

Digital Transformation of Standard Contracts into E-Contracting¹

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ABSTRACT

According to SpringCM (2018), companies still use several tools to manage contracts such as MS Excel, Contract Management Tools, Shared Drives, email, and other alternatives. It also mentions that 77% of businesses still report human errors in the contract process.

New technologies might help to reduce claims and disputes in projects because it might automatize some activities or processes that mitigate or avoid potential impacts on cost, time, or quality during the execution of project activities.

L. R. Nyeland (2019) comments that 3D printing, AI/deep learning, big data, BIM model, digital twin, drones, IoT, robotics, and VR/AR are some technologies used in construction. Another technology available is blockchain.

Since the appearance of Blockchain in 2009, M. Bacina (2018) comments that smart contracts are replacing traditional agreements. Smart contracts, inside the blockchain, allow to transport and transfer assets and data without intermediaries. No human action is necessary; it lives on its own. It has a self-executing nature and exists only with a code. It is a safe, uninterrupted, and secure network. The output of a project or agreement fixes, according to the stage, marked dates, and payment, based on a work breakdown structure.

Are smart contracts capable of reducing claims and disputes in projects, are some of the standardized construction contracts adapting their norms to implement e-contracts in their processes?

This research is essential to:

- What do owners have to do to be able to adapt their FIDIC, AIA, EJCDC, or CONSENSUS DOCS to e-contracting?
- What changes or modifications do FIDIC, AIA, EJCDC, or CONSENSUS DOCS need to do to adapt their standard documents for more “E-contracting friendly”?

This paper concluded the following:

Owners can create platforms or use platforms as ConsensusDocs has to manage all the supporting documents offered by FIDIC, AIA, and EJCDC. They also use contract management software to store, track, search, and report the different contracts they manage, but still, some forms vary for each software. Standard contracts forms could be loaded and improve the relationship between parties for different types of contracts.

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Owners can also implement blockchain platforms to store, validate, and execute specific transactions to make faster and trustable the communication between parties. It is essential to determine what clauses can transform in code from FIDIC, AIA, EJCDC, or ConsensusDocs for using smart contracts.

Some actions recommended to FIDIC, AIA, EJCDC, and ConsensusDocs to convert to e-contracting are:

- Load all the forms that are in a text software (for example, in MS Word extension) to a platform, and participants can drag and drop any clause required for different relationships or types of contracts.
- Information required to fulfill like name, dates, durations, milestones, and other relevant information, can be entered as if we were codifying a smart contract, to agree between parties the clause for a specific section.
- As in contract management software, approvals do not require a physical signature or printed documents. Or, like in blockchain, when a rule or agreement meets the specifications, validation is automatic.
- Codify as part of the code for a blockchain (smart contract) to notify an alert when, for example, the blockchain did not reach 51% of approval of a transaction or Notify when there is an approval for payment or money transfer.
- A cloud or blockchain platform can store all the information, and it allows browsing all documentation.

Key words - Standard Contracts, Smart Contracts, Blockchain, E-Contracting, Project Management, Contract Management, Change Management, Contract Management Software, BIM

INTRODUCTION

Arcadis, in a Global Construction Disputes Report 2019² mentions that most of the relevant factors for disputes are human factors and misunderstanding of contractual obligations, errors or omissions in the contract document, and inadequate project management and administration. Besides, depending on the region, other factors are the differing of site conditions, third-part or force majeure events, poorly drafted contracts, and failure to serve the appropriate notice under the contract.

E. Camak, et al. (2014) have also categorized the causes of disputes in seven (7) categories, as shown in the following image.

² ARCADIS. (2019). Global Construction Disputes Report 2019. Retrieved November 18, 2019, from https://images.arcadis.com/media/5/D/1/%7B5D16141D-B883-4398-BB35-218023E1F4F6%7DRP_GCDR_AL20190620_Final.pdf?_ga=2.8526965.1379341575.1574054278-587053395.1574054278

Category of Disputes	Causes of Disputes
Owner related (A)	variations initiated by the owner (A1)
	change of scope (A2)
	late giving of possession (A3)
	acceleration (A4)
	unrealistic expectations (A5)
	payment delays (A6)
Contractor related (B)	delays in work progress (B1)
	time extensions (B2)
	financial failure of the contractor (B3)
	technical inadequacy of the contractor (B4)
	tendering (B5)
	quality of works (B6)
Design related (C)	design errors (C1)
	inadequate / incomplete specifications (C2)
	quality of design (C3)
	availability of information (C4)
Contract related (D)	ambiguities in contract documents (D1)
	different interpretations of the contract provisions (D2)
	risk allocation (D3)
	other contractual problems (D4)
Human behavior related (E)	adversarial / controversial culture (E1)
	lack of communication (E2)
	lack of team spirit (E3)
Project related (F)	site conditions (F1)
	unforeseen changes (F2)
External factors (G)	weather (G1)
	legal and economic factors (G2)
	fragmented structure of the sector (G3)

Figure 1 Category and Causes of Disputes³

Despite the implementation of methods like Party-to-Party negotiation, mediation, or arbitration, which were the most used for dispute resolution, or techniques to avoid claims like Risk Management, Contract and Specifications Review and Constructability reviews, disputes remain in the industry.

Also, some causes of disputes lead to contractors to failure, producing troubles like ineffective financial management system, poor estimating and job costing reporting, poor project management, and no comprehensive business plan.

