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From Risk Assessment to Procurement Decision: A Systematic Review in Construction

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Abstract- ***Risk management and procurement are established fields in construction research, but the decision chain connecting them has not been examined as an object in itself. This review asked whether exposure identified by risk analysis reaches the sourcing decision, whether that decision is fixed contractually, and whether performance data returns to the assessment. Following the PRISMA 2020 statement, one hundred and ninety-seven records were retrieved through eight structured searches, citation chaining and hand searching. After duplicate removal, screening and eligibility assessment, one hundred and thirty studies were coded against a five-stage chain comprising exposure diagnosis, analytical triage, procurement allocation, contractual fixing, and monitoring with feedback. Coverage was analysed at stage level, at span level, and as a pairwise co-occurrence matrix, with a sensitivity analysis excluding venues not indexed in Scopus. Every stage proved substantially covered, from ninety studies addressing exposure diagnosis to thirteen addressing monitoring and feedback. Adjacent transitions were far thinner. Forty-two studies linked diagnosis to analysis, but nine linked analyses to a procurement decision, nine linked procurements to the contract, and two linked the contract to monitoring. One hundred and ten studies spanned two stages or fewer, two traversed analyses through procurement into contractual terms, and none covered all five. The findings were stable across corpus sizes and insensitive to venue exclusion. The review contributes a decision-chain coding scheme, evidence that the field's central prescriptive claim rests on a narrow empirical base, and a research agenda addressing the untraversed transitions.***

Index Terms- ***Construction supply chain, contract risk allocation, procurement strategy, risk management, systematic review.***

I. INTRODUCTION

Background

Construction and infrastructure projects are exposed to risks that disrupt schedules, inflate costs and compromise quality, and the exposure intensifies as the logistics content of the project rises. Where materials, plant and specialist equipment must be moved across long distances, held in intermediate storage and delivered against a sequenced programme, delivery becomes dependent on a network of carriers, suppliers and clearing agents that no single party directly controls. Analysis of overseas engineering, procurement and construction projects estimates that transportation, customs clearance and insurance together account for approximately 14.6 per cent of total investment cost, before internal logistics and personnel movement are counted [1].

The consequences of leaving that exposure unmanaged are documented consistently across developing economies. Analysis of Ethiopian building and road projects found average cost overruns of thirty-five and eighteen per cent respectively, driven principally by inflation, inaccurate cost estimating and variation [2]. Studies of the sub-Saharan contracting environment rank economic conditions above technical factors as the dominant inhibitor of contractor performance [3]. Research on international construction ranks exogenous risk factors above client, consultant and contractor factors, indicating that the most significant threats to delivery originate outside the project organisation [4].

The problem addressed

Both risk management and procurement are mature fields with substantial literatures and multiple review articles. The problem is not that either is under-studied. It is that the connection between them is rarely studied as an object in its own right.

Stated as a sequence, that connection has five stages. An organisation diagnoses its exposure, producing a register. It triages that exposure analytically, separating what must be modelled from what can be screened. It converts the surviving priority set into a procurement decision about what to buy, from whom, and by which route. It fixes the resulting allocation in a contract. And it monitors supplier performance so that the data re-enters the diagnosis. Break the chain at any point and the preceding work loses its effect. A register that never alters a sourcing decision has produced documentation rather than management.

Whether the published evidence travels that chain, and where it stops if it does not, is an empirical question. This review asks it, and answers it by coding a corpus rather than by argument.

What existing reviews cover

The territory is partly occupied and the occupancy pattern is informative. A systematic review and bibliometric analysis of construction supply chain risk management covering 1999 to 2023, conducted on Scopus and IEEE Xplore, maps risk management phases, micro and macro risk classifications, traditional approaches and the emergence of artificial intelligence applications [5]. A systematic review of supply chain risk management research in construction covers related ground to 2022 [6]. Adjacent reviews address risk management in sustainable construction projects [7], risk management approaches in modular construction [8], and intelligent or artificial-intelligence-supported risk management [9].

Three observations follow. First, these reviews are organised by technique, by technology or by project type, not by decision sequence. Baghalzadeh Shishehgarkhaneh et al. [5] come closest to a sequence view, recording that the field initially focused on risk identification, assessment and analysis and expanded over time to include allocation, prioritisation and recovery, but the sequence is reported as a chronological broadening of scope rather than analysed as a decision chain within individual studies. Second, several identify the same imbalance from within their own corpora: considerable focus has been devoted to hazard identification and assessment, while hazard mitigation and monitoring have not yet received much attention [6]. Third, on the procurement side, reviews of supplier selection concentrate on supply chain partner selection, green supplier selection and supplier evaluation, and in doing so overlook construction contractor selection, which remains one of the most challenging decisions in the tendering process [10].

