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Ethical and social implications of smart contracts in construction: comparison with Joint Contracts Tribunal procedures

Navaneeth Narendra Vasudeva

School of Science, Engineering & Environment, University of Salford,
Manchester, UK (Orcid:0000-0001-5773-8418) (corresponding author:
n.n.vasudeva1@salford.ac.uk, vasu114@gmail.com)

Paul Tracey

University of Salford, Manchester, UK

The ethical and social implications of smart contracts (SC) in the construction industry are examined, with a particular focus on their interaction with the Joint Contracts Tribunal (JCT) suite of standard forms. Using a qualitative, narrative literature review, this article compares blockchain-enabled automation with established contractual mechanisms, concentrating on payment processes, governance and the role of professional judgement. Although the findings suggest that SC can enhance transparency and payment integrity, especially in a building information modelling enabled environment, they also introduce rigidity, reduce the scope for discretionary decision making and raise concerns regarding fairness, inclusivity and legal certainty. A hybrid model is proposed in which SC complement, rather than replace, JCT mechanisms, preserving relational trust and interpretative flexibility while delivering auditable efficiency where automation adds genuine value. The review draws on peer-reviewed academic literature, industry reports and material relevant to contemporary UK construction practice. Academic databases (Scopus, ScienceDirect, Taylor & Francis Online and the ICE Virtual library) were searched using targeted keywords. Sources were selected based on relevance, academic rigour and recency, with priority given to publications from the past decade.

Keywords: blockchain; blockchain in construction; contracts & law; digital ethics; digital transformation; digital twin; ethics; JCT payment terms; smart contracts; social impact of automation

1. Introduction

From the Code of Hammurabi to contemporary digital platforms, societies have sought to reduce ambiguity in commercial relations by formalising obligations through written law (Harper, 1904). Blockchain-based smart contracts (SC) are a modern manifestation of that impulse of self-executing protocols that encode agreed conditions and automatically perform predefined outcomes to reduce ambiguity (Wells, 2010). Their attraction lies in automation, immutability and transparent auditability. However, risk lies in rigidity and the diminished space for context-sensitive judgement (Tonelli *et al.*, 2023).

This paper situates SC within UK construction practice, where the Joint Contracts Tribunal (JCT) suite (JCT, 2024a) remains the dominant framework for relational governance and professional discretion. With the Procurement Act 2023 taking effect in the UK in February 2025, the sector faces renewed pressure to embrace digital agility while upholding fairness, flexibility and social value. Accordingly, the critical enquiry concerns where SC may appropriately enhance JCT contractual procedures, and where discretionary, interpretative human judgement must continue to prevail.

1.1 From the Code of Hammurabi to blockchain

Rigidity and enforceability, reflecting a highly perspective conception of justice, are anchored in dominant authority rather than

relational negotiation (Werbach and Nicolas, 2017). This rigidity can be observed in contemporary blockchain-based SC, which encode commercial terms within an immutable and transparent digital architecture (Chong and Cheng, 2023). As self-executing agreements deployed on distributed ledgers, SC prioritise automation and certainty over contextual judgement. This raises critical questions about adaptability, quality and the role of human discretion in contractual governance (Tonelli *et al.*, 2023).

1.2 Defining SC

Digital innovation is increasingly transforming contractual practice in the construction industry (Tonelli *et al.*, 2023). SC are event-driven programmes deployed on distributed ledgers that automatically execute specified actions once predefined conditions are met (Nakamoto, 2008). Accordingly, SC are essentially computer codes that execute a predefined logic and do not inherently constitute legally binding contracts in a traditional legal sense (Taherdoost, 2023).

While early conceptualisations by Szabo (1997) imagined SC as digital analogues of legal promises, contemporary authors highlight that such protocols operate as ‘if-then’ logic structures whose outputs are constrained by code and consensus mechanisms on the network (Finck, 2019). The state of Arizona defines SC as event-driven programmes that can take custody of and transfer

assets on a shared, replicated ledger (SoA, 2017). According to the UK Government Chief Scientific Adviser, blockchain is a type of database that groups records into blocks and links them cryptographically, enabling a shared ledger among permissioned participants (GCSA, 2016). At present, a legal framework specifically tailored to blockchain technologies and SC is needed; however, the limited specific regulations do not mean the general principles of law do not apply to blockchain technologies and SC, nor that they are completely unregulated.

