A Decision-Support Framework for Blockchain Feasibility Assessment in Public Construction and Transportation

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Blockchain has been widely recognized as a promising technology for inter-organizational collaboration in construction and transportation. However, many blockchain initiatives fail to progress beyond pilot projects. Existing blockchain adoption frameworks primarily identify adoption determinants or technology acceptance factors but provide limited support for structured, evidence-based feasibility assessment in domain-specific contexts. This paper presents a Design Science Research (DSR) approach to develop a blockchain feasibility assessment framework for public construction and transportation projects. The research was conducted through three iterative Design Science cycles. The Relevance Cycle identifies and validates blockchain-specific feasibility dimensions and assessment factors. The Design Cycle synthesizes these findings into a structured decision-support framework comprising a five-stage assessment process, seven feasibility dimensions, and 58 assessment factors supported by evidence-based scoring and implementation guidance. The Rigor Cycle operationalizes the framework as a web-based decision-support system and evaluates its usability and practical applicability through expert assessment involving three construction and blockchain specialists. The evaluation produced an overall usability score of 4.73/5, indicating strong perceived usefulness, completeness, and practical applicability of the proposed artifact. By integrating technical, organizational, governance, legal, economic, and implementation perspectives within a transparent and repeatable assessment process, the framework extends existing blockchain adoption research from descriptive assessment factors toward actionable decision support.

Povzetek: Prispevek predstavi na Design Science Research temelječ okvir za presojo izvedljivosti uporabe veriženja blokov v javnih gradbenih in prometnih projektih, ki združuje sedem dimenzij, 58 ocenjevalnih dejavnikov ter spletno orodje za strukturirano in ponovljivo podporo odločanju.

1 Introduction

Blockchain technology has attracted considerable attention as an enabling infrastructure for secure, transparent, and decentralized information sharing among multiple organizations. Its inherent characteristics, including immutable records, distributed consensus, traceability, and programmable smart contracts, make blockchain particularly attractive for applications requiring trusted collaboration across organizational boundaries [33, 7, 30]. Consequently, blockchain has been proposed for numerous public-sector and construction-related applications, including procurement, contract management, infrastructure asset management, supply-chain traceability, quality assurance, environmental monitoring, sustainability reporting, and digital twins [34, 35, 9, 11].

Despite this growing interest, blockchain adoption remains considerably lower than anticipated. Many organizations initiate blockchain projects because of technological enthusiasm rather than a clear understanding of whether blockchain is actually needed or whether the organizational and institutional conditions required for successful implementation exist [29, 25]. Recent reviews show that blockchain adoption depends not only on technical suitability but also on governance arrangements, organizational readiness, ecosystem collaboration, legal compliance, and expected business value [8, 1, 26]. Numerous blockchain adoption frameworks have therefore extended traditional technology adoption theories such as the Technology–Organization–Environment (TOE) framework by incorporating blockchain-specific factors including decentralized governance, trust, interoperability, stakeholder coordination, and regulatory compatibility [5, 4, 14].

Existing research provides valuable insights into blockchain adoption determinants, governance mechanisms, maturity models, and suitability assessment. Nevertheless, three important gaps remain. First, most studies identify adoption factors without integrating them into a comprehensive decision-support process that practitioners can systematically follow. Second, existing blockchain assessment approaches are generally domain-independent and provide limited guidance for construction and transportation projects characterized by complex governance structures and public-sector regulations. Third, relatively few studies operationalize blockchain feasibility assessment as a practical software artifact that supports transparent, repeatable, and evidence-based decision-making.

To address these gaps, this paper presents a Design Science Research (DSR) approach for developing a blockchain feasibility assessment framework tailored to Vietnam's public construction and transportation sectors. This study addresses the following research questions:

- **RQ1:** What blockchain-specific feasibility factors are required to comprehensively evaluate blockchain initiatives in public-sector construction and transportation projects?
- **RQ2:** How can these feasibility factors be synthesized into an actionable decision-support framework that systematically guides blockchain feasibility assessment?
- **RQ3:** To what extent can the proposed framework be effectively operationalized and validated through a web-based decision-support system for practical blockchain feasibility assessment?

The research makes three primary contributions. First, it develops a comprehensive taxonomy of blockchain feasibility factors specifically tailored to public construction and transportation projects. Second, it proposes an evidence-based assessment framework that integrates technological, organizational, governance, legal, economic, and implementation perspectives into a unified decision-support process. Third, it demonstrates how the framework can be operationalized as a web-based software artifact that supports transparent, repeatable, and context-aware blockchain feasibility evaluation for government agencies and infrastructure organizations.

2 Background

2.1 Blockchain feasibility assessment frameworks

The rapid evolution of blockchain technology has stimulated the development of numerous assessment frameworks that assist organizations in determining whether blockchain is an appropriate solution for a particular application. Unlike general technology adoption models such as the Technology Acceptance Model (TAM), TOE framework, Task–Technology Fit (TTF) model, and Diffusion of Innovations (DOI) theory, blockchain-specific assessment frameworks explicitly account for the distinctive characteristics of distributed ledger technology, including decentralized governance, distributed consensus, immutable records, inter-organizational data sharing, smart contracts, and trust among multiple stakeholders [29, 30, 7, 33]. These frameworks seek to answer three fundamental questions: (i) whether blockchain is genuinely needed for a given problem, (ii) whether the adopting organization is sufficiently prepared for blockchain deployment, and (iii) what conditions are necessary to achieve successful implementation.