One prior study addresses the connection directly and must be distinguished from the present work. Osipova and Eriksson [11] examined how procurement options, comprising delivery method, payment form, collaboration arrangement and early contractor involvement, influence the risk management process across eleven Swedish projects. That study establishes that the relationship exists and matters. It does not establish how often the literature as a whole traces it, which is the question addressed here. A parallel observation comes from outside construction: comparing academic research with industry practice in global sourcing risk management, Manuj [12] identified integration between procurement and other functions as a research direction that remains largely unanswered.

Aim, objectives and research questions

The aim is to establish how far the published evidence travels along the risk to procurement decision chain in construction, and to identify where it stops. Four objectives follow.

To define a decision-chain coding scheme capable of consistent application to a construction risk and procurement corpus.

To characterise the retrieved evidence by period, method and venue indexing status.

To measure stage coverage, span and pairwise co-occurrence across the corpus, and thereby locate where the chain breaks.

To test whether the resulting pattern is sensitive to corpus size, to full-text verification, or to the exclusion of studies published in venues not indexed in Scopus.

Four research questions correspond:

RQ1. What are the descriptive characteristics of the evidence linking risk assessment to procurement in construction?

RQ2. Which stages of the decision chain does the corpus address, and in what proportion?

RQ3. How far along the chain does an individual study travel, and which transitions are strongest and weakest?

RQ4. Is the observed pattern robust to corpus growth, to verification of the codings against full text, and to venue exclusion?

II. REVIEW METHODOLOGY

Design and protocol

A systematic review was selected because the research questions concern the structure and extent of an existing evidence base rather than a phenomenon requiring primary observation. The review followed the PRISMA 2020 statement, which supplies explicit reporting standards, a standardised flow diagram and a checklist supporting critical appraisal and replication [13]. PRISMA is well established in construction engineering and management research and has been applied to reviews of construction supply chain risk [5], megaproject management [14], circular construction [15] and raw material supply risk [16].

The protocol was fixed before screening began and covered the search strings, the inclusion and exclusion criteria, the extraction fields, the coding scheme and the venue rule. It was not registered on PROSPERO, which does not accept reviews outside health and social care; this is stated for transparency rather than as a claim of equivalence.

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Databases and search strategy

Eight structured searches were executed, each expressed as a research question rather than a keyword string. Searches were run through a research discovery service indexing Scopus-sourced metadata, supplemented by targeted searching of a multidisciplinary journal corpus and of regional outlets carrying African construction management scholarship. Each search returned up to twenty ranked records with abstracts, publication venue and, where available, the SCImago journal quartile.

Table 1. The eight search questions

No.	Search question	Records
1	How do construction and infrastructure projects use the output of risk assessment to inform procurement route selection, sourcing strategy, or supplier selection decisions?	20
2 and 3	What methods are used to identify, categorise and record risks in construction and infrastructure projects? How are qualitative and quantitative risk analysis techniques applied?	20
4 and 7	How does the choice of procurement route or sourcing strategy affect risk exposure? What risks affect logistics, transportation and materials supply in construction and EPC projects?	20
5	How do contract types and contractual clauses allocate risk between clients and contractors in construction projects?	20
6	How does supplier performance monitoring, service level agreement management and supplier development affect risk in construction supply chains?	20
8	How do public procurement regulations and developing economy conditions affect risk management and procurement decisions in construction projects?	20

Searches two and three, and four and seven, were executed as combined queries by the discovery service. Searches addressing single stages were run deliberately alongside the bridging search, because establishing where the chain breaks requires that single-stream literature be retrieved rather than filtered out. A corpus containing only integrated studies would have made the central finding unobservable by construction. Reference lists of retrieved reviews were hand-searched and forward citation chaining was applied to the most-cited items.

Inclusion and exclusion criteria

Table 2. Inclusion and exclusion criteria

Criterion	Included	Excluded
Publication type	Peer-reviewed journal articles and review articles; statutory instruments retained separately for regulatory context	Conference abstracts, theses, trade press, unrefereed working papers
Language	English	All other languages
Subject	Construction, infrastructure, engineering procurement construction, project logistics	Manufacturing, electronics or general federal procurement settings with no construction dimension
Focus	At least one of the five decision-chain stages, addressed substantively	Occupational safety risk; structural reliability; financial market risk without a delivery dimension

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Period	No lower bound; foundational procurement route studies retained for theoretical continuity	None applied on date
Venue	Journals indexed in SCImago, Scopus, Web of Science or DOAJ retained in the strict corpus; unindexed venues retained in the full corpus and reported separately	None excluded on venue alone; see the sensitivity analysis

Screening and selection

One hundred and sixty records were identified through the eight structured searches and thirty-seven through supplementary searching and citation chaining, giving one hundred and ninety-seven in total. Twenty-six duplicates were removed, leaving one hundred and seventy-one for title and abstract screening. Twenty-seven were excluded at that stage as falling outside the subject or focus criteria. One hundred and forty-four records were assessed for eligibility, of which six were excluded as outside subject scope, four as containing no substantive treatment of any decision-chain stage, and four as falling outside the construction domain. One hundred and thirty studies were retained and coded. Seven further sources were retained for method, definitional and regulatory context but were not coded as evidence.