According to Spring CM (2018), companies still use several tools to manage contracts such as:

³ Cakmak, E., & Irlayici Cakmak, P. (2014). An analysis of the causes of disputes in the construction industry using the analytical network process. Retrieved November 20, 2019, from <https://tinyurl.com/yx28ughc>

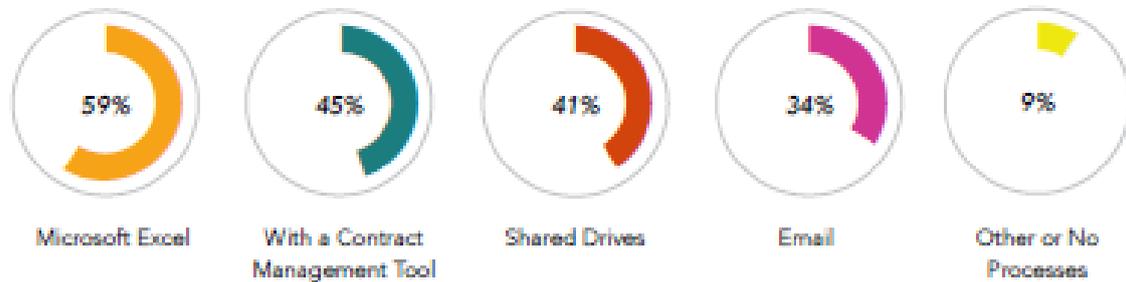


Figure 1 Tools for managing contracts⁴

New technologies might help to reduce claims and disputes in projects because it might automatize some activities or processes that mitigate or avoid potential impacts on cost, time, or quality during the execution of project activities.

L. R. Nyeland (2019) comments that 3D printing, AI/deep learning, big data, BIM model, digital twin, drones, IoT, robotics, and VR/AR are some technologies used in construction. Another technology available is blockchain.⁵

The Cooperative Research Centre (CRC) for Construction Innovation in Australia (2008, p.1) defines E-contracting as a process within an electronic environment where

- The parties negotiate and use an automated communication method to form their contract
- Once created, the parties administer and manage the contract through online collaboration systems to communicate, share, deliver, and approve contractual documents.
- When the contract finishes, an electronic storage medium archives all relevant project documentation and communications.

CRC also mentions that the goals of an e-contracting system are:

- **Confidentiality:** protection of electronic records from unauthorized disclosure or use.
- **Integrity:** To ensure there is not any duplication, modification, or deletion of electronic records.
- **Authenticity:** The parties access when they authenticate themselves into the e-Contracting system.

⁴ Spring C.M. (2018). 2018 State of Contract Management. Page 13. Retrieved November 28, 2019, from <https://www.springcm.com/2018-state-of-contract-management-lp>

⁵ Nyeland, L. R. (2019, July 26). The benefits of blockchain technology in construction || Insights | DLA Piper Global Law Firm. Retrieved October 29, 2019, from https://www.dlapiper.com/en/uk/insights/publications/2019/07/real-estate-gazette-35/the-benefits-of-blockchain-technology-in-construction/?utm_source=Mondaq&utm_medium=syndication&utm_campaign=View-Original

- **Cryptographic non-repudiation:** The parties cannot deny having performed the action or actions attributed.
- **Availability:** The parties can access the information when required.

CRC lists other alternatives systems for e-Contracting such as:

- E-contracting using email
- E-contracting using “Click to agree.”
- E-contracting using XML
- E-Contracting using web-based collaboration systems

M. Bacina (2018) defines a smart contract as a computer code of rules to make possible, validate, or impose the negotiation or performance of an agreement. It also describes:

- A container of open-source computer code.
- It runs on the nodes of a decentralized blockchain.
- It also requires the transfer of a cryptographic token to the contract address and the payment of a transaction fee to remunerate the several nodes on the blockchain for running the code.
- The outcome of the code compares against the code stored on all of the nodes in the blockchain.
- If there is 51% of consensus with the outputs from different nodes, then
- That output transaction is an immutable record of what occurred between users of that code.

Blockchain, according to the Institute of Civil Engineers (2018, p.3), is a distributed ledger of data. It stores across a network of computers, transactions or agreements. Information is stored chronologically, members or users of the community can view it; there is not a central manager such as a government or bank; it is difficult to change when the information is published.

Since the appearance of Blockchain in 2009, M. Bacina (2018) comments that smart contracts are replacing traditional agreements. Smart contracts, inside the blockchain, allow to transport and transfer assets and data without intermediaries. No human action is necessary; it lives on its own. It has a self-executing nature and exists only with a code. It is a safe, uninterrupted, and secure network. The output of a project or agreement fixes, according to the stage, marked dates, and payment, based on a work breakdown structure.