2.1.1 Blockchain suitability assessment

The first question addressed by blockchain feasibility research is whether blockchain is the appropriate technological solution for a particular business problem. Numerous organizations adopt blockchain because of technological trends rather than genuine business requirements, often resulting in expensive systems that provide limited additional value. To address this issue, several Blockchain Suitability Assessment (BSA) frameworks have been proposed to evaluate blockchain necessity before implementation [29, 30].

These frameworks typically employ a decision-tree or checklist approach to evaluate characteristics such as the number of independent organizations involved, trust deficits among stakeholders, the need to eliminate intermediaries, immutable data storage requirements, traceability, transparency, distributed consensus, and smart contract automation. If these characteristics are absent, conventional centralized databases are generally considered more appropriate solutions [13]. Commercial organizations including IBM, Oracle, and ConsenSys have incorporated similar assessment methodologies into their blockchain consulting practices to reduce investment risks by identifying genuinely suitable blockchain use cases. In construction and transportation, this assessment is particularly valuable for applications involving material traceability, construction records, smart contracts, infrastructure asset management, and cross-organizational information sharing.

Although Blockchain Suitability Assessment provides an effective initial screening mechanism, its primary focus remains on technological and application characteristics. Organizational readiness, governance structures, legal constraints, ecosystem maturity, and implementation capability are generally addressed only superficially, motivating the development of more comprehensive adoption frameworks.

2.1.2 Blockchain governance frameworks

Unlike conventional information systems managed by a single organization, blockchain networks operate across multiple autonomous organizations that collectively maintain shared data and distributed infrastructure. Consequently, governance has emerged as one of the most critical determinants of successful blockchain deployment, particularly for consortium and public-sector blockchains [19, 3].

Blockchain Governance Frameworks evaluate issues including stakeholder responsibilities, membership management, decision-making mechanisms, voting procedures, validator selection, access control, protocol evolution, dispute resolution, and auditability. In construction and transportation projects involving government agencies, owners, contractors, consultants, and infrastructure operators, clearly defined governance mechanisms are essential to avoid conflicts regarding data ownership, operational responsibilities, and network control. These studies demonstrate that decentralization does not eliminate governance requirements but instead redistributes governance responsibilities across participating organizations.

2.1.3 Blockchain maturity models

Beyond determining suitability, organizations must also evaluate their capability to implement blockchain successfully. Blockchain Maturity Models assess the readiness of organizations across multiple stages of blockchain adoption, typically progressing from awareness and experimentation to pilot implementation, deployment, and organizational optimization [6].

Assessment dimensions commonly include technical infrastructure, digital capability, governance maturity, organizational processes, workforce competence, risk management, and scalability. For government agencies, maturity models provide an effective mechanism for identifying organizational readiness and developing phased implementation roadmaps rather than attempting large-scale deployment prematurely.

2.1.4 Multi-criteria decision making

Because blockchain feasibility depends simultaneously on technical, organizational, economic, legal, and governance considerations, Multi-Criteria Decision Making (MCDA) techniques have increasingly been adopted to support blockchain investment decisions. Methods such as Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP) enable decision makers to assign criterion weights, compare multiple alternatives, and aggregate quantitative and qualitative evidence into overall feasibility scores.

Within blockchain research, MCDA has been applied to platform selection, use-case prioritization, investment evaluation, and implementation strategy comparison. These approaches provide a rigorous foundation for constructing transparent scoring mechanisms capable of integrating heterogeneous assessment criteria into a single decision-support framework.

2.1.5 ISM–dematel-based analysis

Interpretive Structural Modeling (ISM) and Decision-Making Trial and Evaluation Laboratory (DEMATEL) represent complementary approaches for analyzing causal relationships among adoption factors in complex socio-technical systems. Rather than treating assessment factors independently, these methods explicitly identify hierarchical structures and influence relationships among technological, organizational, and institutional variables.

ISM constructs hierarchical dependency structures that distinguish foundational factors from dependent outcomes, whereas DEMATEL quantifies causal interactions and identifies driving and dependent variables within the adoption ecosystem. Recent blockchain studies employ ISM–DEMATEL to reveal that digital infrastructure, interoperability, governance capability, legal clarity, and organizational readiness function as primary driving factors, while implementation cost and organizational resistance frequently emerge as consequence variables. Such analyses provide valuable guidance for prioritizing interventions before blockchain implementation.

Overall, existing blockchain assessment frameworks collectively demonstrate that blockchain feasibility extends well beyond technological capability. Effective assessment requires simultaneously considering blockchain necessity, organizational readiness, governance arrangements, legal compatibility, ecosystem maturity, economic value, and implementation readiness. However, current frameworks typically emphasize only selected dimensions and remain largely domain-independent. Furthermore, relatively few frameworks integrate these dimensions into a unified assessment process tailored for public-sector construction and transportation projects. This gap motivates the comprehensive multi-dimensional feasibility framework proposed in this study. Table 1 presents the comparison among blockchain assessment approaches. The full list of 58 factors are shown in the Appendix at https://tinyurl.com/blockchainappendix

Table 1: Comparison of representative blockchain feasibility assessment frameworks

Framework	Scope	Decision Support	Prot.
Wüst & Gervais [29]	General domain, Technical	Yes	No
IBM Blockchain Decision Framework [13]	General domain, Technical	Yes	No
TOE-based adoption frameworks [4, 5]	General domain, technical and organizational	Partial	No
MCDA-based approaches	General	Yes	No
Proposed framework	Construction & transportation and 7 dimensions	Yes	Yes

2.2 Success and failure factors in blockchain adoption in construction domain

When contextualized to the construction sector, blockchain feasibility becomes significantly more complex due to project fragmentation, temporary multi-organizational structures, heavy contractual governance, and regulatory oversight. Unlike centralized enterprise environments, construction projects operate as dynamic ecosystems involving owners, contractors, subcontractors, consultants, regulators, and financial institutions. Consequently, feasibility must be assessed as a multi-dimensional alignment problem across technical, process, organizational, and environmental domains.