The modernisation of the JCT 2024 suite (JCT, 2024a) represents a critical pivot in the long history of contractual agreements. As Industry 5.0 takes hold, the construction sector must transition from purely relational contracts to hybrid systems that prioritise human centric values (Mason, 2021). This transition is not merely theoretical; with the Procurement Act 2023 coming into effect on 21 February 2025, the legal mandate for digital agility is now a matter of regulatory urgency. However, its adaptation in the construction sector raises important ethical and social concerns, especially regarding flexibility, fairness and the role of law in human relationships. A key ethical and social concern is that SC may undermine the social and relational functions traditionally supported by construction contracts (Maurice *et al.*, 2022).

1.3 Research framework

This analysis is organised around three interconnecting themes

- the rigidity of SC and emerging risks associated with loss of flexibility and human judgement
- social perspectives in the context of standard forms of contract
- the challenges of security, trust and legal uncertainty.

These themes frame a comparison between automated, code-driven execution and the JCT’s human-centred contract administration, which relies on professional norms and legal precedent.

Figure 1 illustrates the evolving landscape of contractual governance in UK construction projects, depicting a progression from the 2023 Procurement Act’s emphasis on transparency, equal treatment, accountability and social value obligations, through the

relational and flexible framework of the JCT 2024 contract suite (with its focus on governance, discretion and social value oversight), to SC-enabled contract administration ultimately leading to enhanced project delivery outcomes such as efficiency, transparency, ethical compliance and evidenced statutory/social value metrics.

SC rely on rigid, automated execution with limited scope for human intervention, prioritising certainty and efficiency (Chong and Cheng, 2023). In contrast, the JCT contracts operate as relational frameworks that depend on professional judgement, flexibility and established legal precedents (JCT, 2024a). The choice between them is therefore not merely technical, but a strategic decision about whether construction projects are governed through self-executing automation or through dynamically administered, trust-based contractual relationships.

Table 1 provides a comparative analysis of blockchain-enabled SC and traditional JCT standard forms, highlighting key differences in logic, execution, flexibility and basis of trust in construction contract administration. This table contrasts the rigid, automated and code-driven characteristics of SC with the relational, discretionary and professionally administered approach of established JCT contracts, which emphasise collaborative norms, contextual judgement and legal precedence for handling complex and variable construction projects.

2. Rigidity and emerging risks associated with SC

Unlike the Code of Hammurabi (Harper, 1904), which operated within a broader framework of royal interpretation and justice, SC risk transforming contractual justice into an inflexible, rigid system where code becomes the unappealable sovereign, potentially sacrificing fairness and contextual adaptability for the illusion of perfect enforceability.

2.1 The Szabo definition

The concept of SC, originally coined by Nick Szabo as ‘a set of promises specified in digital form including protocols within

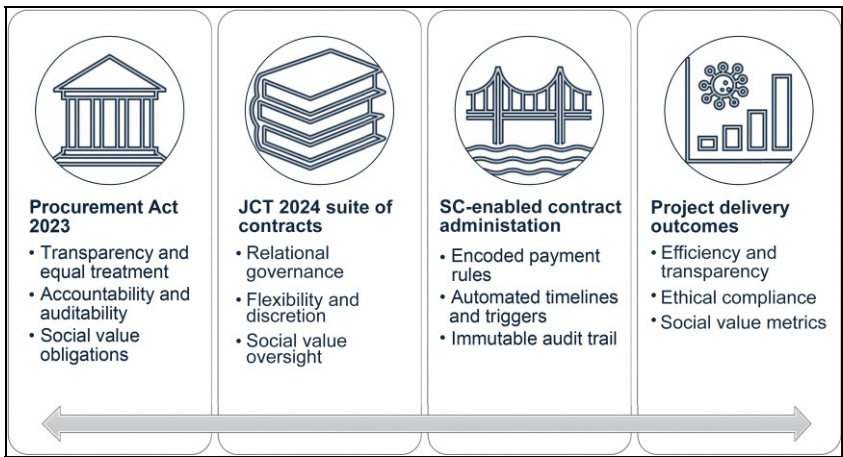


Figure 1. Modern construction procurement and administration

Table 1. Core comparison between automation and human judgement

Feature	Blockchain enabled SC	JCT standard forms
Logic	'Vending machine' logic: payment precedes delivery; rule-based execution	Relational logic: relies on professional norms and collaborative interaction
Execution	Self-executing and autonomous; outcomes are largely irreversible	Traditional administration requiring professional communication
Flexibility	Rigid by design; limited capacity to handle unforeseen variations	Inherently flexible; allows for discretionary judgement and contextual adjustments
Basis of trust	Technological determinism; 'trust by design' through code	Relational trust; derived from professional authority and legal precedence

which the parties perform on these promises' (Szabo, 1997), established the foundational terminology that continues to dominate contemporary discourse (Nakamoto, 2008). While this formulation prioritises technical execution through digital protocols, it fails to fully account for the relational and interpretative flexibility inherent in traditional contract law (Mason, 2017). Critics argue that SC prioritise the technical form of the contract at the expense of the social contexts in which contracts operate, potentially creating inflexibility that undermines the routine social functions the law is expected to serve.

