have a concentrated demand for certain materials, plant and specialist services. A sole domestic source may well be able to help achieve local

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expenditure targets but will in all likelihood create material bottlenecks. On the other hand, indiscriminate international sourcing may well miss out on a number of viable local suppliers. Chen et al. (2023) model purchasing and supplier selection under uncertainty in pricing, capacity and lead times; Chen et al. (2024) look at backup sourcing under uncertainty in both demand and supply. These papers support a portfolio approach in which suppliers are assessed on their criticality, alternatives are maintained for the more vulnerable categories and procurement decisions are linked to rolling project demand. Digital supply dashboards should be able to flag capacity pressure, lead time variation and substitution dependencies without the dashboard interpreting any of the algorithmic scores as gospel.

Resilience is also a function of the structure of the subcontracting and logistics. Zhang et al. (2024) identify module movement and coordination as the key issues in modular construction supply chains. Matarneh and Mohsen (2024) find that regional construction professionals are very much aware of the benefits of digital supply but cite interoperability, cybersecurity and lack of expertise as the main barriers. A local supplier policy therefore cannot simply be based on the assumption that being local will result in reliable delivery. Procurement officers will need to look at the transport interface, factory throughput, quality rejection rates and exposure to competing projects. A supplier's development path must be considered in the same way as the resilience of the overall sourcing portfolio; they are related but not the same thing.

4.6 Adoption constraints in Saudi Arabia

Country specific evidence would suggest that you shouldn't just import a platform without taking account of the organisational context. Al-Hammadi and Tian (2020) point to lack of demand, lack of expertise and lack of awareness as key impediments to the uptake of information modelling. Alshibani et al. (2024) identify skilled personnel, compatibility, implementation processes and cost as the principal barriers to adoption in the Saudi construction management context. Alfalah et al. (2024) look at the perceived potential and the barriers to the use of programmable contracts with technical complexity and security being the main issues.

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Collectively these findings point to the need for process ownership, professional capability and procurement policy to develop in parallel with the software. Procurement transformation should therefore be about training the evaluation committees, the suppliers, the technical approvers and the contract administrators rather than simply about the licensing of the platform.

Urban development governance must also take into account changes which originate outside the purchasing team. Alkhattabi et al. (2023) show that change orders have a significant impact on the budgets of Saudi public construction projects and so the importance of early planning and a controlled process for change is reinforced. If a drawing changes after a supplier has already committed to purchase materials then the procurement platform should not just silently replace the original purchase commitment. There must be versioned records which link each change to the commercial exposure, the schedule impact and the approval authority. This provides the basis for fair claims administration and enables learning across the programme. It also prevents a supplier's performance score from being penalised for a delay which is in fact the result of the buyer's changing requirements.

4.7 Sustainable material stewardship requires procurement rules that survive handover and eventual asset renewal

Chen et al. (2022) look at how circularity in the supply chain can link procurement with resource efficiency and Ye et al. (2022) look at the legal and technical issues with programmable construction contracts. For the Saudi urban projects, environmental criteria need to be linked to verifiable product characteristics, substitution options, maintenance access and end of life information. A supplier should not be credited with a sustainability claim unless there is evidence that can be checked against the actual components that are delivered. Digital traceability therefore takes governance beyond the award decision and into the life of the asset that has been procured.

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4.8 Analytics and the limits of automation

Purchasing information can be used to identify suppliers with a history of delivery problems, to spot any odd concentrations of awards and to identify training requirements. Spreitzenbarth et al (2024) note that the use of machine learning in purchasing and supply management applications is still very uneven across the range of use cases and that the priorities of the practitioners don't always align with the emphasis of the research. Nai et al (2023) provide some examples of the analytical potential using public tender and complaint data. The governance implication is that you would use the models as a form of decision support within a documented workflow. Predictions should not become an unexplained exclusion criterion, particularly where there is already a history of award patterns which disadvantage the smaller firms who will have less to show in terms of digital records.