Our systematic review indicates that blockchain applications in construction concentrate on contract administration, payment automation, supply chain traceability, BIM integration, sustainability reporting, and quality monitoring. Despite consistent reporting of technical advantages such as transparency, immutability, and auditability, empirical maturity remains limited, with most studies positioned at conceptual, modeling, or prototype stages rather than real-world deployment [18]. This gap highlights the importance of structured feasibility evaluation before large-scale implementation.

Technical feasibility concerns whether blockchain's core characteristics genuinely address the trust and coordination problems encountered in construction projects. The literature consistently highlights immutability, non-repudiation, traceability, cryptographic integrity, and decentralized validation as key capabilities for supporting multi-party collaboration, payment verification, inspection records, and compliance management [35, 34]. Smart contracts have been widely investigated for automating payment execution, milestone certification, and regulatory compliance [23]. However, recent studies argue that construction contracts are inherently relational and frequently involve variations and exceptions, limiting the applicability of fully automated smart contracts [31]. Beyond core blockchain functionality, successful implementation depends heavily on integration with existing digital infrastructure. Hybrid on-chain/off-chain architectures are commonly required to accommodate large BIM models, IoT-generated data, and enterprise information systems [27]. Technical failures are therefore more often attributed to poor interoperability, limited scalability, inadequate integration, and data management challenges than to blockchain technology itself [21].

Process feasibility means that blockchain should align with well-defined processes in procurement, inspection, contract administration, and information exchange. Reliable data acquisition mechanisms, including IoT devices and automated verification procedures, are essential to ensure that trustworthy information enters the blockchain network [35, 9]. Similarly, automated milestone verification and payment execution depend on standardized documentation, structured workflows, and consistent digital records [23, 24]. Transparent audit trails and clearly assigned responsibilities further contribute to reducing contractual disputes and improving accountability among project participants [22]. Conversely, fragmented documentation, inconsistent procedures, and low levels of digitalization remain major barriers to process feasibility [24, 28].

Organizational feasibility focuses on whether participating organizations possess the capabilities, governance structures, and commitment necessary to implement blockchain successfully. Empirical studies applying ISM–DEMATEL, structural equation modeling, and TOE-based analyses consistently identify organizational readiness, leadership commitment, stakeholder collaboration, workforce capability, and regulatory support as major determinants of adoption [18, 2, 10, 15]. Effective implementation also requires clear governance arrangements defining participant responsibilities, access permissions, and long-term operational ownership, particularly in consortium-based blockchain networks [34, 16]. Furthermore, phased deployment strategies, organizational learning, and structured change management have been shown to reduce resistance and facilitate gradual adoption [17]. Organizational challenges therefore extend beyond technical capability to include governance, collaboration, skills development, and strategic leadership.

Environmental feasibility is decisive in determining blockchain feasibility, particularly within public-sector construction. Regulatory compatibility, legal recognition of digital records and smart contracts, procurement regulations, and data governance requirements must be established before blockchain can be deployed at scale [22, 26]. Economic viability remains equally important. Although prototype implementations demonstrate improved transparency and operational efficiency in applications such as Project Bank Accounts and automated payment systems [23], questions regarding implementation costs, scalability, and long-term return on investment remain unresolved [18, 25]. Emerging applications in carbon accounting, sustainability reporting, and ESG management further illustrate blockchain's potential but also highlight the importance of supporting digital infrastructure and regulatory incentives [11, 32]. Particularly in developing countries, institutional conservatism, regulatory uncertainty, and limited digital maturity continue to constrain blockchain adoption [28, 2].

3 Research method

3.1 Design science research

This research adopts the DSR methodology to develop and evaluate a practical framework for assessing the feasibility of blockchain adoption in construction and transportation sectors [12, 20]. DSR is chosen because the research objective is not only to understand blockchain adoption challenges but also to create an actionable artifact that supports real-world decision-making.

Following the DSR paradigm proposed by Hevner et al. [12] and Peffers et al. [20], the study iteratively develops and refines three complementary artifacts: (i) a blockchain feasibility factor taxonomy, (ii) a comprehensive feasibility assessment framework, and (iii) a web-based assessment tool implementing the framework. The development process consists of three iterative Design Science cycles: the Relevance Cycle, the Design Cycle, and the Rigor Cycle.

The research was conducted over a seven-month period from January to July 2026 following three iterative Design Science cycles. The *Relevance Cycle* (January–April 2026) focused on identifying and validating blockchain feasibility factors through a systematic literature review and expert interviews. The *Design Cycle* (May 2026) synthesized the validated factors into a structured feasibility assessment framework, including the assessment process, decision logic, and scoring mechanism. Finally, the *Rigor Cycle* (June–July 2026) implemented the framework as a web-based decision-support system and evaluated its usability and practical applicability through expert demonstrations and qualitative feedback.

3.2 Cycle 1: relevance cycle – identification of feasibility factors

The cycle begins with a PRISMA-guided systematic literature review covering blockchain adoption, construction informatics, digital government, and information systems research. From the selected studies, feasibility factors, adoption barriers, governance mechanisms, implementation drivers, and evaluation criteria were extracted through qualitative coding and synthesis. The result of the systematic literature review is reported separately in another work.