2.2 Autonomous execution

Autonomous execution lies at the conceptual core of SC and represents their most disruptive characteristic. It is defined as computerised protocols that execute the terms of the contract. It is claimed that SC are designed to satisfy common contractual obligations while providing an automated performance mechanism (NRF, 2016). These contracts are digital, embedded in code and operate autonomously once initiated, making their outcomes largely irreversible (Mason, 2021). While this autonomy enhances predictability and reduces administrative costs, it simultaneously introduces rigidity.

The principal attraction of autonomous execution is predictability. Once initiated, SC performs exactly as coded, reducing the risk of opportunistic behaviour, strategic delay or non-performance. Mason (2021) notes that this deterministic nature of execution produces outcomes that are largely irreversible. This limits opportunities for correction and equitable adjustments in response to unforeseen circumstances, thereby creating high-stakes outcomes with limited recourse.

On the other hand, traditional contracts are not merely instruments of enforcement but frameworks for managing uncertainty (JCT, 2024a). They anticipate the possibility of error, ambiguity and unforeseen circumstances, providing mechanisms such as variation clauses, dispute resolution procedures and equitable remedies (Mason, 2021). By contrast, autonomous SC lack the inherent capacity for discretion or contextual assessment. The irreversibility of execution is especially problematic when errors occur. Coding bugs, flawed logic or inaccurate external data inputs can trigger unintended outcomes with limited scope for correction (Fukuda, 2020). Unlike traditional contracts, where mistakes may be rectified through renegotiation or judicial intervention, SC may execute immediately and irreversibly, transferring assets or enforcing penalties before parties can respond (Hochscheid *et al.*, 2023). For SC to be viable in complex commercial environments,

autonomy must be addressed by governance mechanisms that allow for intervention, suspension or override.

2.3 Reducing intermediaries

Szabo's analogy with vending machines illustrates the principle of payment first, delivery second – highlighting the automatic and rule-based nature of SC (Szabo, 1997). Thus, it is argued that this approach reduces the need for third-party intermediary institutions (Nakamoto, 2008). Therefore, the defining features of SC are automation, immutability and decentralisation, which reduce reliance on intermediaries but also create rigid, high-stakes failure modes in technical, economic and legal dimensions.

However, SC are frequently promoted for their ability to reduce reliance on third-party intermediaries. Some scholars argue that SC constitute agreements between parties, expressed in digital code, and some believe that they should be considered self-sufficient and legally binding agreements (Werbach and Nicolas, 2017) because SC clearly create obligations that stand independently of their digital code. While the code is designed to automate performance, it does not exhaust the normative content of the agreement itself. Where malfunctions in SC occur due to a coding error, the existence of a binding obligation should not be extinguished merely because its technological mechanisms failed to perform as intended. For example, if party A agrees to transfer property to party B in exchange for an agreed sum, the contractual obligation arises from the mutual assent, and consideration comes not due to the successful execution of the code. Thus, a failure in SC should be treated as a failure of performance, not a failure of obligation.

This distinction mirrors established analogies in consumer and contract law, such as vending machines, where the insertion of money creates a binding obligation to deliver the selected goods regardless of mechanical failure (Nakamoto, 2008). An experience of one of the authors further illustrates this point. A photo booth processed images incorrectly due to a system error, but nevertheless charged for the prints. Despite the automated nature of the transaction, the operator accepted responsibility and issued a refund following customer service intervention. This demonstrates that even in highly automated systems, human and legal accountability persists beyond the code.

Accordingly, SC should be understood as tools for performance rather than a substitute for legal obligation. Treating code as a medium for technical execution without regard for contractual intent undermines established principles of fairness, remedy and accountability, which are particularly relevant in complex construction contracts.

While the technical and legal dimensions of SC have been examined, their deployment in construction also raises important ethical and social questions that warrant careful consideration. Table 2 presents a comparative analysis of the ethical and social implications associated with SC and JCT standard forms across six key aspects: payment mechanisms, transparency, dispute resolution, risk allocation, contractual flexibility, and governance and accountability. These considerations are essential to understanding whether SC can be implemented in ways that uphold the ethical standards and social responsibilities expected within the construction industry.