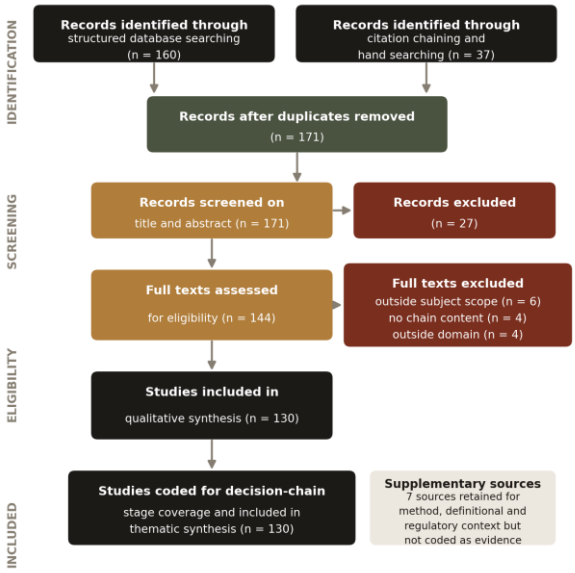

Figure 1. PRISMA 2020 flow of the review process.

Source: Prepared by the authors following the PRISMA 2020 statement [13]

The decision-chain coding scheme

The scheme is the methodological contribution of this review and is set out in full so that it can be replicated or contested. Each included study was coded for whether it substantively addresses each of five stages. Substantive treatment was defined as the stage forming part of the study's aim, method or findings; passing mention in a background section did not qualify.

Table 3. Decision-chain stages and coding rules

Stage	Definition	Coded present when the study…
S1 Exposure diagnosis	Identification and categorisation of risk, including registers, taxonomies and breakdown structures	identifies, categorises or ranks risks, or develops instruments for doing so

S2 Analytical triage	Application of a formal technique producing a quantified assessment of risk exposure or priority	applies or develops probability and impact scoring, elicitation, simulation, decision trees, sensitivity analysis, fuzzy inference, structural equation modelling, importance indexing or Pareto prioritisation
S3 Procurement allocation	Conversion of assessed exposure into a sourcing or route decision	addresses procurement route selection, sourcing mix, or supplier and contractor selection as a response to risk
S4 Contractual fixing	Expression of the allocation in enforceable contractual terms	addresses contract type, risk allocation clauses, incentives, bonds, guarantees or price adjustment mechanisms
S5 Monitoring and feedback	Measurement of supplier performance and its return to the diagnosis	addresses service-level measurement, supplier development, performance review or feedback into risk assessment

The S2 rule requires attention because it was tightened during coding. An early formulation listed specific techniques and excluded importance indexing and Pareto prioritisation. Applying that formulation inconsistently would have produced arbitrary results, since ranking by relative importance and prioritising by Pareto analysis both produce a quantified ordering of exposure in exactly the way a probability and impact matrix does. The rule as stated above was therefore adopted and applied uniformly.

Verification of codings against full text

Coding was performed from titles, abstracts and indexed metadata in the first instance. Because that basis is weaker than full-text reading, a verification exercise was carried out on the codings most likely to affect the reported figures. Studies were tiered: those spanning three or more stages, those carrying an adjacent-transition coding, and those coded to the least-populated stage were classed as load-bearing and prioritised. Twenty-four such studies were obtained in full text and re-coded against the rules in Table 3, with the justifying sentence recorded for each stage.

Thirteen of the twenty-four codings changed, a rate of fifty-four per cent. Four gained a stage, five lost one, three were revised in both directions and one study was excluded as falling outside the construction domain. The direction was consistent: abstract-based coding systematically overstated stage coverage, because terms such as procurement risk or supplier appearing in an abstract led to a stage being coded where the full text contained no corresponding decision. Three studies coded as linking analysis to procurement proved on reading to contain no procurement decision at all. One study gained a stage and became the second study in the corpus to traverse analysis through procurement into contractual terms.

Fifty-five of the one hundred and thirty codings now rest on full text and seventy-five on abstracts and indexed metadata. The seventy-five are identified in the supplementary matrix. This is a material limitation and is revisited below.

Venue rule and sensitivity analysis

A venue rule was agreed before any journal was checked, to avoid the appearance of a criterion drawn to suit the result. Studies published in journals listed in SCImago, Scopus, Web of Science or DOAJ constitute the strict corpus. A quartile threshold was deliberately not applied, since requiring first or second quartile publication would exclude most regional scholarship, including the African and Nigerian work the review has a specific interest in, and would bias the corpus against the settings least represented in the literature.