Model accountability requires clear variable definitions, rigorous handling of missing data and a genuine opportunity to challenge any errors. Data from the tendering process can be polluted by inconsistent descriptions, outmoded qualifications and subjective performance ratings. An apparently neutral supplier score can therefore end up reinforcing past market exclusions. Performance analytics must state clearly what they are for, who the reviewer is and how often they are validated. Harju et al (2023) demonstrate why information processing capability only becomes useful when it is linked to operational risk management. The parallel in procurement is that a correct prediction is not necessarily a valid decision. Human accountability, commercial reasonableness and the right of the supplier to respond are all still essential elements of the control system.

5. Proposed technology-driven governance framework

The synthesis is of a 5 layer framework which links project demand to domestic supplier development. Layer 1 is the programme level policy (local content rules, procurement integrity,

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competition protection, cyber security, reporting definitions etc). Layer 2 takes the approved project design and produces the visible category forecasts and package strategies. Layer 3 is responsible for supplier identification, gap assessment and qualification with appropriate levels of evidence. Layer 4 is the tendering, awarding, variation, delivery and payment control layer with all the associated records being interoperable. Layer 5 is the layer which returns the verified outcomes to future sourcing and supplier development. Figure 1 shows the sequence with oversight and secure data stewardship operating across all layers rather than as an optional final check.



Figure 1. Proposed sequential governance architecture; an original conceptual representation.

Governance responsibility must be clear at the handover points. The programme sponsor will approve the strategic targets and the conflict of interest rules; the project owner will approve the demand and procurement strategy; the designer will certify the specification; the procurement team will manage the competition; the quality team will validate the critical supplier's competence; the commercial controller will confirm the contractual settlement. A supplier development function can be in place to coordinate training without having any say in the award or in the relaxation of any safety criteria. An independent assurance function can be in place to review the high risk exceptions and potentially discriminatory design choices. This approach removes a very predictable failure mode in large programmes where everyone has access to the platform but nobody actually owns the decision and that leads to a delay. Figure 2 shows this responsibility structure as an evidence based operating cycle.

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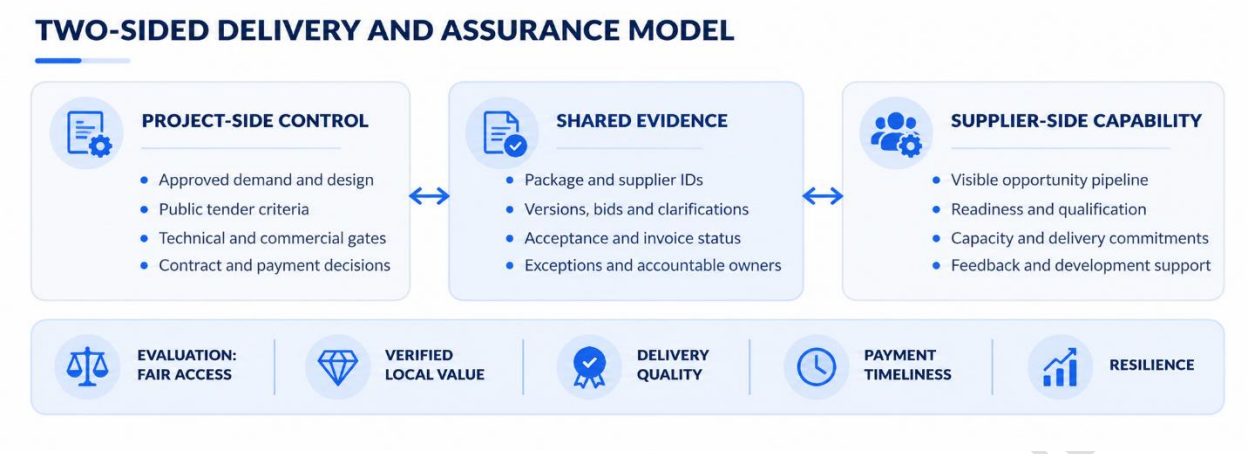


Figure 2. Project and supplier responsibilities connected through shared, auditable records.