3. Social perspective in the context of standard forms of contracts

Within the scope of this study, the conventional standard forms of contract and the SC concepts were examined and their respective advantages and disadvantages considered. In the scope of this work, the following documents were examined and analysed.

- The Standard Building Contract with Quantities (SBC/Q 2024) (JCT, 2024b).
- The Standard Building Contract Guide (SBC/G 2024) (JCT, 2024c).
- The Procurement Act 2023.
- The procurement guide published by the Ministry of Defence (MoD, 2025).
- The report by Boyce (2000).
- Existing literature relating to SC.

3.1 Comparative analysis

Boyce (2000) argues that MoD procurement processes are frequently characterised by excessive bureaucracy, slow decision making and an over-reliance on the rigid procedures at the expense

of innovation. While this can be explained under the banner of public accountability, independent audits, most notably by the National Audit Office (NAO, 2025), have exposed inefficiencies, delays and underperformance across organisations. Over-bureaucratic approaches can stifle collaboration, delay project delivery and increase costs, thereby undermining both performance and public trust (Boyce, 2000). While standard JCT forms are a common starting point, they are typically heavily amended and drafted by legal experts to meet the specific commercial and contractual requirements of complex MoD projects (MoD, 2025). The experiences of Boyce underscore the need for embedding procedural compliance within fostering innovation, agility and social value driven outcomes (Constructionline, 2026). For the construction sector, the MoD sets an ideal benchmark, particularly within the context of public procurement and contractual framework, such as the JCT 2024 suite and the UK Procurement Act 2023.

3.2 Modernising and streamlining

The construction industry has long sought a balanced approach to procurement, ensuring accountability and transparency while embracing digital tools, modern procurement methods and contractual mechanisms that promote efficiency, adaptability and innovation (Latham, 1994). Without this balance, the sector risks repeating the systemic inefficiencies that have long challenged the MoD, with detrimental consequences for project outcomes, client satisfaction and long-term industry resilience.

Automated contract terms align well with the current JCT forms, which encourage electronic communication and digital execution (JCT, 2024a). With new statutory requirements embedded in the JCT forms, especially under the Building Safety Act 2022 and Construction Design and Management Regulations (HMG, 2015), SC could offer immutable audit trails for compliance data, while also demonstrating adherence to safety and regulatory standards (HSE, 2022). The Procurement Act 2023 mandates that

Table 2. Ethical and social comparison of SC and JCT standard forms

Aspect	SC	JCT standard forms	Ethical and social implications
Payment mechanisms	Automated payments triggered by predefined conditions and verified data inputs	Interim payments administered through certification and valuation processes; reliance on human interpretation	Automation may improve transparency and cash flow reliability but raises concerns regarding fairness where contractual discretion is removed
Transparency	Code-based execution offers high procedural transparency but limited interpretability for non-technical users	Contract terms are explicit, but interpretation may vary across parties	Risk of digital exclusion for SMEs and practitioners lacking technical expertise
Dispute resolution	Dispute resolution mechanisms are less mature and may require off-chain legal intervention	Formal mechanisms such as adjudication, arbitration or litigation are well established	Challenges in accountability and access to justice if automated outcomes are contested
Risk allocation	Risk allocation is embedded in code logic, potentially reducing flexibility	Risks are allocated through standardised clauses with recognised legal precedent	Ethical concern over rigidity and inability to respond to unforeseen circumstances
Contractual flexibility	Variations require reprogramming or hybrid contractual arrangements	Allows amendments, variations and professional judgement	Potential conflict between efficiency and equitable treatment of parties
Governance and accountability	Accountability may be diffused between developers, users and platform providers	Established legal frameworks and professional responsibilities	Raises questions of responsibility, liability and professional ethics

electronic invoices must be accepted and paid within 30 days (GCF, 2022). Thus, SC could automate and validate invoices and trigger payments, reducing administrative burdens and ensuring regulatory compliance, especially if integrated into a building information modelling (BIM) enabled process (Stellmacher *et al.*, 2023). Although the JCT suite of contracts is a time-tested set of standard forms of contract, the integration of SC into the JCT suite can pose a challenge, particularly relating to the risks associated with codifying, rigidity and potential inequality, undermining the social, relational and functions of contract (Georgiou *et al.*, 2024). JCT forms of contracts are inherently flexible, recognising the complexity and variability of construction projects. As already noted, SC are rigid by design, executing only the terms encoded within them and often lacking the capacity to handle unforeseen circumstances or the exercise of discretionary judgement in situations such as when extremely adverse climatic conditions may necessitate adjustments to project schedules and resource allocations, as informed by tools like EHAB's WeatherWise platforms (Maurice *et al.*, 2022). Szabo (1997) observed that intelligent contracts aim to minimise exceptions. However, in construction, the dynamic and context-dependent nature of project activities frequently necessitates changes or variations, which current SC frameworks struggle to accommodate. In addition, the UK construction industry is increasingly required to demonstrate social value as part of procurement and project delivery, following the Public Services (Social Value) Act 2012 and further reinforced by the Procurement Act 2023 (Watts *et al.*, 2024).