Journal status was checked individually on SCImago. Of the venues carrying no quartile in the search output, two were confirmed absent from Scopus and one was confirmed present at second quartile with an SCImago journal rank of 0.350. Nineteen remain unverified at the time of writing and are treated as unindexed in the strict corpus, which is the conservative assumption. All analyses are reported for both corpora.

Data extraction

Each study was extracted against a structured sheet capturing bibliographic details, publication venue and indexing status, year, dominant research method, the five stage codes, the evidence basis for the coding, and a written justification. The complete matrix, the coding protocol and the list of retrieved but uncoded sources are provided as supplementary material so that every count reported below can be recomputed independently.

Methodological limitations

Four limitations qualify the findings. First, seventy-five of the one hundred and thirty codings rest on abstracts and indexed metadata rather than full text. The verification exercise establishes that such codings carry an error rate of roughly one half, biased towards

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false positives, so the unverified codings should be assumed to overstate coverage rather than understate it. Because the review's central finding concerns the scarcity of transitions, and because verification reduced rather than increased the transition counts, this bias works against the finding rather than for it. Second, nineteen venues remain unverified for indexing status and are treated as unindexed in the strict corpus. Third, restriction to English-language publication introduces a known bias against non-Anglophone scholarship, which is material given that substantial construction management research is published in Chinese. Fourth, independent double coding by a second reader has not been completed, so inter-rater reliability is unquantified.

Descriptive characteristics of the corpus

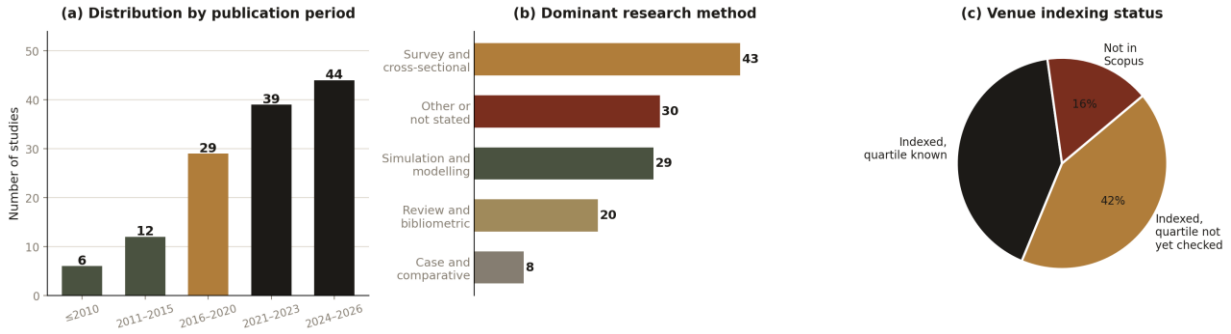

Figure 2. Descriptive characteristics of the one hundred and thirty coded studies: (a) publication period, (b) dominant research method, (c) venue indexing status.

Source: Prepared by the authors from the supplementary coding matrix

Publication period

The corpus is weighted towards recent work without being confined to it. Thirty-nine studies were published between 2021 and 2023 and forty-four between 2024 and 2026, together accounting for sixty-four per cent of the corpus. Twenty-nine fall in the 2016 to 2020 window, twelve between 2011 and 2015, and six in 2010 or earlier. The older material comprises procurement route and contract strategy studies retained for theoretical continuity, notably the construction procurement route literature of the early 2000s [17, 18] and the joint risk management strand that followed it [19].

Research method

Survey and cross-sectional designs are the most common approach, appearing in forty-three studies, typically deployed to rank risk factors using a relative importance index or to test relationships by structural equation modelling. Simulation and modelling accounts for twenty-nine, encompassing Monte Carlo simulation, Bayesian networks, fuzzy inference, analytic hierarchy process, interpretive structural modelling and data envelopment analysis. Twenty are reviews or bibliometric analyses and eight are case or comparative studies. Thirty carry no method descriptor in the indexed metadata, a consequence of coding from abstracts that is recorded rather than concealed.

The method distribution anticipates the finding reported below. Simulation and modelling studies cluster on the analytical stages of the chain, while survey and comparative designs cluster on procurement route and contract questions. Where a corpus divides by method in this way, it is likely to divide by decision stage as well, and the coding confirms that it does.

Venue

One hundred and nine studies were published in venues confirmed as indexed, of which fifty-four carry a recorded SCImago quartile, forty-eight of those at first quartile. Two studies are confirmed as published outside Scopus and nineteen remain unverified. The strict corpus used in the sensitivity analysis therefore comprises one hundred and nine studies.

III. WHAT THE CORPUS CONTAINS, STAGE BY STAGE

Before the transitions are analysed, the content of each stage is summarised, both to characterise the corpus and to show that the thinness reported later concerns the connections rather than the stages themselves.