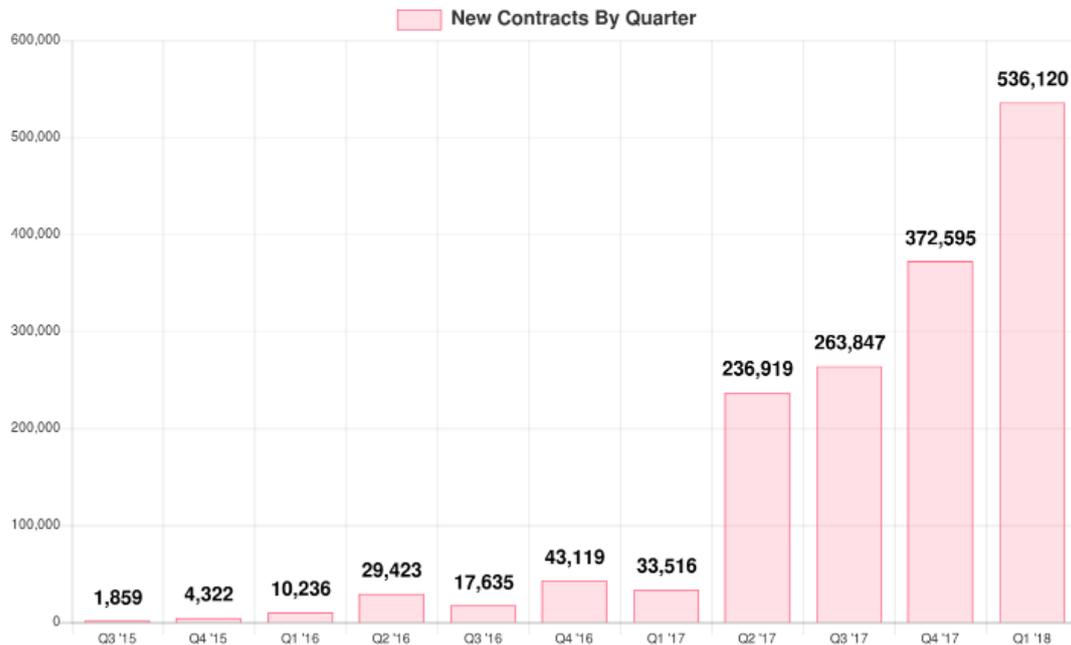


Figure 2 Number of Smart Contracts per quarter⁶

The Institution of Civil Engineers⁷ from the UK (2018, p.17) mentions that smart contracts could have the following benefits in the construction industry:

- **Accuracy:** If terms and conditions are registered precisely on a smart contract, there is a high accuracy during the execution and monitoring of requirements.
There is a reduction of contractual collaboration, and several claims and disputes also decrease in correlation with the time of solving them, leading to improve relationships among stakeholders.
- **Transparency:** blockchain registers every transaction, payment, or business interaction and execution, making the whole process transparent and followable.
- **Compliance:** With contractual standards (for example, NEC3 and NEC4) logged in blockchain, a demonstration of regulatory compliance is easy.
- **Cost-effectiveness:** Significant cost savings on overheads, administration, and project control.

⁶ Chandrasekhar, P. (2018, May 23). Ethereum Smart-Contracts. Retrieved from <https://hackernoon.com/ethereum-smart-contracts-most-of-them-are-rarely-used-f45749730d3e>

⁷ Institution of Civil Engineers. (2018, December). Blockchain technology in the construction industry. Digital Transformation for High Productivity. Retrieved November 21, 2019, from <https://www.ice.org.uk/ICEDevelopmentWebPortal/media/Documents/News/Blog/Blockchain-technology-in-Construction-2018-12-17.pdf>

- **Risk Management:** The network of smart contracts ensures mitigation of late payments and a reduction of disputes.

Also, Dangi (2019) analyses that digital contracts are better than traditional arrangements. They are fast, economical, providing transparency, mutual, provide reliable security, and are self-executive.

Are smart contracts capable of reducing claims and disputes in projects? How can they mitigate or avoid most of the factors mentioned above?

Are some of the standardized construction contracts adapting their norms to implement e-contracts in their processes?

This research is essential to:

- What do owners have to do to be able to adapt their FIDIC, AIA, EJCDC, or CONSENSUS DOCS to e-contracting?
- What changes or modifications do FIDIC, AIA, EJCDC, or CONSENSUS DOCS need to do to adapt their standard documents for more “E-contracting friendly”?

METHODOLOGY

Step 1

According to Arcadis, in its Global Construction Disputes Report 2019, most of the factors for disputes are human factors and misunderstanding of contractual obligations, errors or omissions in the contract document, and inadequate project management and administration. Besides, depending on the region, other factors are differing site conditions, third-part or force majeure events, poorly drafted contracts, and failure to serve the appropriate notice under the contract.

E. Camak et al. (2014) have also categorized the causes of disputes in seven (7) categories: Owner, Contractor, Design, Contract, Human behavior, Project related grouping 28 causes of conflicts.

Despite the implementation of methods like Party-to-Party negotiation, mediation, or arbitration, which were the most used for dispute resolution, or techniques to avoid claims like Risk Management, Contract and Specifications Review and Constructability reviews, disputes remain in the industry.

Spring C.M. (2018) conducted a survey among 1,891 respondents from different sectors and different support areas that shows that businesses are still reporting human errors in their contracting process.

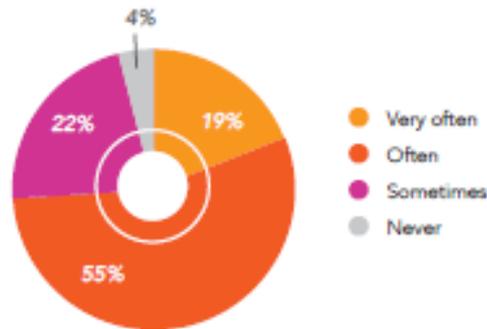


Figure 2 Human Errors in the contracting process⁸

It also mentions that the respondents consider the approval process as one of the causing deals to stall contracts.