The data architecture proposed is one of linking records via persistent identifiers rather than requiring all parties to be on the same software platform. A supplier identifier would link their qualifications and delivery history, a package identifier would link the drawings, the tender questions, the evaluation reports, the purchase orders, the inspections and the payment events. Permissioned application interfaces could be used to synchronise approved revisions and status changes. A common vocabulary would be required for category codes, certificate types, exception causes and local value reporting. The work of Hijazi et al (2023) and Yevu et al (2021) provides some of the relevant technological underpinning, but as with any such system the critical thing is agreement on what the terms mean and who has the authority to determine that. The immutability of the records in themselves does not make false declarations true.

Three governance gates should be tested prior to an award being accepted. The access gate looks at whether the appropriate notice was given to qualified suppliers and whether the requirements were proportionate. The integrity gate looks at whether the scoring, conflicts, deviations and clarifications all adhered to the published rules. The delivery gate looks at technical acceptability, capacity, financial viability and realistic lead times. Local contribution can then be assessed through demonstrable manufacturing activity, workforce development or approved subcontracting rather than simply on the basis of nationality. The gates are complementary in that a bidder may satisfy a localisation criterion but fail on some fundamental aspect of technical

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capacity or may offer a technically sound product under a non-contestable award process. Neither of those failings is addressed by digitisation.

The framework also makes a clear distinction between outputs and outcomes. Outputs are the measures of system activity (number of platform registrations, number of electronic tenders, number of purchase orders awarded). More meaningful indicators of performance are the eligible local bid rate, the rate of progression from pre-qualification to first delivery, on time quality acceptance rate, supplier concentration, verified domestic value created and the percentage of invoices settled within the agreed terms. These should be broken down by package criticality, supplier size and category so that any apparent improvement is not simply the result of a change in the mix of contracts. Table 2 sets out a practical measurement scheme. At programme level learning occurs when the reasons for rejected bids, delayed qualifications and failed deliveries lead to changes in specifications, training or sourcing.

Table 2. Proposed indicators for evaluating local supplier integration and procurement integrity.

Indicator	Operational definition	Responsible owner	Interpretive safeguard
Accessible tender rate	Share of relevant packages advertised within stated notice rules	Procurement assurance	Count qualifying packages; audit exemptions.
Local bidder progression	Qualified local bidders proceeding to compliant bids and awards	Supplier development	Separate first-time entrants from incumbents.
Verified domestic contribution	Audited local manufacturing, services and approved employment contributions	Commercial / compliance	Do not infer value creation from vendor location.
First-pass acceptance	Deliveries accepted without major quality rework	Quality assurance	Stratify by material criticality and contract size.
On-time payment	Invoices paid within the contractually defined period	Financial control	Exclude invalid invoices only with documented reasons.

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Supplier continuity	Local firms completing repeat projects at acceptable performance	Programme office	Control for concentration and dependence risk.

Implementation should be staged rather than wholesale. A pilot could be run on two or three material categories with varying risk profiles, establishing baseline cycle times and supplier engagement. You'd then link the design, sourcing and contract records before moving to a wider scale. High criticality packages would be subject to rigorous qualification whereas more standardised items could be used to test a simplified onboarding process and transparent lot design. The pilot would record any unforeseen consequences such as increased documentation requirements, contractor workarounds and duplication of data entry. Predictive scoring and/or programmable settlement would only be introduced once the procurement teams and suppliers have demonstrated they can use the system reliably. This is exactly the approach recommended by Alshibani et al. (2024) and Alfalah et al. (2024) in their adoption warnings.