The initial taxonomy was subsequently refined through six semi-structured expert interviews involving specialists from construction management, blockchain development, public infrastructure, digital transformation, construction law, and government agencies. Experts were selected through purposive sampling using four recruitment strategies: identifying researchers through a targeted literature search and inviting them to participate, leveraging the professional networks of the co-authors, snowball sampling through referrals from interviewees, and recruitment at academic events. Approximately thirty experts were contacted, resulting in six completed interviews, as shown in Figure 2. The interviews sought to capture expert perspectives on practical implementation challenges, blockchain suitability, organizational readiness, governance constraints, legal considerations, economic feasibility, and implementation strategies within Vietnamese construction projects. Although interview questions were adapted to each participant's expertise, we skipped sections or questions in the interview protocol that does not fit to the interviewee's experience or background. Interview data were analysed using a tailored thematic analysis that combined deductive and inductive approaches by the last author. The predefined interview themes and protocol questions served as the initial analytical framework to examine blockchain feasibility dimensions identified from the literature. During the analysis, researchers iteratively reviewed the interview transcripts to identify additional recurring concepts, insights, and contextual issues emerging from the experts' responses. These emergent themes were documented and synthesised as the findings presented in RQ1 and were subsequently used to refine the feasibility assessment framework.

Table 2: Summary of expert interviews

ID	Background	Duration	Channel
E1	Ph.D. in Construction Management, Faculty of Civil Engineering	60 min	Literature search
E2	Associate Professor in Construction Engineering and Management, Faculty of Civil Engineering	75 min	Literature search
E3	Ph.D., Faculty of Civil Engineering	30 min	Literature search
E4	Chief Executive Officer, AI Technology Company	70 min	Professional Network
E5	Chair, National Society of Construction Law	30 min	Snowball Sampling
E6	Researcher	25 min	University Seminar

The primary output of Cycle 1 is **Artifact A1**, a structured taxonomy consisting of seven feasibility dimensions and fifty-eight assessment factors covering technical, organizational, governance, legal, economic, and implementation perspectives.

The taxonomy was validated qualitatively through the same expert group. Participants evaluated the completeness, clarity, practical relevance, and contextual suitability of the factors. Their feedback resulted in refinement of factor definitions, removal of redundant factors, and incorporation of Vietnam-specific considerations, particularly regarding procurement regulations, public-sector governance, and digital transformation maturity.

3.3 Cycle 2: design cycle – development of the feasibility assessment framework

Cycle 2 followed a task-oriented approach commonly adopted in decision-support systems. The development began by analyzing existing technology assessment frameworks, digital transformation maturity models, and blockchain adoption methodologies to identify common evaluation activities (as presented in Section 2). These activities were then compared with the insights from the six expert interviews in Cycle 1. We found out that the assessment should begin by understanding the management problem, collecting sufficient evidence, evaluating feasibility factors objectively, and finally determining an appropriate implementation strategy.

Based on these observations, the assessment process was organized into a sequence of decision stages that reflect how practitioners naturally evaluate new digital initiatives. Each stage has a clearly defined objective, required inputs, assessment activities, and expected outputs. The process was intentionally designed to be iterative; if insufficient evidence is available or critical feasibility conditions are not satisfied, assessors may revisit earlier stages to collect additional information or redefine the project scope before continuing.

To improve consistency among different evaluation teams, every assessment activity is linked directly to the seven feasibility categories and their corresponding fifty-eight assessment factors developed in Cycle 1. Numerical ratings are complemented by documentary evidence and qualitative justification, reducing subjective judgment and increasing transparency. The resulting process constitutes the second design artifact of this research (Artifact A2), providing a standardized workflow that can be implemented consistently across different blockchain projects within the construction and transportation sectors.

3.4 Cycle 3: rigor cycle – web-based operationalization

Cyle 3 operationalized the assessment framework as an interactive web-based decision-support system that improves consistency, transparency, and usability during practical assessments. The web application implements the complete assessment workflow developed in Cycle 2. Users are guided through each assessment domain using structured questionnaires corresponding to the fifty-eight assessment factors. For every factor, users record numerical ratings, qualitative justification, and supporting evidence. The system automatically aggregates scores, visualizes strengths and weaknesses across assessment domains, and generates comprehensive assessment reports.

The resulting artifact, **Artifact A3**, is a web-based blockchain feasibility assessment platform implementing the proposed framework and providing automated scoring, visualization, documentation, and reporting functionalities. The usability and practical applicability of the platform were evaluated through demonstration sessions with three evaluators. The evaluators were recruited through the author's professional network , and their profiles are shown in Table 3. The prototype was evaluated by three domain experts who had previously participated in the framework validation process. Each evaluator was first introduced to the objectives of the framework and the functionality of the web application. They were then asked to complete a pilot project assessment, including scoring the assessment factors, providing textual justifications, and reviewing the automatically generated feasibility dashboard. After completing the assessment, the experts independently evaluated the prototype using five criteria: ease of use, relevance, completeness, efficiency, and overall value.