Exposure diagnosis

The largest body of work sits here, with ninety studies. Categorisation is treated as the first analytical act, though the categories vary with setting. Research on

international construction distinguishes exogenous, client, consultant and contractor groupings, ranking the exogenous group first at an average relative importance index of 0.743 and recording that fifty-three per cent of respondents preferred to transfer exogenous risk rather than mitigate or retain it [4]. Work on pipeline construction identified twenty-six recurring factors, the leading five being discrepancy between implementation requirements and specification, financial failure, poor material quality, supply of invalid materials, and weak capability in identifying and monitoring threats [20]. Studies of commercial and administrative complexes group risk into eleven categories, of which three concern the supply chain directly [21]. Risk breakdown structures appear as the organising device in several studies, applied both to project-level taxonomies and to supplier evaluation.

On registers and tracking, the literature is consistent that value rests on unique identification, comparable scoring, named ownership and a live review cycle, and that identification is foundational because an unidentified risk can be neither controlled, transferred nor managed [22]. The same work notes that the key causes of delay differ significantly between countries at different levels of development and between periods, which limits the transfer value of imported registers.

Analytical triage

Forty-nine studies apply or develop a technique producing a quantified assessment. On the qualitative side the probability and impact matrix dominates, with each risk scored on ordinal scales and the product placed in a band that prescribes a response [23]. Fuzzy inference approaches address the ambiguity inherent in linguistic assessment, on the argument that likelihood and severity are interlinked with fuzzy set concepts and that expert knowledge remains valid data despite its imprecision [24]. Cloud model approaches respond to criticism of the analytic hierarchy process as too general and of fuzzy comprehensive evaluation for suppressing evaluative uncertainty [25].

On the quantitative side, Monte Carlo simulation is the dominant technique, valued because it permits the certainty of meeting a target to be assessed rather than asserted [26]. Three limitations recur: it cannot itself determine the probability distribution of each input [25]; omitting correlation between inputs understates the spread of the outcome [22]; and data and computational demand are high [27]. Hybrid responses address the first directly, using a double-entry probability and impact matrix to define risk magnitude levels which then inform distribution selection, reducing estimation error to under five per cent on a major road project [28], or permitting the analyst to choose between fuzzy sets and probability distributions when quantifying inputs [29]. Quantitative analysis assesses overall project risk while qualitative analysis addresses individual risks, and the toolsets are complementary rather than substitutable [30].

Procurement allocation

Forty-nine studies reach a sourcing or route decision. Procurement route studies establish that the route dictates whether delivery is design-led, producer-led or coordinator-led, and describe procurement as a succession of calculated risks in which even experienced clients cannot know the full risk profile of each available system [17]. Contract strategy is the means through which the chosen route is implemented and should be settled at contract-type level before detailed provisions are drafted [31].

Supplier selection is consistently framed as a multi-criteria decision problem in which cost, delivery performance and quality are critical [32]. Resilience-oriented selection extends the criterion set: reorganisation and redundancy emerge as the most important supplier selection criteria in construction, and both are properties of the supply arrangement rather than attributes of any individual supplier [33]. Dual sourcing is the most extensively studied structural response, sitting within a wider set including inventory holding and rerouting [34]. A behavioural finding qualifies the stage: the buying party is more likely to be cost-oriented than resilience-oriented, so pursuing resilience is not reliably attractive where low cost is available [35].

Contractual fixing

Thirty-eight studies address the contract as a risk instrument. Fixed-price contracts place risk on the major contractor while reimbursable cost contracts share it between client and supplier [14]. Design-build transfers most project risk including cost escalation to the contractor, with the criticism that reduced client control may permit a substandard product to emerge after guarantees expire [36]. Where a construction manager is bound to a guaranteed maximum price the character of the relationship changes, because the manager then protects its own position as well as acting in the owner's interest [18].

Incentive design divides into cost-plus incentives, which introduce a target cost and divide savings on a predetermined profile, and performance bonus incentives applied to schedule, technical or safety attainment; systems perceived as fair produce more positive contractor motivation [37]. A simple time-based incentive can coordinate a decentralised multi-

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stage project without requiring disclosure of private cost information [38]. Perception studies show wide divergence in allocation preferences both between and within contracting parties, alongside general enthusiasm for joint risk management and a preference for assigning reduced risk to joint management rather than shifting more risk to the counterparty [19]. Earlier work found delayed payment scoring 9.1 out of 10 among contractors, the highest of any factor [39].

Monitoring and feedback

Thirteen studies address this stage, the fewest of the five. Trust relationships with suppliers positively affect resilience, and information sharing favourably influences readiness, responsiveness and recovery capability [33]. The procurement due diligence sequence documented in the compliance literature closes with supplier development where audit identifies capability gaps, placing development inside the procurement process rather than outside it [40]. The same work records a structural constraint specific to construction: subcontractors change from project to project with much less continuity than in other industries, which shortens the period over which development investment can be recovered.