3.3 Statutory alignment

Social value encompasses outcomes such as skills development, local employment, community engagement and sustainable practices. In contractual terms, demonstrating and evidencing social value contributions has historically relied on reporting mechanisms, which are often fragmented, subjective and prone to disputes over measurement and verification. Despite the technological promises, the adoption of blockchain technology in the established construction process presents notable challenges (Heiskanen, 2017). Recent developments on SC within construction increasingly engage with themes of digitalisation, automation and ethical implications (Mason, 2021). The JCT 2024 suite introduced four key themes as part of its new launch: modernising and streamlining, new provisions, legislative challenges and future proofing (JCT, 2024a). These themes provide a framework for evaluating the framework for the potential role of blockchain-enabled SC. Under modernising and streamlining, JCT 2024 enhances electronic communication protocols, including provisions for email notices and digital execution. The literature on blockchain highlights comparable efficiencies in the automated notification and certification process (Georgiou *et al.*, 2024). This can be perceived as an alignment between contractual modernisation and distribution ledger application. Blockchain technology offers a potential solution by providing a binding, transparent, auditable ledger of project-related social value commitments and outcomes (Boyce, 2000). The key themes on social value include training apprenticeships and local employment, waste diverted from landfill, the gender pay gap, accident frequency reduction and the provision of staff volunteer hours (Watts *et al.*, 2024).

4. Trust and legal uncertainty

The move towards adopting SC in the construction sector, particularly in relation to established standard forms such as JCT, reveals a correlation between security, trust and legal certainty (Chong and Cheng, 2023). This section analyses this triad, arguing that a purely technological determinist approach risks undermining the relational and discretionary foundations upon which effective construction project governance is built.

4.1 Technological determinism versus relational trust

The adoption of SC signifies a potential shift from relationally based trust to technologically enforced execution. While blockchain-based SC are often promoted for their reliability and security, this rigidity raises concerns relating to BIM limitations and liability (Li *et al.*, 2019). It can be argued that the perceived liability and risks stem primarily from BIM itself or from an inadequacy of contractual and regulatory instruments in accommodating collaborative digital practices (Hochscheid *et al.*, 2023).

4.2 Liability and BIM limitations

Trust is historically constructed through professional norms and, in the context of this paper, the long-standing authority of the JCT contracts (Boyce, 2000). In an SC scenario, the risk tends to be replaced by technological determinism, whereby contractual obligations are executed automatically without scope for negotiation or contextual judgement. Furthermore, legal uncertainty persists due to the lack of definitive judicial treatment of SC in the UK (UKJT, 2019).

These three challenges suggest that while SC may enhance efficiency, their integration into JCT-governed construction projects must be approached with caution, balancing technological potential against relational and doctrinal complexities (Savelyev, 2017).

4.3 Judicial status and legal enforceability

SBC/Q 2024 (JCT, 2024b) is a comprehensive document suitable for use on a wide range of construction projects. The Procurement Act 2023 came into effect on 21 February 2025. Based on this act, many barriers to digitalisation are being removed and the industry is encouraged to implement a central digital platform. The act allows the contracting parties to award contracts using competitive flexible procedures referencing to supplier membership. Similarly, the National Procurement Policy Statement 2025 (GCF, 2025) describes the need for harnessing technology and innovations in construction projects. This policy statement further strengthens the need to consider the social value model in all government projects from October 2025 (Cabinet Office, 2025) when awarding contracts.

In traditional JCT contracts, interim payment due dates are fixed, with the architect/contract administrator issuing an interim certificate within 5 days of the due date. When adopting SC, the dates can be coded on the blockchain immutably, automatically calculating and notifying the due date for each interim payment cycle. Triggers could link to verifiable milestones, based on 4D and 5D BIM models or digital visualisations, ensuring the due date is precisely enforced without manual delays. This process aligns with the Procurement Act's push for digital platforms and reduces payer-led discretion risks under the Construction Act.