Table 3: Summary of framework evaluators

ID	Background	Experience
R1	Full Professor in Construction Engineering, Vietnamese university	>20 years research
R2	Senior Project Manager, Construction Company, Vietnam	>10 years industry experience
R3	Full Professor in Information Technology and Blockchain, Norwegian university	>10 years research

4 Results

4.1 Cycle 1: a taxonomy of blockchain feasibility factors

The interviews complemented the literature review by revealing contextual factors that are rarely emphasized in generic blockchain adoption frameworks. While many factors identified in prior studies were confirmed, participants highlighted several conditions that appear particularly important in the local public construction and transportation sector. Five overarching themes emerged as below:

Theme 1. Blockchain should solve a clearly defined governance problem rather than be adopted because of technological novelty. Across interviews, experts consistently argued that blockchain should not be viewed as a universal digital infrastructure. Instead, adoption should begin with a concrete governance problem such as payment disputes, document authenticity, or auditability. One participant emphasized that the most important question is not whether blockchain should be used, but what exactly needs to be traced:

> "What exactly are we trying to trace? That is the important question." (E1)

Similarly, an industry practitioner explained that their organization adopted only selected blockchain mechanisms rather than a complete blockchain platform:

> "We only implemented part of it (Blockchain solution)." (E4)

These findings suggest that feasibility depends primarily on problem-solution fit rather than technology availability. This insight directly informed the Problem Relevance and Blockchain Necessity dimensions of the framework.

Theme 2. Organizational and institutional barriers outweigh technical limitations. Participants rarely considered blockchain technology itself to be the principal obstacle. Instead, organizational inertia, fragmented governance, and conflicting stakeholder incentives were repeatedly identified as the major implementation challenges.

One interview described the industry's resistance as stemming from established work habits rather than technical capability:

> ”Construction personnel are simply accustomed to existing ways of working.” (E2)

Another participant highlighted that transparency may threaten existing interests:

> ”I want transparency, but I do not necessarily want all financial information to become visible.” (E3)

These observations reinforce that blockchain projects are socio-technical initiatives requiring governance alignment and stakeholder commitment rather than purely technical deployment.

Theme 3. Successful blockchain adoption favors selective, hybrid implementation. A particularly distinctive finding from practitioners with implementation experience is that successful projects rarely deploy ”full blockchain” architectures. Instead, organizations selectively integrate blockchain components—such as cryptographic hashes and immutable audit trails—while keeping most operational data off-chain. As one participant explained:

> ”We use certain blockchain techniques rather than the complete blockchain.” (E4)

Similarly, participants noted that complete on-chain implementation could unnecessarily increase infrastructure costs and reduce performance:

> ”There needs to be a balance between security and performance.” (E4)

These insights support evaluating the degree of blockchain adoption rather than treating blockchain as an all-or-nothing technology.

Theme 4. High-value, legally sensitive processes represent the strongest blockchain opportunities

Interviewees consistently converged on a relatively narrow set of high-value use cases where blockchain provides clear advantages. Payment management, contract execution, milestone verification, document authentication, and legally significant records were repeatedly mentioned. One expert stated:

> ”The most feasible application is payment management.” (E6)

Another practitioner emphasized that blockchain primarily strengthens evidentiary assurance:

> ”It provides evidence later to verify whether this is the original contract.” (E5)

Conversely, participants considered blockchain substantially less suitable for subjective activities such as quality assessment or loosely structured construction processes.

Theme 5. Incremental pilot deployment is more realistic than organization-wide transformation. Rather than advocating comprehensive transformation, nearly all experts recommended starting with narrowly scoped pilot projects involving standardized processes and measurable outcomes.

Participants also highlighted the importance of consortium governance, phased implementation, and hybrid on-chain/off-chain architectures before considering larger-scale deployment. These findings motivated the inclusion of the Pilotability, Evidence, and Scale Path dimension within the proposed framework.

4.2 Cycle 2: framework structure and assessment logic

The proposed framework operationalizes blockchain feasibility assessment as a structured five-stage decision-support process, guiding practitioners from problem identification to implementation recommendations.

Stage 1 – problem definition and scope identification. The first stage identifies the management problem, project objectives, evaluation scope, stakeholders, existing business processes, current information systems, and available digital infrastructure. The purpose of this stage is to determine whether the project actually represents a suitable candidate for blockchain adoption. Projects that do not require multi-party collaboration, distributed trust, immutable records, or shared governance may be more appropriately addressed using conventional centralized information systems.

Stage 2 – evidence collection. After defining the assessment scope, evaluators collect supporting evidence required for the assessment. Evidence may include project documentation, business process descriptions, BIM models, ERP reports, IT architecture documents, organizational policies, financial reports, digital transformation strategies, legal regulations, stakeholder interviews, and other relevant documentation. Where documentary evidence is insufficient, additional interviews or workshops may be conducted to clarify missing information.

Stage 3 – feasibility assessment. Each of the fifty-eight assessment factors is evaluated using a five-point Likert scale ranging from 1 (*Very Low*) to 5 (*Very High*). Assessments are performed independently for each factor based on available evidence rather than subjective opinions. Every rating must be supported by qualitative justification and documentary evidence. If sufficient evidence is unavailable, the corresponding factor remains unassessed until additional information is collected.