What is largely absent is the return path. Studies measure supplier performance; few trace that measurement back into a revised risk assessment or a changed subsequent sourcing decision. The loop is asserted in conceptual work and rarely evidenced, which is what the transition analysis below quantifies.

The regulated setting

Sixteen studies address procurement regulation or developing-economy conditions. Assessments of the Nigerian Public Procurement Act 2007 report that the enactment has not produced the intended delivery outcomes for a number of identified reasons [41], while work on transparency situates the Act against a prior system characterised by inefficiency and award through non-competitive discretionary processes [42]. Country risk commentary emphasises pre-investment due diligence and caution towards abnormally low bids that may conceal back-end charges [43]. Adjacent review work identifies limited regional differentiation among the gaps in infrastructure project research [44], an observation this corpus supports.

IV. CHAIN-COMPLETENESS ANALYSIS

This section answers the second, third and fourth research questions and contains the review's principal empirical findings. All counts are computed from the supplementary coding matrix and can be reproduced from it.

Stage coverage

Every stage of the chain is substantially covered. Ninety of the one hundred and thirty studies address exposure diagnosis, sixty-nine per cent of the corpus. Forty-nine address analytical triage and forty-nine address procurement allocation, thirty-eight per cent each. Thirty-eight address contractual fixing, twenty-nine per cent. Thirteen address monitoring and feedback, ten per cent.

The distribution declines towards the tail of the chain but does not collapse. Contractual fixing, which an earlier and smaller version of this corpus suggested was thinly studied, proved on expanded searching to be addressed by nearly a third of the corpus. Only monitoring and feedback is genuinely sparse. A reader seeking evidence on any single stage of the chain will find a literature waiting.

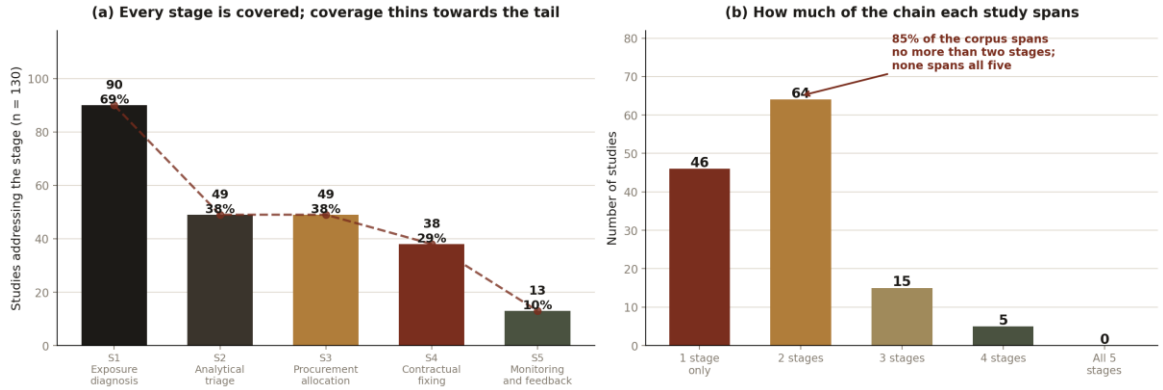

Figure 3. Chain-completeness analysis: (a) stage coverage across the corpus; (b) span, being the number of stages each study addresses.

Source: Prepared by the authors from the supplementary coding matrix. Percentages are of the one hundred and thirty coded studies

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Span

Forty-six studies, thirty-five per cent of the corpus, occupy a single stage. Sixty-four span two stages, fifteen span three and five span four. No study in the corpus addresses all five stages. One hundred and ten studies, eighty-five per cent of the corpus, span two stages or fewer.

The five four-stage studies indicate what a near-complete treatment looks like, and it is notable that they arrive at that span by different routes rather than by covering the chain in sequence. Trautrims et al. [40] trace a procurement due diligence sequence from supply chain mapping through assessment, prequalification, contracting and audit to supplier development, covering every stage except analytical triage. Baghalzadeh Shishehgarkhaneh et al. [5] map the field's own phases from identification and assessment through allocation to recovery. Both are reviews rather than empirical studies, which is itself informative: the fuller span currently appears in the literature as a synthesis of what others have done separately.

Adjacent transitions

The transitions between stages tell a different story from the stage counts, and this is the review's central result.