Therefore, the introduction of the SC layer to JCT Section 4 represents not merely a technical enhancement but a substantive recalibration of risk allocation and contractual governance. The continued reliance on the contract administrator's certification role and statutory safeguards, most notably pay less notices under Section 4, and the right to decide at any time, therefore remains essential to mitigate the rigidity inherent in self-executing code. Although such adoption aligns with the Procurement Act 2023 and the National Procurement Policy Statement 2025 in promoting digital transparency and efficiency, it may simultaneously exacerbate power asymmetries if automation privileges employers or platform providers. Accordingly, the implementation of SC within the JCT framework must be approached cautiously, ensuring that technological efficiency does not erode contractual flexibility, procedural fairness or the legal safeguards that underpin trust and balance in construction payment practices.

4.4 Social value integration

The effective integration of social value into construction projects requires the establishment of clearly defined outcomes and transparent awarding criteria. Outcomes should extend beyond traditional project metrics to capture the broader societal impact, including economic, environmental and social dimensions (Watts *et al.*, 2024). Key areas of focus may include the creation of new employment opportunities, the enhancement of health and safety standards and the adoption of practices that mitigate climate change.

To ensure the practical delivery of social value, commitments should be formulated according to a framework that is specific, measurable, achievable, realistic and time-bound (Smart). By adopting Smart objectives, project stakeholders can systematically plan, monitor and evaluate social value outcomes, thereby embedding accountability and continuous improvement within project delivery.

Social value considerations should be integrated at the earliest stages of project development, particularly during preliminary engagement with relevant authorities. Procurement authorities must embed social value criteria within tender documentation and evaluation frameworks, using clearly articulated questions, scoring mechanisms and measurable performance indicators (JCT, 2024a). Beyond traditional assessments of cost and quality, this approach ensures that contractors and suppliers are evaluated on their capacity to deliver tangible societal benefits (Mason, 2021). Emerging tools, such as SC, can further enhance accountability by automating the monitoring and enforcement of social value commitments, ensuring that objectives such as job creation, improved health and safety, or environmental sustainability are delivered in a transparent and verifiable manner throughout the project lifecycle (NAO, 2025).

Guidance from the National Procurement Policy (GCF, 2025) highlights that social value considerations are particularly pertinent for projects exceeding £10 million, with an emphasis on fostering innovation and encouraging the adoption of modern methods of construction. Incorporating social value at this scale supports sustainable industry practices while promoting broader economic, social and environmental benefits.

5. Methodology

A qualitative research strategy underpinned by a narrative literature review was adopted for this study to critically examine the ethical, social and contractual implications of SC within the UK construction industry. The methodological stance is interpretative, aligning with the research aim of evaluating not only technological functionality but also the normative, legal and professional dimensions of this transformation. The analysis is specifically contextualised within the framework of SBC/Q 2024 (JCT, 2024b) and the statutory provisions of the Procurement Act 2023. This qualitative approach facilitates a critical engagement with the contested debates and evolving professional discourses that are not readily captured through systematic or quantitative methods alone.

5.1 Qualitative narrative literature review design

A narrative literature review was selected to enable a critical, discursive synthesis of relevant scholarly and professional literature. Narrative literature reviews use qualitative, interpretive logic to synthesise diverse studies and 'tell the story' of a field (Sukhera, 2022). They are less rigid than systematic reviews but can still be designed and reported with transparency and rigour. In contrast to scoping or systematic reviews, which prioritise procedural rigour, exhaustiveness and replicability, the narrative review is suited to interdisciplinary enquiry, allowing for interpretative synthesis and conceptual critique (Fellow and Liu, 2015). This approach is appropriate given that the implications of SC extend beyond technical specifications to encompass social relations, contractual governance structures and professional judgement inherent in construction projects. The design supports a critical reflection on the alignment, or trends, between the encoded logic of SC and the relational, discretionary ethos that underpins standard forms of construction contract, particularly within the JCT suite.

5.2 Search strategy

The literature search was conducted using a structured, yet selective, strategy across established academic databases, including Scopus, ScienceDirect, Taylor & Francis Online and the ICE Virtual Library. To ensure contemporary relevance and alignment with UK practice, these sources were supplemented by industry reports, professional guidance notes and UK government publications.

Search terms were developed iteratively and included combinations of 'smart contracts', 'blockchain in construction', 'JCT 2024', 'digital procurement', 'digital transformation' and 'Procurement Act 2023'. Priority was given to peer-reviewed literature published within the last decade to reflect the rapid evolution of digital contracting technologies; however, earlier seminal works were retained where they offered foundational theoretical or legal insights. The selection of material was guided by relevance, analytical depth and applicability to UK construction procurement and contracting practice, rather than by volume alone.