Table 4: Overview of the proposed blockchain feasibility assessment framework

Assessment Category	#	Assessment Factors
Problem Relevance and Blockchain Necessity (PR)	8	PR1 Problem significance; PR2 Governance impact; PR3 Multi-party collaboration; PR4 Transparency and trust requirements; PR5 Blockchain comparative advantage; PR6 Expected value addition; PR7 Need for immutable digital evidence; PR8 Shared data infrastructure requirement.
Use-case Fit and Process Codifiability (UC)	9	UC1 Process standardization; UC2 Rule codifiability; UC3 Objective verification; UC4 Transaction frequency; UC5 Digital workflow maturity; UC6 Smart contract suitability; UC7 Process stability; UC8 Automation potential; UC9 Exception handling complexity.
Data and Digital Readiness (DR)	10	DR1 Data quality; DR2 Data availability; DR3 Digital identity management; DR4 Interoperability; DR5 Existing digital platforms (BIM/ERP/GIS/IoT); DR6 Metadata standardization; DR7 Data governance; DR8 Cybersecurity readiness; DR9 On-chain/off-chain architecture readiness; DR10 ICT infrastructure maturity.
Governance and Adoption Feasibility (GA)	11	GA1 Leadership commitment; GA2 Stakeholder commitment; GA3 Governance structure; GA4 Organizational readiness; GA5 Digital capability; GA6 Human resources and skills; GA7 Change management; GA8 Collaboration mechanisms; GA9 Incentive alignment; GA10 Operational responsibility; GA11 Long-term sustainability.
Legal and Public-sector Compatibility (LP)	7	LP1 Legal compliance; LP2 Electronic transactions; LP3 Smart contract legality; LP4 Personal data protection; LP5 Public procurement compatibility; LP6 Regulatory support; LP7 Institutional alignment.
Economic and Public Value Case (EV)	7	EV1 Cost-benefit justification; EV2 Implementation cost; EV3 Operational cost; EV4 Public value creation; EV5 Efficiency improvement; EV6 Return on investment; EV7 Financial sustainability.
Pilotability, Evidence and Scale Path (PS)	6	PS1 Technology maturity; PS2 Pilot feasibility; PS3 Availability of empirical evidence; PS4 Risk management; PS5 Scalability; PS6 Replication and long-term deployment potential.

Stage 4 – result aggregation and analysis. Assessment scores are aggregated within each feasibility category to identify strengths, weaknesses, and major implementation risks. The score of each category is calculated as the arithmetic mean of all assessment factors within that category:

$$Score_i = \frac{\sum_{j=1}^{n_i} Score_{ij}}{n_i} \tag{1}$$

where $Score_i$ represents the score of assessment category i, $Score_{ij}$ denotes the score assigned to factor j within category i, and n_i is the total number of factors belonging to category i.

Equal weighting was intentionally adopted in this version of the framework to improve transparency, interpretability, and ease of practical adoption. Because no empirical evidence currently demonstrates that particular feasibility dimensions consistently outweigh others across blockchain applications, assigning equal weights avoids introducing unsupported assumptions. Organizations may adapt the weighting scheme according to their priorities.

The overall project feasibility score can subsequently be computed using either an unweighted average or a weighted aggregation of the category scores, depending on organizational priorities. In addition to numerical scores, evaluators analyze low-scoring factors to identify implementation risks and prerequisite improvements before deployment.

Stage 5 – feasibility classification and recommendation. Based on the aggregated assessment results, projects are classified into one of four feasibility levels (Table 5):

Table 5: Feasibility classification

Average Score	Recommendation
4.5–5.0	Highly Feasible (Immediate implementation)
3.5–4.5	Feasible (Minor improvements required)
2.5–3.5	Conditionally Feasible (Address key gaps first)
<2.5	Not Feasible (Blockchain not recommended)

The final recommendation considers not only the overall feasibility score but also the performance of critical assessment categories. For example, projects receiving high overall scores but exhibiting substantial weaknesses in governance or legal compatibility should still be regarded as high-risk implementations. This multi-dimensional interpretation prevents misleading conclusions that may arise from relying solely on aggregated numerical scores and better reflects the socio-technical complexity of blockchain adoption in construction and transportation projects.

As shown in Figure 1, the framework guides assessors through a five-stage evaluation process, from project definition and evidence collection to structured assessment across seven feasibility dimensions, score aggregation, and implementation recommendations. The workflow is operationalized through a web-based decision-support system that supports standardized assessment, visualization, documentation, and reporting.

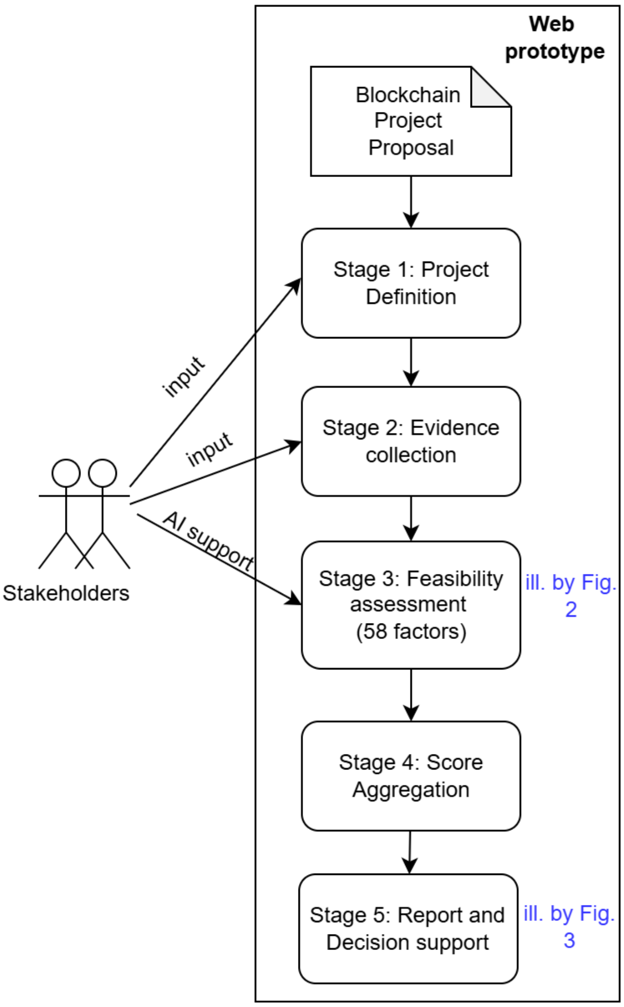

Figure 1: Overview of the proposed blockchain feasibility assessment framework.

