International Construction Law
Academic Monograph

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DOI: 10.64457/icl.en.ch29

Navigating Data-Driven Construction Contracts: Practical Frameworks for Cross-Border Digital Engineering Disputes

Recommended citation: Dmitry Semenovich Belkin. Navigating Data-Driven Construction Contracts: Practical Frameworks for Cross-Border Digital Engineering Disputes. In: International Construction Law. Moscow: Slavic Greek Latin Academy, 2025. DOI: 10.64457/icl.en.ch29.

Digitalisation reshapes international construction contract law by integrating Building Information Modelling (BIM), terrain information models and digital twins into cross-border projects. The chapter traces the evolution from the British notion of the Common Data Environment to ISO 19650 and the divergent Russian standards, showing regulatory gaps after the repeal of GOST R 58439. It discusses intellectual-property allocation over models and algorithms, GDPR-compliant data governance, cyber-security duties and the pending adaptation of FIDIC forms and UNCITRAL instruments. The

analysis concludes that harmonised terminology, auditable data-exchange protocols and contractual clauses on digital quality control and cyber-risk insurance are indispensable for legal predictability. Case studies cited in the literature review illustrate the urgency of uniform solutions.

Digitalisation fundamentally transforms the international regulation of construction projects, altering traditional approaches to implementation. Modern information and digital technologies – such as Building Information Modelling (BIM), 3D terrain modelling and digital twins – not only optimize construction processes but also give rise to new legal challenges concerning intellectual property (e.g. rights to digital models and the algorithms governing them) and the data generated by these models. These developments call for a rethinking of international construction contract law (ICCL) in light of differences between national legal regimes and global standards. In particular, cross-border data exchange, protection of confidential information, and legal control over information flows related to project operations must be addressed. These processes should comply with information law norms, including data protection, the legal framework for electronic transactions, cybersecurity, and the harmonization of national information standards.

As A. A. Danelyan observes, the absence of a unified approach to cyberspace and digital technologies hinders the creation of effective international mechanisms needed to harmonize legal regimes and ensure legal predictability. These issues are especially pressing given the growing importance of the digital economy, in which data becomes a key resource for the construction industry and international cooperation. This creates a requirement for national legal systems not only to improve existing legislation but also to adapt it to new realities (Gulemin, 2023). Harmonizing national regulations with international standards is crucial to creating a single legal environment in which participants can confidently interact using modern digital tools in international construction contracts.

Information-related aspects of construction go beyond intellectual property issues and include regulation of electronic document management, participant authentication, electronic data exchange, and the use of cryptographic protection as provided by international agreements. There is a

need to synchronize rules governing electronic document flow to give legal force to electronic transactions and minimize the risks of data forgery. In the context of digital twins and extensive data collection for construction sites, it is crucial to distinguish which categories of data should be public and which should be treated as personal data. Given the increasing role of data analytics, common regulations for data processing and storage – such as the EU's General Data Protection Regulation (GDPR) and Russia's Federal Law on Personal Data (152-FZ) – should apply. Such regulatory alignment removes additional barriers and risks in international projects, ensuring legal security and protection of private interests.

Notably, domestic developments in information technology highlight the need for a robust legal framework. According to M. A. Malinovsky and I. E. Alenin (2022), Russian software for information modelling (e.g. Renga, Pilot-BIM) shows progress but still lags behind foreign counterparts in functionality and compliance with international standards. The advancement of ICT and policies of import substitution and competitiveness of domestic software point to the necessity of creating an effective legal basis for ICT use in construction. Thus, reliable legal mechanisms ensuring intellectual property protection, standardization and legal certainty, while recognizing cross-border data exchange and integration of Russian solutions into the international regulatory system, are decisive factors in the digitisation of the construction sector.

The introduction of digital twins (Construction 4.0) combined with deep learning (DL) technologies is an important direction in digital transformation. Research by Kor, Yitmen, and Alizadehsalehi (2023) confirms that integrating digital twins and deep learning contributes to optimizing design and construction processes by enabling autonomous modelling, risk prediction and decision support via cognitive data analysis. The creation of digital twins enables interconnected, adaptive digital ecosystems incorporating big data analytics, automated asset management and resource optimisation. This integration becomes an integral element of international construction contracts, requiring legal regulation of intellectual property, data processing and cross-border information exchange. It underlines the need to develop unified international legal mechanisms that ensure the predictability of the digital environment in construction.

In the context of digital twins and large datasets from construction sites, distinguishing between public and personal data categories is critical. Given the heightened role of analytics, adherence to common data processing and storage regulations – such as the EU's GDPR and Russia's 152-FZ – becomes necessary when European market participants are involved. Such regulatory consistency alleviates additional barriers and risks in international projects, ensuring legal safety and protection of private interests.