5.3 Synthesis and interpretation

The synthesis of literature was conducted narratively, permitting thematic development through critical comparison and interpretative analysis. Preliminary reading identified three primary thematic domains

- contractual rigidity and the risks associated with reduced flexibility and diminished professional judgement
- the social and relational dimensions embedded within standard forms of contract
- challenges pertaining to security, trust and legal uncertainty.

These domains were subsequently interpreted through an analytical framework structured around the evolving architecture of SBC/Q 2024 (JCT, 2024b). This framework comprised four lenses: modernising and streamlining, new provisions, legislative changes, and future proofing. The emergent findings were further situated within the statutory obligations and policy objectives of the Procurement Act 2023, particularly concerning transparency, accountability and the delivery of social value.

This synthesising approach facilitated a contextualised and critical understanding of how SC might be positioned to complement, rather than wholly replace, traditional JCT contractual mechanisms. By integrating legal, technical and professional perspectives, the methodology supports conclusions regarding both the potential benefits and inherent limitations of SC in construction procurement, with reference to payment integrity, governance and ethical accountability.

6. Discussion

The literature review highlighted an increasing trend in the integration of SC within the UK construction sector, driven largely by the promise of enhanced efficiency, transparency and accountability. The narrative review indicated that the adoption of blockchain-enabled SC presents both substantial opportunities and notable ethical and legal challenges, particularly regarding enforceability, data privacy and equitable risk allocation. When compared with the JCT 2024 suite, a fundamental trend emerges between the automated precision and efficiency of SC execution and the relational, interpretative and collaborative qualities embedded within traditional standard forms of contract. This comparison underscores the need to critically examine how emerging digital contract technologies can coexist with established legal frameworks and procurement legislation, such as the Procurement Act 2023, to deliver social, economic and environmental benefits within the construction sector.

The JCT 2024 suite introduces several provisions aimed at promoting sustainability and collaborative working. Notably, clause 2.1.2 of SBC/Q 2024 (JCT, 2024b) encourages contractors to propose economically viable amendments to improve environmental performance and sustainability. Additionally, article 3 mandates that parties work cooperatively and in a collaborative manner in good faith, fostering an environment conducive to delivering social value. However, while these provisions advocate for positive outcomes, they lack the automation capabilities inherent in SC.

The Procurement Act 2023 significantly enhances the role of social value within public procurement. It mandates that contracting authorities consider social, economic and environmental benefits throughout the procurement process. The act introduces a more flexible and transparent system, aiming to reduce bureaucratic barriers and increase opportunities for small and medium-sized enterprises (SMEs) and voluntary, community and social enterprises.

6.1 Rigidity and flexibility

The first theme identified the rigidity of SC and confirms a recurring concern in the literature (Maurice *et al.*, 2022; Szabo,

1997). By codifying contractual obligations into software protocols, SC inevitably sacrifice interpretative flexibility and contextual judgement, which are hallmarks of the JCT contracts. Construction projects are inherently dynamic, often requiring changes, variations or subjective assessments. Current frameworks for SC offer limited capacity to accommodate these contingencies, raising risks of inequitable enforcement of the contractual terms. This rigidity underscores the need for hybrid approaches, where blockchain automation supports – rather than displaces – traditional mechanisms of contractual discretion.

6.2 Social context and procurement reforms

The second theme, focused on the social context and standard forms, revealed that JCT contracts and the UK Procurement Act 2023 are increasingly shaped by social value imperatives. Public procurement now emphasises sustainability, skills development and community benefit, requiring contractual structures that enable both accountability and flexibility. SC could enhance transparency by offering auditable ledgers of social value commitments. However, embedding such metrics within immutable code risks reinforcing overly narrow interpretations of value, potentially excluding qualitative and contextual benefits. According to Boyce (2000) and (Watts *et al.*, 2024), excessive bureaucracy has the capacity to constrain innovation – a comparable risk that may emerge should digital contracts evolve into overly technocratic instruments.

Thus, any integration of blockchain within the JCT suite of contracts must balance efficiency gains with an appropriate recognition of construction's socio-relational dimensions.

6.3 Security, trust and legal uncertainty

The third theme highlights that blockchain's promise of trust by design must be tempered by unresolved questions of liability and enforceability. While SC are often presented as secure and tamper-proof, their reliance on technological determinism removes scope for equitable consideration, raising concerns about fairness and accessibility (Chong and Cheng, 2023). Moreover, the absence of definitive judicial treatment in the UK relating to SC perpetuates legal uncertainty (UKJT, 2019). In contrast, the JCT contracts derive legitimacy from long-established legal frameworks, legal precedence and professional norms, ensuring a more stable foundation for dispute resolution. This tension illustrates the paradox of trust: whereas blockchain seeks to eliminate reliance on intermediaries, construction contracts are traditionally embedded within professional, relational and institutional trust networks.