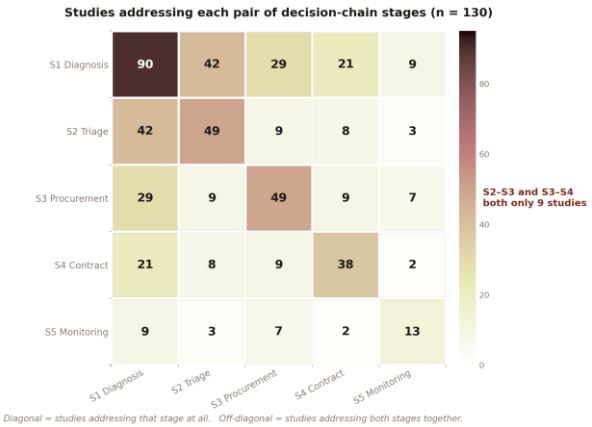

Figure 4. Pairwise co-occurrence of decision-chain stages across the one hundred and thirty coded studies.

Source: Prepared by the authors from the supplementary coding matrix

Table 4. Adjacent transitions in the full and strict corpora

Transition	Full corpus (n = 130)	Per cent of upstream stage	Strict corpus (n = 109)	Per cent of upstream stage
Diagnosis to analysis	42	47	38	51
Analysis to procurement	9	18	7	16
Procurement to contract	9	18	9	22
Contract to monitoring	2	5	2	6

Forty-two studies address both diagnosis and analysis, which is forty-seven per cent of those addressing diagnosis at all. That pairing behaves as one would expect of two activities conventionally treated as halves of a single risk management process.

The remaining transitions do not. Nine studies connect analytical triage to a procurement decision, eighteen per cent of those performing analysis. Nine connect procurement to the contract, again eighteen per cent. Two connect the contract to monitoring, five per cent. Expressed plainly, a study that assesses risk is roughly one third as likely to reach a procurement decision as it is to have identified the risk in the first place, and a study that reaches a contract is very unlikely indeed to follow performance afterwards.

Traversal

The strongest expression of the result concerns continuous traversal rather than pairwise co-occurrence. Two studies in one hundred and thirty carry an assessment through analysis, into a procurement decision, and on into contractual terms.

Dixit [45] assesses risk across sixty-four combinations of sourcing arrangement, contract type and pricing regime, selecting the best combination as the procurement strategy for each category of item. Tembo Silungwe and Khatleli [46] identify pertinent risks in the Zambian building sector, prioritise them by Pareto analysis, and establish how the client allocates them by selecting the procurement method, the payment method and the contract form together. No third study in the corpus does this, and none extends the sequence into monitoring.

This figure is notable for its stability. It stood at one when the corpus contained thirty-nine studies, and remained at one at seventy-seven, one hundred and four, one hundred and fifteen and one hundred and thirty studies. It rose to two only when full-text verification promoted a study that abstract-based coding had under-read. Five of the eight searches were

directed at stages suspected of being thinly covered, and each expanded the stage counts without producing an additional traversal.

Sensitivity

The pattern is insensitive to the venue rule. Excluding the twenty-one studies from venues not confirmed as indexed changes every stage percentage by two points or less, leaves the traversal count at two, and leaves no study spanning all five stages. The analysis to procurement transition falls from eighteen to sixteen per cent, so the strict corpus expresses the finding slightly more sharply than the full corpus rather than softening it.

The pattern is also insensitive to corpus growth, having held across five successive corpus sizes, and to full-text verification, which reduced the transition counts rather than increasing them. The finding therefore does not depend on the boundaries of the search, on the treatment of unindexed venues, or on the weaker codings.

Interpretation

Three readings follow, each with a different implication.

The descriptive reading attributes the pattern to a division of research labour. Risk analysis is performed by researchers working with simulation, elicitation and multi-criteria methods; procurement route and contract research is performed by researchers working with survey and case designs. The method distribution reported above supports this directly.

The evidential reading is more consequential. If nine studies in one hundred and thirty observe both the analytical assessment of risk and the procurement decision that should follow it, and only two carry that sequence into contractual terms, then the field's central prescriptive claim, that risk analysis should shape what is bought and on what terms, rests on a narrow empirical base. The claim is made in conceptual and practitioner literature and embedded in professional guidance, but the work that would establish whether the transition occurs in practice, and whether projects where it occurs perform better, has largely not been done.

The corroborative reading notes that the result gives quantitative form to observations already made from within adjacent corpora. Pham et al. [6] recorded that hazard identification and assessment have received considerable focus while mitigation and monitoring have not. Baghalzadeh Shishehgarkhaneh et al. [5] recorded the same imbalance chronologically. Feng et al. [10] recorded that reviews of supplier selection overlook construction contractor selection specifically. Each observed a symptom; the coding applied here measures the underlying structure.

An alternative explanation deserves consideration and can be only partly discounted. It might be argued that a chain assembled across studies serves the field as well as one contained within them, and that specialisation is efficient. That argument holds for description but fails for causal inference. A study that does not observe both the assessment and the subsequent decision cannot establish that the former influenced the latter, however well it describes either.