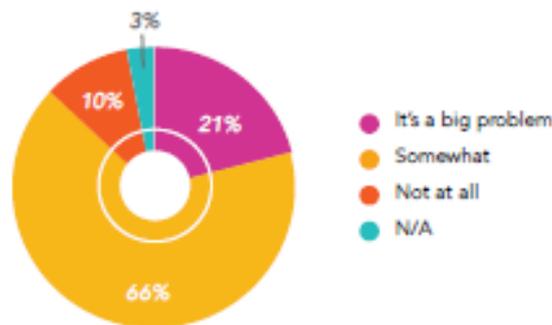


Figure 3 Approval process is a causing deal to stall contracts⁵

According to Spring, C.M., companies still use several tools to manage contracts such as:

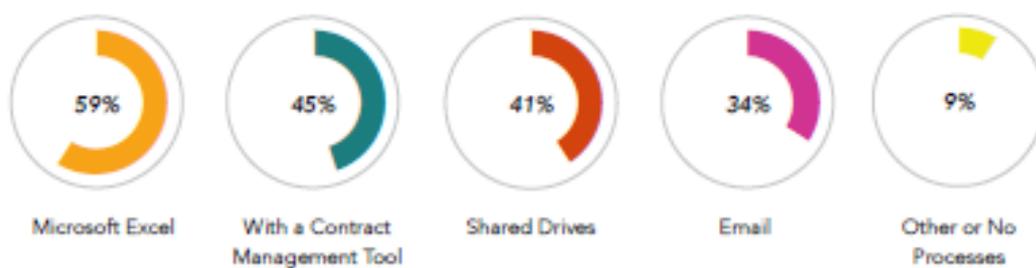


Figure 4 Tools for managing contracts⁵

New technologies might help to reduce claims and disputes in projects because it might automatize some activities or processes that mitigate or avoid potential impacts on cost, time, or quality during the execution of project activities.

⁸ Spring, C.M. (2018). 2018 State of Contract Management. Page 8, 11. Retrieved November 28, 2019, from <https://www.springcm.com/2018-state-of-contract-management-lp>

E-contracting is a process within an electronic environment where: The parties negotiate and use an automated communication method to form their contract; once created, the parties administer and manage the contract through online collaboration systems to communicate, share, deliver, and approve contractual documents. When the contract finishes, an electronic storage medium archives all relevant project documentation and communications.

A smart contract is a computer code of rules to make possible, validate, or impose the negotiation or performance of an agreement.

Since the appearance of Blockchain in 2009, M. Bacina (2018) comments that smart contracts are replacing traditional agreements. Smart contracts, inside the blockchain, allow to transport and transfer assets and data without intermediaries. No human action is necessary; it lives on its own. It has a self-executing nature and exists only with a code. It is a safe, uninterrupted, and secure network. The output of a project or agreement fixes, according to the stage, marked dates, and payment, based on a work breakdown structure.

Dangi (2019) concludes that smart contracts are better than traditional arrangements. They are fast, economical, providing transparency, mutual, provide reliable security, and are self-executive.

- What do owners have to do to be able to adapt their FIDIC, AIA, EJCDC, or CONSENSUS DOCS to e-contracting?
- What changes or modifications do FIDIC, AIA, EJCDC, or CONSENSUS DOCS need to do to adapt their standard documents in E-commerce?

Step 2

The alternatives for the current research are:

1. Standard Contracts

There are some contract models in the construction sector. For the present paper, we have selected the following entities

1.1 FIDIC (Fédération Internationale des Ingénieurs-Conseils / International Federation of Consulting Engineers)⁹¹⁰

It started in 1913 with France, Belgium, and Switzerland. Now it has several members from 60 different countries.

FIDIC is well known for publishing standard form contracts for the construction and engineering industry. FIDIC contracts are the first contracts in International Construction.

⁹ National Building Specification (NBS). (2014, February 1). A brief introduction to FIDIC contracts. Retrieved from <https://www.thenbs.com/knowledge/a-brief-introduction-to-fidic-contracts>

¹⁰ <http://fidic.org/about-us>

Associations as the International Federation of Asian and Western Pacific Contractors Association ratifies FIDIC contract form and editions. Besides, the Associated General Contractors of America, the Inter-American Federation of Construction Industry, and the Multilateral Development Banks and others approve FIDIC standard contract.

1.2 AIA Contracts Documents¹¹

The American Institute of Architects consolidates 200 forms and contracts to define the terms and relationships in design and construction projects in the USA. The contracts' templates have the consensus of owners, contractors, attorneys, architects, engineers, and others, compiled by a 120-year history.

There are changes and developments in the case of new contract documents or a requirement to review existing ones.

The first contract document dates from 1888, the Uniform Contract elaborated by the "three-man Committee." They released updated documents in 1937, 1951, and 1958.

In 1970 the name changed to AIA Documents Committee. It revised its documents (1977, 1987, 1997, and 2007), asking for feedback and account for emerging trends in the construction and legal sector. The committee released in 2017 an update of the core of the Contract Document and marked 130 years of the Documents Committee.

1.3 ConsensusDocs¹²

Twenty (20) organizations in the USA in the architecture, engineering, and construction industry founded ConsensusDocs in 2007. Their main goal is to protect the best interests of the project by developing contracts that depend on trust, collaboration, and innovation.

The ConsensusDocs Coalition creates working groups to discuss current trends and best practices through numerous virtual and in-person meetings. All voices of A/E/C industries draft a document to express all positions and discussions, which the Contract Advisory Council receives for approval.

Once the Council assesses and approves any document, the ConsensusDocs Executive Director circulates it to the ConsensusDocs Endorsing Organizations. Then the Endorsing Organization publishes for use.

¹¹ American Institute of Architects. (n.d.). The History of AIA Contract Documents. Retrieved from <https://www.aiacontracts.org/contract-doc-pages/21531-the-history-of-aia-contract-documents>.

¹² Consensusdocs. About us. <https://www.consensusdocs.org/about/>

1.4 Engineers Joint Contract Documents Committee¹³

It is a joint venture of three major organizations of professional engineers:

- a. The American Council of Engineering Companies (ACEC)
- b. The National Society of Professional Engineers (NSPE)
- c. The American Society of Civil Engineers – Construction Institute (ASCE)

Since 1975, it elaborated and updated standard documents to represent the best contractual relation between all parties who participate in engineering, design, and construction projects.