6.4 Industry 5.0

Industry 5.0 represents a convergence of cyberspace and physical space, placing humans, sustainability and resilience at the centre of technological development. Emerging in response to the limitations and disruptions of rapid digitalisation, Society 5.0 aims to integrate artificial intelligence, robotics and data processing to enhance human capability and societal wellbeing (Fukuda, 2020). In construction, this approach supports hybrid frameworks where automation and SC complement rather than replace human judgement, enabling project stakeholders to achieve efficiency while maintaining flexibility, ethical responsibility, and social value. According to Fukuda (2020) the Society 5.0 concept exemplifies

this human-centric integration, providing a model for balancing technological innovation with societal needs.

6.5 Ethical implications

From an ethical standpoint, two critical considerations emerge. First, automation risks exacerbating digital exclusion, particularly for SMEs or practitioners lacking the resources to engage with blockchain systems. Second, fairness in contract administration may be compromised if immutable code disproportionately benefits stronger parties who are able to influence contract mechanisms and design. These risks reinforce the need for ethical frameworks that ensure inclusivity, transparency and proportionality in adopting SC within construction.

Taken together, the findings suggest that SC should not be conceived as wholesale replacements for established JCT mechanisms but rather as potential enhancements to targeted areas, particularly payment integrity and compliance auditing. Their role is best framed as complementary, embedding efficiency in transactional processes while retaining human judgement in interpretative and discretionary matters.

7. Conclusion

The ethical and social implications of SC in the construction industry were explored, with particular emphasis on the JCT 2024 suite and the evolving statutory environment under the Procurement Act 2023. By adopting a narrative review approach, three central themes were identified

- rigidity and emerging risks
- social prospectus in the context of standard forms
- security, trust and legal uncertainty.

7.1 Complementary versus wholesale replacement

While blockchain-enabled SC offer significant potential to enhance transparency, automate payment processes and provide auditable compliance records, their current limitations render them ill-suited as wholesale replacements for standard forms of construction contracts. The JCT 2024 suite pursues a deliberately pragmatic and incremental pathway to digitalisation, aligning with new statutory duties while cautiously preserving the interpretative flexibility and relational fairness central to traditional construction contracting. This approach prioritises industry stability and manageable transition over disruptive innovation.

7.2 Evolutionary change

In practical terms, construction stakeholders should approach SC with cautious optimism. Their adoption should be incremental, supported by hybrid contractual frameworks that allow for both automation and human judgement. Policymakers and professional

bodies must provide clearer regulatory and ethical guidance, ensuring that the benefits of digitalisation do not come at the expense of fairness or inclusivity.

Ultimately, the integration of SC into construction procurement represents an evolutionary rather than revolutionary change. Like the Code of Hammurabi (Harper, 1904), which codified but did not eliminate interpretative justice, blockchain-based contracts must coexist with legal and social practices that acknowledge the complexity of human relationships in construction. The challenge for industry lies not in replacing the JCT suite with code, but in embedding technological innovation within frameworks that sustain trust, fairness and social value.

7.3 Future research directions

Future research should examine how the construction industry can adopt digital and blockchain technologies while preserving flexibility, social value and ethical oversight, drawing on the experiences of organisations such as the MoD. Case studies could explore the practical implementation of SC and distributed ledger systems across varied project types, assessing impacts on procurement efficiency, transparency and stakeholder collaboration. Attention should also be given to ethical considerations, including data privacy, accountability and equitable access, alongside potential barriers such as integration with legacy systems, skills gaps and regulatory constraints.

The construction industry stands at a pivotal juncture, where the integration of digital and blockchain technologies offers a transformative opportunity to enhance efficiency, transparency and collaboration. However, as we advance towards Industry 5.0, it is imperative that these technological advancements are harmonised with human-centric values, ethical considerations and a commitment to social value. As highlighted by Heiskanen (2017), the potential for these technologies to revolutionise the sector is immense. By investigating these dimensions, research can inform a framework for digitally enabled construction practices that balance innovation with responsible governance and societal benefit, positioning the industry for Industry 5.0.

8. Key contributions of this study

- Providing a critical comparison of SC and JCT frameworks, highlighting the potential for complementing existing standard forms rather than wholesale substitution.
- Identifying ethical challenges relating to fairness, inclusivity and digital exclusion in automated contracting.
- Situating SC within the broader statutory framework, particularly the Procurement Act 2023 and its emphasis on social value delivery.

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