6. Discussion and research agenda

The paper contributes to the literature by situating supplier development within the procurement governance cycle rather than as a stand-alone compliance report. Stefano et al. (2023) focus on the multi-level nature of megaproject relationships, Harju et al. (2023) on the link between procurement digitalisation and risk management capacity. Bringing those together implies that programme policy determines market access, digital records facilitate inter-firm coordination and commercial practice determines whether SMEs can stay in the game. The Saudi local content objectives add a distinctly developmental dimension to the model which is missing from many of the more technology focused models. Success is predicated on having an explicit theory of change: predictable demand and fair qualification are required to get participation; collaborative planning and reliable payment are required to get delivery; and repeated learning is required to build capability and resilience.

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Four propositions are worth testing. The positive link between digital procurement maturity and local award participation should be greater where the qualification criteria and tender evaluation processes are transparent. Demand visibility should only lead to improved first time supplier delivery where there is realistic package size and technical assistance. Payment traceability should only go some way to supporting supplier retention where the approval responsibilities and dispute processes are enforceable. Data interoperability should only improve programme resilience where it enables alternative sourcing and allows for a timely response to design changes. All of these are conditional rather than deterministic. The relationships could well work in the opposite direction if the dominant contractors are using the platforms to restrict access and pass on unmanageable risks to the local suppliers.

Future work should be based on longitudinal project level records rather than just on perceptions of digital readiness. A good design would be to take a set of similarly sized packages and run the same analysis both before and after a staged deployment. You'd record the bidder mix, the scores, the technical acceptance, the variation frequency and the actual payment dates. You could do interviews with the suppliers who were rejected at pre-qualification to find out what the exclusion mechanisms were (something you wouldn't be able to see in the award database). A multi-level analysis would allow you to separate out the effect of the policy of the programme from the effect of contractor behaviour and from the actual capacity of the market in that particular category. Of course ethical access to and confidentiality of the data is vital as the procurement records contain a great deal of commercially sensitive information. Where possible independent audits should be carried out to check that the local value claimed is in fact being realised in terms of actual production and actual skill formation rather than just on the basis of a paper claim.

This review also highlights the ongoing tension between the need for standardisation in procurement and the need for context sensitive development. Standardised forms are obviously useful for auditability but too much standardisation can clearly have a disproportionate impact on small suppliers. Preferential arrangements can create a development incentive but if poorly designed they can reduce competition and undermine accountability. Sharing of technical data is

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clearly a benefit in terms of coordination but uncontrolled sharing of such data can lead to the exposure of sensitive information or even to collusion. The answer is not either full automation or the complete abandonment of common standards. It's about appropriately calibrated governance: standardise the transparency of decisions, the accuracy of records and the rights of review, but vary the depth of qualification, the level of development support and the extent of data sharing according to the demonstrable level of risk in each category.

7. Limitations and conclusion

The study is constrained by its purposive sample of 30 publications, the diversity of methods employed and the unevenness of the direct evidence available on actual Saudi urban projects. A number of the mechanisms are established in other institutional contexts and their application to the Saudi programmes is therefore a logical proposition rather than an observed outcome. The study does not provide any estimates of cost savings, localisation rates or causal impacts and its framework has not been field tested. Its real strength is in the specification of the organisational context which is so often missing from product-based accounts of procurement technology. Future research will need to test these organisational conditions against transaction level evidence and supplier experience.

Digital procurement can underpin Saudi Arabia's urban development agenda if the procurement system is conceived as an accountable network of decisions, obligations and learning. Transparent tenders are of course a necessary precondition but are not in themselves sufficient. Local suppliers also need clear pathways into the market (i.e. qualification pathways), reliable information on demand, appropriately sized contracts, verifiable technical performance and predictable payment terms. Interoperable records and analytics will be the means by which all of these are measurable and the governance arrangements will determine whether the data in fact lead to fair and sound outcomes. The framework proposed therefore moves the focus away from the simple adoption of technologies and towards the co-development of procurement integrity,

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supplier capability and supply chain resilience. That is the basis on which technology can be used to achieve genuine local integration. It's not about the number of transactions going digital.

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