2. Smart Contracts (Decentralised Applications)

M. Bacina (2018) defines a smart contract as a computer code of rules to make possible, validate, or impose the negotiation or performance of an agreement. It also describes:

- A container of open-source computer code.
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- The outcome of the code compares against the code stored on all of the nodes in the blockchain.
- If there is 51% of consensus with the outputs from different nodes, then
- That output transaction is an immutable record of what occurred between users of that code.

The applications of smart contracts, according to Osetskyi (2018), are not limited to the following:

- Validation of the authenticity of a copyright product.
- Transfer of money or currency without a third party involved.
- Intellectual property protected.
- Protection from theft and counterfeit. For example, selling a good, and there is a rejection of transaction out of the blockchain.
- Automate the validation of steps from selling to transferring the good to a transporter. Payment is also part of the process.

¹³ Engineers Joint Contract Document Committee. <https://www.ejcdc.org/>

- Authentication of certificates. (E.g. job certificate, post-graduate diplomas, etc.)
- In the insurance sector, a smart contract helps to execute a claim automatically, identifying the action that triggers the transaction.

Capgemini (2016) elaborated a graphic that shows how smart contracts would work in blockchain system as follows:

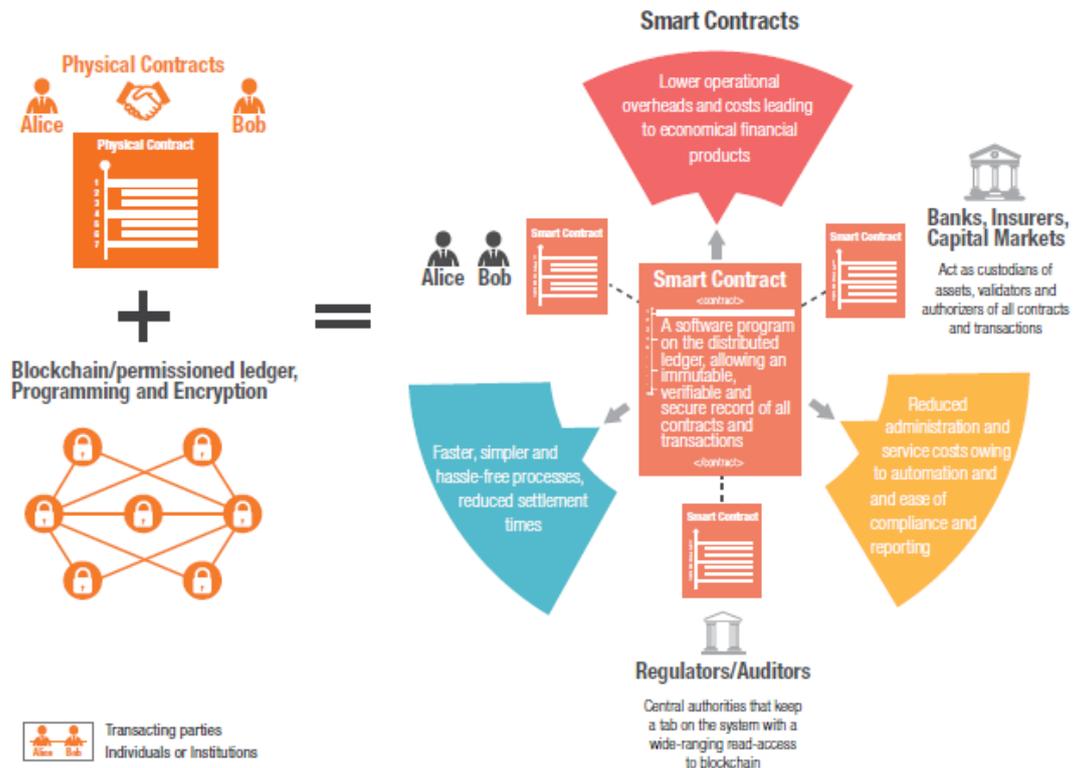


Figure 5 How smart contracts would work in a blockchain system?¹⁴

What would a smart contract lifecycle be? Capgemini indicates a lifecycle should have the following steps:

¹⁴ CAPGEMINI. (2016, October 7). Smart Contracts in Financial Services: Getting from Hype to Reality. Page 6. Retrieved from https://www.capgemini.com/wp-content/uploads/2017/07/smart_contracts_in_fs.pdf