V. DISCUSSION

Theoretical implications

Three propositions follow from the analysis and are offered as testable rather than established.

Contingency theory holds that no procurement arrangement is optimal in the abstract and that fit between arrangement and transaction conditions determines performance. The analysis here suggests specifying risk profile as the contingency variable, which supplies a determinate basis for route selection in place of general reference to client objectives. Proposition: packages whose route is selected against a documented risk profile will outperform those selected against a project-level default.

Transaction cost reasoning explains why firms design networks that prioritise cost efficiency and source from remote low-cost locations, and why those networks are vulnerable to disruption [16]. The chain analysis suggests an extension: the transaction costs of distance are borne substantially as schedule cost rather than procurement cost, and therefore fall outside the budget against which the sourcing decision is evaluated. Proposition: sourcing decisions evaluated on landed cost alone will systematically under-weight disruption exposure.

The resource-based view treats supply chain capability as a firm asset. The finding that monitoring and feedback is the least covered stage, combined with evidence that supplier development sits inside the procurement process [40], suggests that development is analytically part of risk management rather than adjacent to it, because it alters the underlying probability of failure rather than its consequence. Proposition: buyers with formal supplier development programmes will exhibit lower residual exposure on comparable packages.

Implications for practice

Four implications follow. Organisations should require the output of risk analysis to be presented as an

input to the procurement strategy paper rather than as a parallel submission, with the strategy stating which identified exposures each element addresses. Sourcing decisions should be taken at package level against package-specific risk profiles, since a single project-wide posture will be wrong for some packages by construction. Contractual instruments should be selected against identified exposure rather than applied as a standard suite, because each carries cost in the bid price whether or not the risk it addresses is present. And performance data should be structured at the point of contract to be usable in the next assessment cycle, rather than collected in a form supporting payment certification alone.

Implications for policy

Where a statutory procurement regime makes open competitive bidding the default, as in a number of developing economies, the route that risk analysis indicates may be unavailable to a public client. The exposure identified is not removed by the unavailability of the response; it is displaced onto the two mechanisms that remain, namely prequalification stringency and contractual instruments. That displacement raises the practical importance of the contractual stage precisely where the reviewed literature is thinner, and it suggests a narrow policy question: whether a documented risk analysis might constitute part of the justification for a restricted or direct route, subject to independent review, so that the transparency objective and the delivery objective are pursued together rather than traded against one another.

Limitations

The methodological limitations stated earlier apply to all findings reported here, and the reliance of seventy-five codings on abstracts is the most serious of them. Three further qualifications attach to the interpretation. The coding scheme is new and has not been applied by an independent team, so its reliability beyond this review is unestablished; publishing the protocol and the matrix is intended to make that test possible. The review synthesises published findings and cannot establish whether practice follows the literature or diverges from it. And it cannot distinguish between a literature that neglects the later transitions and a practice that performs them without generating publishable research, which is a real possibility given that contract and supplier performance data is commercially sensitive.

VI. CONCLUSION AND RESEARCH AGENDA

Conclusion

This review examined how far the published evidence travels along the decision chain connecting risk assessment to procurement in construction. One hundred and thirty studies were coded against five stages. Every stage proved substantially covered, from ninety studies addressing exposure diagnosis to thirteen addressing monitoring and feedback. The transitions between stages are far thinner. Forty-two studies link diagnosis to analysis, but nine link analysis to a procurement decision, nine link procurement to the contract, and two link the contract to monitoring. Two studies traverse analysis through procurement into contractual terms, and none covers all five stages.

The literature is therefore bridged but not traversed. Each link has been studied and several have been studied well, yet the sequence as a whole has almost never been followed within a single study. The consequence is not that any individual study is deficient. It is that the field's central prescriptive claim has a narrow empirical base, because testing it requires observing both ends of a transition that nine studies in one hundred and thirty span, and that two carry further.

Research agenda

Observe the transition directly. Studies capturing both the risk assessment and the subsequent procurement decision on the same projects would establish whether the former influences the latter, and whether projects where it does perform better.

Extend into the tail. Monitoring and feedback is addressed by thirteen studies and connected to the contract by two. Research on whether and how supplier performance data re-enters risk assessment addresses the least developed part of the chain.

Replicate the coding on other corpora. The protocol and matrix are supplied as supplementary material; applying them to a Scopus or Web of Science corpus assembled independently would establish whether the pattern is a property of the literature or of the sample retrieved here.

Test the regulated case. Research on how public clients in statutory-default regimes compensate at the contractual stage for constraints on route selection would address a practically important condition that the corpus barely represents.

Establish the cost case. Evidence that buyers are more reliably cost-oriented than resilience-oriented [35] suggests that work establishing when risk-driven

procurement is justified on expected-value grounds is the practical precondition for any of this to be adopted.

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