4.3 Cycle 3: web application

Figure 2 illustrates the assessment interface, where evaluators rate individual factors using a five-point Likert scale and record qualitative evidence supporting each assessment. The assessment follows the seven dimensions in sequential tabs to guide users through the evaluation process. Within each dimension, individual assessment factors are displayed together with their descriptions and scoring guidance. Evaluators assign a score on a five-point Likert scale, provide a textual justification, and may optionally attach supporting evidence or AI-assisted explanations.

After all assessment factors have been evaluated, the system automatically aggregates the individual scores and presents the results through an interactive summary dashboard, as shown in Figure 3. The dashboard reports the overall feasibility score together with the number of missing assessments and critical gaps requiring attention. It also visualizes assessment results using radar and bar charts to compare the seven feasibility dimensions, while a factor heatmap highlights strengths, weaknesses, and incomplete evaluations at the individual factor level. These visualizations enable decision makers to quickly identify areas requiring further evidence or organizational improvement before blockchain implementation.

Table 6 summarizes the evaluators' ratings after using the web platform in a demonstration section. The evaluation results indicate a highly positive perception of the proposed tool, with an overall mean score of 4.73 out of 5. The experts unanimously rated the relevance and overall value of the tool at the maximum score (5.0), suggesting that the artifact effectively addresses the practical need for a structured blockchain feasibility assessment. Ease of use and completeness also received high average ratings (4.67), indicating that experts found the interface intuitive while considering the assessment framework sufficiently comprehensive for real-world decision-making. Efficiency obtained the lowest average score (4.33), with reviewers suggesting that future versions could further streamline data entry and automate evidence collection to reduce evaluation effort. The expert feedback was analysed descriptively and used to identify opportunities for improving the usability and functionality of the prototype.

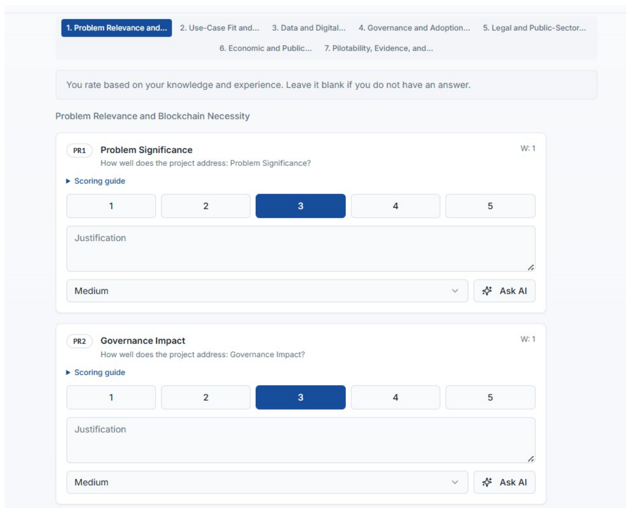

Figure 2: Individual rating for factors.

5 Discussion

5.1 Answering the research questions

Regarding RQ1, we found that blockchain feasibility in public construction and transportation projects extends be-

Table 6: Expert evaluation of the web-based assessment tool

Criterion	R1	R2	R3	Mean
Ease of Use	5	4	5	4.67
Relevance	5	5	5	5.00
Completeness	4	5	5	4.67
Efficiency	4	4	5	4.33
Overall Value	5	5	5	5.00
Overall Mean				**4.73**

yond technological suitability to encompass governance, organizational readiness, legal and regulatory compatibility, economic viability, implementation capability, and expected public value. By integrating evidence from the systematic literature review and expert interviews, the study identified seven feasibility dimensions comprising fifty-eight assessment factors that collectively capture the key considerations for blockchain adoption.

Regarding RQ2, the findings showed that these feasibility factors can be effectively organized into a structured assessment process that guides practitioners from problem definition to implementation recommendation. The framework supports systematic evidence collection, transparent evaluation, and consistent decision-making while remaining flexible enough to accommodate projects with different levels of organizational maturity and data availability.

Regarding RQ3, we found that the conceptual framework can be successfully operationalized through a web-based decision-support system. Expert evaluation indicated that the software artifact provides a practical, usable, and transparent mechanism for conducting standardized blockchain feasibility assessments, demonstrating its potential to support real-world decision-making in public construction and transportation projects.

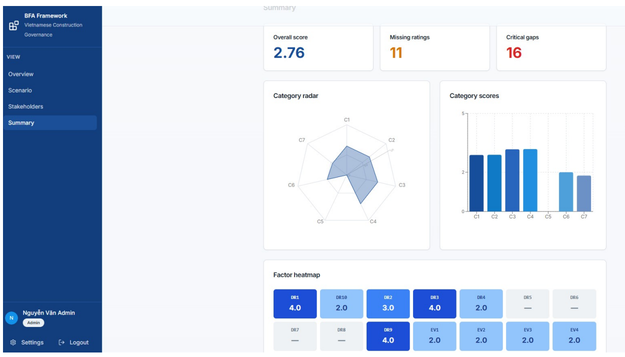

Figure 3: Summarized result for the project possibility

5.2 Comparison with existing frameworks

Existing frameworks such as blockchain suitability assessment checklists and industrial decision frameworks primarily focus on determining whether blockchain is technically appropriate for a given application. Similarly, Technology–Organization–Environment (TOE) frameworks and related

Table 7: Summary of findings by research question

RQ	Main Finding	Contribution
RQ1	Identified 7 feasibility dimensions and 58 assessment factors.	Blockchain feasibility taxonomy for public construction and transportation.
RQ2	Developed a five-stage evidence-based assessment process.	Actionable decision-support framework for blockchain feasibility assessment.
RQ3	Implemented and positively evaluated a web-based assessment tool.	Validated software artifact supporting transparent and repeatable decision making.