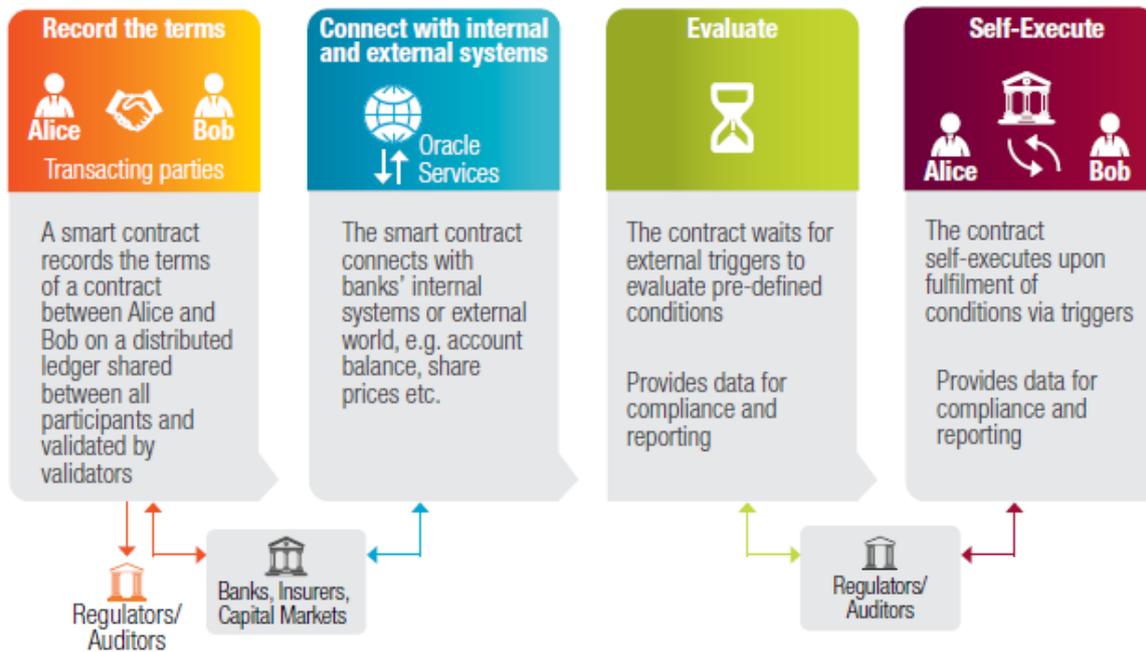


Figure 6 Smart contract lifecycle¹⁵

3. E-Contracts / Contract Management Software

The Cooperative Research Centre (CRC) for Construction Innovation in Australia (2008, p.1) defines E-contracting as a process within an electronic environment where:

- The parties negotiate and use an automated communication method to form their contract
- Once created, the parties administer and manage the contract through online collaboration systems to communicate, share, deliver, and approve contractual documents.
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- **Confidentiality:** protection of electronic records from unauthorized disclosure or use.
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¹⁵ CAPGEMINI. (2016, October 7). Smart Contracts in Financial Services: Getting from Hype to Reality. Page 6. Retrieved from https://www.capgemini.com/wp-content/uploads/2017/07/smart_contracts_in_fs.pdf

- **Authenticity:** The parties access when they authenticate themselves into the e-Contracting system.
- **Cryptographic non-repudiation:** The parties cannot deny having performed the action or actions attributed.
- **Availability:** The parties can access the information when required.

CRC lists other alternatives systems for e-Contracting such as:

- E-contracting using email
- E-contracting using “Click to agree.”
- E-contracting using XML
- E-Contracting using web-based collaboration systems

On the other hand, R. Marvin et al. (2018) comment that Contract Management Software uses Software-as-a-Service (SaaS) platforms. It unifies in a trusted medium, all the participants, the contracts, and the versions involved in negotiations. It is possible to track changes and the timeline of a commitment from inception to signing.

They also mention that four essential functions are critical such as the platform can store, track, search, and report.

Another vital function is integration with other systems like Customer Relationship Management, Enterprise Resource Planning, Human Resource Management, Document Control Management, and Multi-Party collaboration.

Software Advice website (www.softwareadvice.com) also adds the following functions: Contract Drafting, Alerts and Notifications, and Analytics and Reporting.

They do not use yet blockchain for the current analysis.

Step 3

The outcomes produced by each alternative are:

1. Standard Contracts (For more detail of each standard contract, go to Appendix 1)

1.1 FIDIC (Fédération Internationale des Ingénieurs-Conseils / International Federation of Consulting Engineers)¹⁶¹⁷

The primary documents elaborated by FIDIC are the following:

¹⁶ National Building Specification (NBS). (2014, February 1). A brief introduction to FIDIC contracts. Retrieved from <https://www.thenbs.com/knowledge/a-brief-introduction-to-fidic-contracts>

¹⁷ FIDIC. About us. <http://fidic.org/about-us>

1.1.1. The Orange book:

Design and Build Turnkey 1st Ed (1995).

1.1.2. The Red Book

Construction Contract 2nd Ed (2017). Building and Engineering Work designed by the Employer.

1.1.3. The Yellow Book

Plan and Design-Build Contract 2nd Ed (2017). Electrical & Mechanical Plant & For Building & Engineering Works Designed by the Contractor.

1.1.4. The Silver Book

EPC/Turnkey Contract 2nd Ed (2017). Conditions of Contract for EPC Turnkey Projects.

1.1.5. The Pink Book

European International Contractors (EIC). Contractors Guide to the MDB Harmonised Edition (June 2010).

1.1.6. The Gold Book

Design, Build and Operate Contract 1st Ed (2008).

For more information, you can visit this website <http://fidic.org/about-us>.

1.2 AIA Contracts Documents¹⁸

AIA Contract Documents divides in six alphanumeric series by document use or purpose.

A-Series: Owner/Contractor Agreements

B-Series: Owner/Architect Agreements

C-Series: Other Agreements

D-Series: Miscellaneous Documents

E-Series: Exhibits

G-Series: Contract Administration and Project Management Forms

A better understanding of applications of these forms is when they are organized by family as follows:

¹⁸ American Institute of Architects. (n.d.). The History of AIA Contract Documents. Retrieved from <https://www.aiacontracts.org/contract-doc-pages/21531-the-history-of-aia-contract-documents>

- 1.2.1 Conventional
- 1.2.2 Construction Manager as Adviser (CMa)
- 1.2.3 Construction Manager as Constructor (CMc)
- 1.2.4 Design-Build
- 1.2.5 Integrated Project Delivery
- 1.2.6 Interiors
- 1.2.7 International
- 1.2.8 Program Management
- 1.2.9 Small Projects
- 1.2.10 Digital Practice Documents
- 1.2.11 Construction Administration and Project Management Forms

These documents apply for small and large projects.

For more information, you can visit the following website

<https://www.aiacontracts.org/contract-doc-pages/21531-the-history-of-aia-contract-documents>.