In this regard, a noteworthy development is the Moscow Government Decree of 29 December 2022 No. 3048-PP on the "AIS 'Digital Twin'." This regulation establishes the authority of the operator and sets rules for collecting, processing and exchanging spatial data, effectively creating legal frameworks for implementing digital twins in urban planning processes. This approach aligns with trends in import substitution and digital transformation, allowing legal regulation to adapt to rapidly evolving technological conditions. The legal integration of the "Digital Twin" into urban management systems underscores the prospect of further cross-cutting digital technologies and the need for unified international legal principles (including protection and use of intellectual property and cross-border data exchange) to enhance the competitiveness of the Russian construction industry and ensure transparency in major infrastructure projects.

Strategic documents such as Russia's Information Society Development Strategy for 2017–2030 define key directions for regulating information technologies, including their application in construction. They enshrine the necessity of creating international legal mechanisms to ensure that innovative solutions comply with current standards. Harmonisation of national legislation with international norms helps to form a unified legal environment, improve the competitiveness of domestic companies and advance international cooperation. The Strategy emphasizes protecting national interests, reducing legal risks, and regulating rights to intellectual property, security and quality of digital technologies. Forming an effective legal environment is a necessary condition for integrating digital solutions into international construction contract law.

The digital economy envisions widespread use of information modelling and automated project management technologies, which contribute to more

effective interaction among participants in international construction projects, streamline contract negotiation and ensure transparency at all stages. However, without adequate legal mechanisms, these opportunities can be accompanied by significant legal risks, especially in a cross-border context. Therefore, ICCL and related areas must harmonize existing legal norms and terminology. As T. N. Savina (2018) notes, the digital economy creates new prospects and legal challenges, requiring legal systems to be flexible and respond quickly to technological changes.

The study leads to the following conclusions: Digitalisation of international construction contracts necessitates revising existing legal norms, especially regarding protection and use of intellectual property and data. The implementation of BIM and other digital technologies introduces new legal challenges, such as ownership and management of rights to digital models, which can cause disputes and complications in cross-border projects in the absence of clear international rules. The proliferation of global ecosystems (e.g. smart home/office infrastructures) calls for legislation covering all aspects of user-provider interactions. Cross-border use of global terrain modelling systems requires alignment of different legal regimes to resolve IP and data exchange issues.

In construction, standard forms developed by the International Federation of Consulting Engineers (FIDIC) are key tools for harmonizing contractual obligations internationally. These forms provide a uniform legal mechanism regulating client–contractor–consultant relations and reduce legal risks in implementing cross-border contracts. As L. Klee (2018) notes, using FIDIC standards ensures contract predictability, minimizes disputes and creates legal frameworks for managing digital models. However, despite the broad applicability of FIDIC forms, they currently lack specific provisions on digital technologies and BIM, necessitating their adaptation to modern realities.

Based on these conclusions, several recommendations follow. It is important to develop international legal norms that unify approaches to the use of digital technologies in construction projects. This includes a clearer definition of rights for using digital models, harmonization and proper interpretation of terminology in BIM, and the development of international standards for managing cross-border data flows and intellectual property. Personal data

collected by information systems should be categorized and structured in contracts, and license agreements must address not only the use of digital models but also the management of large volumes of data generated during asset operation.

Expanding the scope of ICCL through information and communication technologies implies including contract clauses on dispute resolution that address conflicts of law and information law principles. The organization of cross-border interaction (for example, determining the level of trust in smart contracts or blockchain protocols) could be regulated by specific legal instruments such as the UNCITRAL Model Law on Electronic Commerce (1996) and the Model Law on Electronic Signatures (2001). Arbitration rules like those of UNCITRAL (1976, amended) and the ICC Arbitration Rules (2021 edition) explicitly allow electronic interaction of the parties. Construction contracts should also enshrine rules for electronic evidence, including criteria for trusting executive and primary accounting documents in digital form. When using FIDIC standard forms, it is advisable to supplement them with clauses on digital quality control, performance monitoring, and data protection, aligning these provisions with the requirements of international information law. Such a comprehensive regulatory framework would ensure a more reliable and transparent legal environment for introducing digital solutions and foster innovative mechanisms in the construction industry.

Note on the publication of the main research results

Academic specialty: 5.1.5. International legal studies.

International legal cooperation in the scientific and technological sphere. International law and new technologies (digital economy, artificial intelligence, biotechnologies and other related technologies). International information law.

The main research results have been published in the following peer-reviewed article: Белкин, Д. С. Цифровые технологии в трансграничных строительных проектах: правовые проблемы и механизмы решения / Д. С. Белкин // Информационное право. – 2025. – № 1(83). – С. 35-41. – DOI

10.55291/1999-480X-2025-1-36-41. – EDN BKDDLL. DOI: 10.55291/1999-480X-2025-1-36-41 EDN: BKDDLL

Article URL: https://www.elibrary.ru/item.asp?id=82572036

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