adoption models identify organizational and environmental determinants of technology adoption but generally stop short of providing an operational decision-support process. Multi-Criteria Decision-Making (MCDA) approaches offer rigorous scoring and weighting mechanisms, yet they are typically applied as generic evaluation techniques rather than comprehensive blockchain feasibility frameworks tailored to a specific application domain. Our proposed framework extends the current state of the art in several respects. First, it is specifically designed for public construction and transportation projects, where blockchain adoption is influenced not only by technical considerations but also by governance structures, procurement regulations, stakeholder coordination, and public-sector requirements. Second, rather than providing a checklist of independent assessment criteria, the framework operationalizes blockchain feasibility as a structured five-stage workflow that guides practitioners from problem definition and evidence collection through feasibility assessment, score aggregation, and implementation recommendation. Third, the framework integrates seven complementary feasibility dimensions comprising 58 assessment factors, enabling a more comprehensive evaluation than approaches focusing on individual technical or organizational aspects. Finally, unlike most existing studies, the framework is implemented as a web-based decision-support system that standardizes evidence collection, scoring, visualization, and reporting, thereby improving the transparency, repeatability, and practical applicability of blockchain feasibility assessment.

5.3 Limitations

Several limitations should be considered when interpreting the findings of this study.

First, although the feasibility factors were derived from a comprehensive systematic literature review and refined through expert interviews, the interview sample consisted of six domain experts. While the participants represented diverse perspectives from academia, industry, construction law, and digital transformation, the sample size remains relatively small. Consequently, the framework reflects expert consensus rather than statistical representativeness. Future studies should involve substantially larger evaluator populations representing government agencies, contractors, consultants, and infrastructure owners. To further reduce subjective bias, future deployments may require independent scoring by multiple assessors followed by structured consensus discussions or facilitated workshops.

Second, the framework was developed specifically for blockchain adoption in the construction and transportation sectors within a specific developing country, which is Vietnam. Although many of the identified feasibility factors are grounded in international literature and are likely transferable to other domains, several criteria were adapted to reflect Vietnam's regulatory environment, digital transformation initiatives, and institutional practices. Therefore, the framework may require contextual adaptation before being applied to other countries or industrial sectors. Future work will validate the framework through multiple real-world blockchain feasibility assessments involving completed and ongoing construction projects, enabling comparison between predicted feasibility and actual implementation outcomes. Future studies shall also validate the framework across different countries, private-sector projects, and other infrastructure domains to establish broader applicability.

Third, the evaluation focused primarily on expert assessment of the framework and its web-based implementation. Three independent evaluators assessed the usability and perceived usefulness of the decision-support tool, providing qualitative feedback and Likert-scale ratings. Although the evaluation demonstrated positive acceptance, it did not include longitudinal deployment within actual blockchain implementation projects. Consequently, the effectiveness of the framework in improving real investment decisions and project outcomes remains to be empirically validated.

Fourth, the web-based tool is intended for deployment within a secure organizational or government information environment, where access control, authentication, and data governance are managed by the underlying infrastructure. If the framework is adopted as part of a larger national or sector-wide digital platform, additional privacy, cybersecurity, and governance mechanisms should be incorporated into the overall system architecture.

Finally, the proposed assessment model currently assigns equal importance to all feasibility factors within each assessment category. While this design improves transparency and ease of use, different organizations or application scenarios may prioritize certain criteria differently. Future research could investigate weighting mechanisms using methods such as the Analytic Hierarchy Process (AHP), Analytic Network Process (ANP), Best-Worst Method (BWM), or other multi-criteria decision-making techniques to better reflect varying organizational priorities.

6 Conclusion

This paper presented a Design Science Research approach for developing a blockchain feasibility assessment framework for public-sector construction and transportation projects. The proposed framework integrates blockchain-specific feasibility factors into a structured five-stage decision-support process covering problem definition, evidence collection, feasibility assessment, score aggregation, and implementation recommendations. Operationalized as a web-based decision-support system, the framework supports standardized assessment, automated scoring, visualization, and reporting. Expert evaluation demonstrated high perceived usability and usefulness, suggesting that the proposed artifact can improve the transparency, consistency, and repeatability of blockchain investment decisions while extending existing blockchain adoption research from descriptive assessment factors toward actionable decision support.

From a practical perspective, the framework provides government agencies and infrastructure organizations with a structured mechanism for evaluating blockchain initiatives before significant investment. From a research perspective, it contributes an operational design artifact that extends existing blockchain adoption research toward actionable decision support.

Several opportunities exist for future research. First, the framework should be deployed in pilot projects within government ministries and public infrastructure organizations to evaluate its applicability under real operational conditions. Second, longitudinal studies should investigate whether applying the framework improves project selection, implementation success, and long-term organizational outcomes. Future work should also investigate application of the framework throughout project lifecycles, integration with complementary digital technologies such as BIM, digital twins, and IoT platforms, and adaptation of the framework for other infrastructure sectors including energy, healthcare, and manufacturing. Third, the current assessment model employs equal weighting across assessment factors. Future research could investigate adaptive weighting mechanisms using multi-criteria decision-making techniques, such as the Analytic Hierarchy Process (AHP), Best-Worst Method (BWM), or machine learning approaches trained on empirical project outcomes. Finally, as additional blockchain deployments become available, the framework can be continuously refined by calibrating evidence thresholds, updating assessment criteria, and extending the knowledge base to support broader application across different sectors and countries.

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