1.3 ConsensusDocs¹⁹

ConsensusDocs document series include:

200 Series: General Contracting

To address the relationship between an Owner and a Constructor for a given project. There are also agreements between Owners and specialty contractors.

300 Series: Collaborative

The documents include:

- a. Multi-party Integrated Project Delivery Agreement
- b. Building Information Modeling
- c. Lean Construction
- d. Green Building
- e. Joining Agreement for Integrated Project Delivery

¹⁹ Consensusdocs. About us. <https://www.consensusdocs.org/about/>

400 Series: Design-Build

Set of contracts to cover the relationship between Owner and Design-Builder and Design-Builder to Subcontractors.

500 Series: CM at Risk

Set of documents to address a contractual relationship between Owner and Construction Manager.

700 Series: Subcontracting

This set of documents address the relationship between Contractors and Subcontractors.

800 Series: Program Management

These series of documents address the relationship between Owner to a Program Manager, Owner's representative, or CM as Agent. There is a document that allows the Owner to hire a Trader Contractor or Consultant.

900 Series: Public-Private-Partnership

At this date, there is only one document for Public-Private-Partnership. Additionally, there is a document for Standard Operation and Maintenance to procure standalone O&M services.

There is also an online platform to share and collaborate among members.

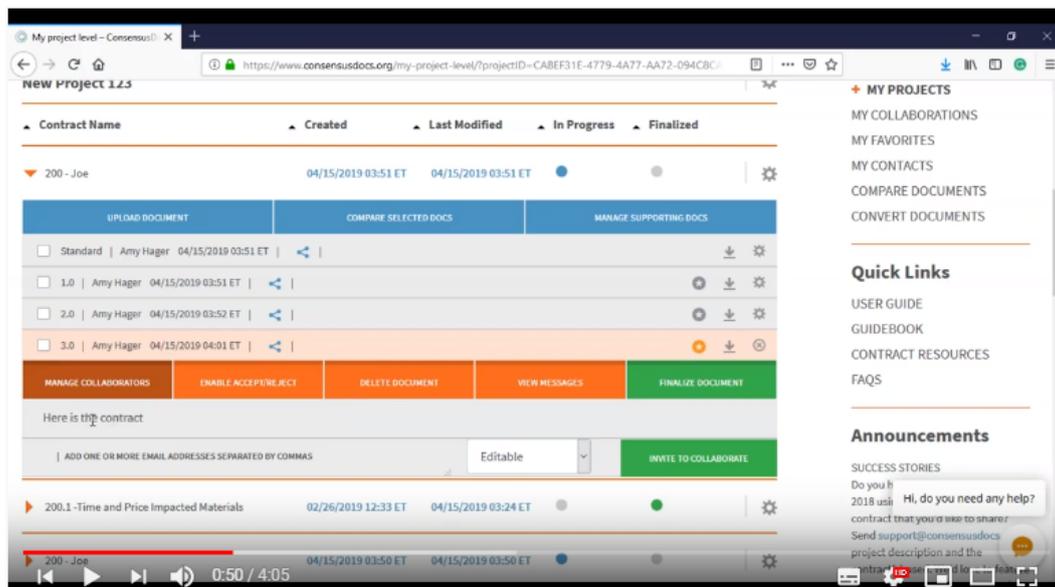


Figure 7 How to share and collaborate in the online platform of ConsensusDocs²⁰

²⁰ ConsensusDocs. (2019, April 19). How to Share Contract Documents and Collaborate Online with ConsensusDoc [Video file]. Retrieved from https://www.youtube.com/watch?v=f2fy_jZfSg&list=PLh1Zw529bwfAJz0AMqyWQAcSFHTQJS3Hd

For more information, you can visit the following website
<https://www.consensusdocs.org/about/>.

1.4 Engineers Joint Contract Documents Committee ²¹

EJCDC documents include the following categories:

1.4.1 Construction Related Documents

The Construction Specification Institute (CSI) and The National Utility Contractors Association (NACA) endorsed these documents.

These series of documents assume the design Engineer participates during the construction. These documents also consider payment alternatives as Lump Sump or Cost-Plus Fee.

1.4.2 Design-Build Documents

This family of documents addresses agreements for Lump Sump and Cost-Plus Fee contracts.

1.4.3 Engineer Subconsultant Documents and Owner Engineer Documents

This family of documents contains agreements between Owner-Engineer and Engineer-Consultants (Geotech, architect, others).

1.4.4 Procurement Documents

The family of documents provides forms to obtain bids.

1.4.5 Public-Private-Partnership

EJCDC reviewed dozens of P3 agreements in use.

1.4.6 USDA Rural Utilities Service Preapproved Documents

It is a group of standards used by the U.S Department of Agriculture, under the Rural Utilities Service (RUS) Water and Waste Disposal program.

For more information, you can visit the following website <https://www.ejcdc.org/>.

2. Smart Contracts

Smart contracts have not reached yet mainstream adoption. Most of the use of smart contracts is related to the payment to reduce the time of validation and to transfer of currency.

²¹ Engineers Joint Contract Document Committee. <https://www.ejcdc.org/>

The Institution of Civil Engineers in the UK (2018) did a report predicting the potential applications of blockchain in the construction industry.

It mentions that companies like Zeus Ecosphere (www.zeusecosphere.com), Costain (www.costain.com), Stablehacks (www.stablehacks.com), Bimchain (www.bimchain.io) are developing collaborative platforms where blockchain is the main actor.

The report grouped the potential uses of blockchain and smart contracts in the construction sector as follows:

2.1. Payment and Project Management

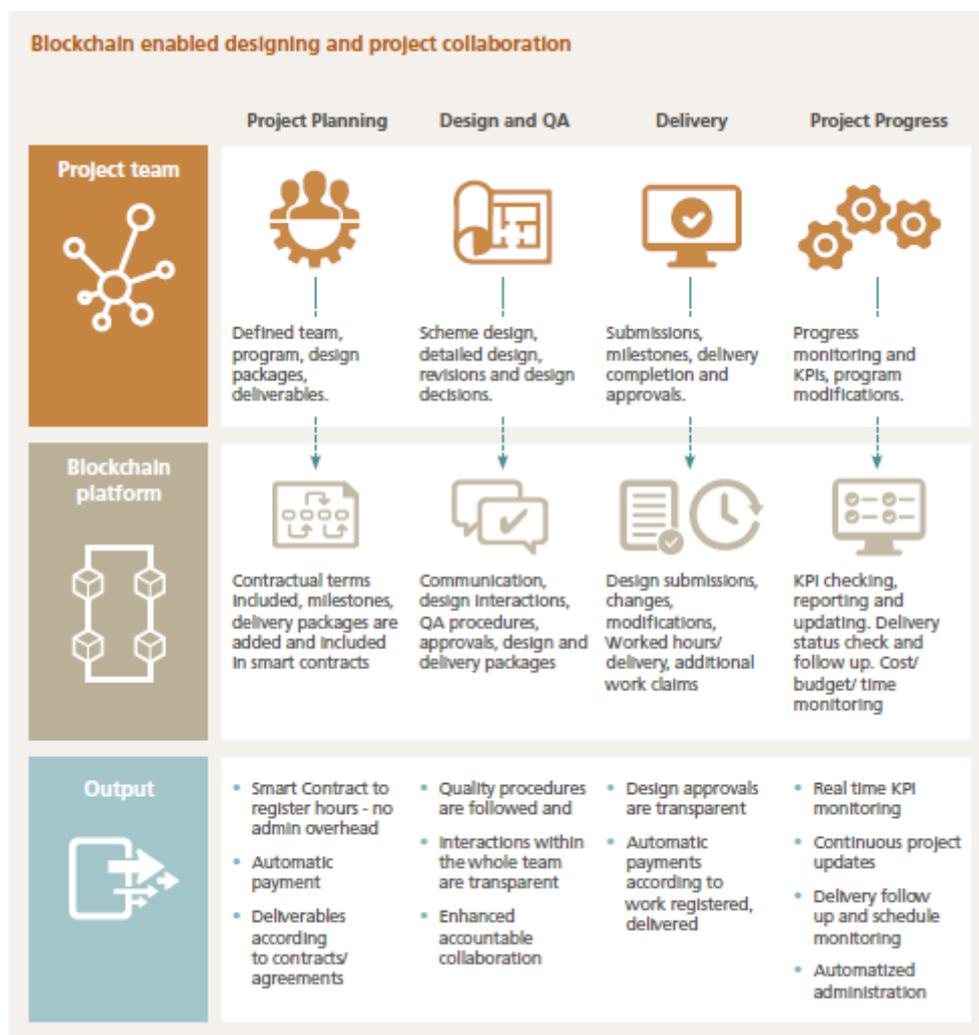


Figure 8 Potential blockchain applications in the Project Management²²

²² Institution of Civil Engineers. (2018, December). Blockchain technology in the construction industry. Digital Transformation for High Productivity. Page 21. Retrieved November 21, 2019, from <https://www.ice.org.uk/ICEDevelopmentWebPortal/media/Documents/News/Blog/Blockchain-technology-in-Construction-2018-12-17.pdf>

2.2. Procurement and Supply Change Management

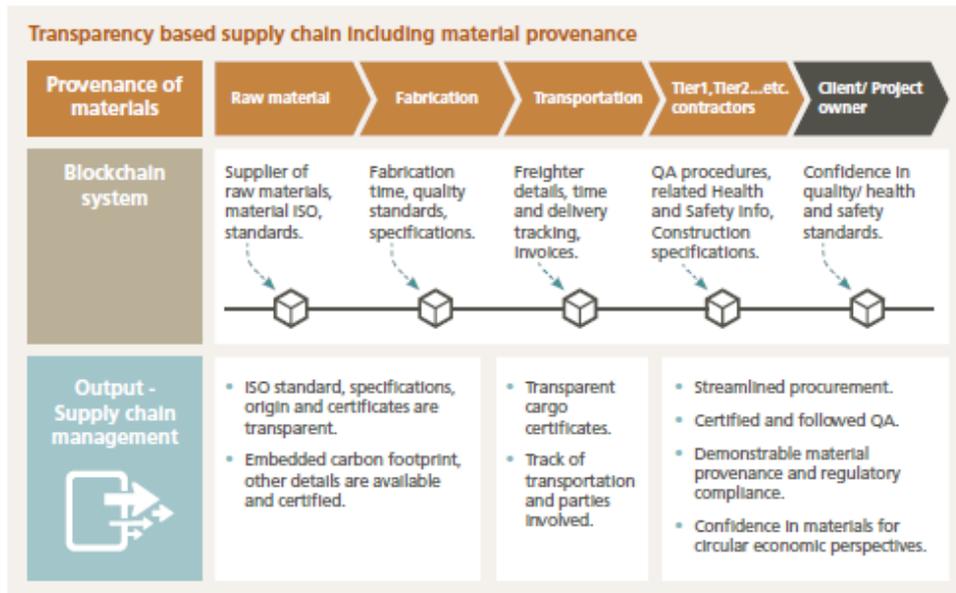


Figure 9 Potential blockchain applications in the Supply Chain Management²³

2.3. BIM and Smart Asset Management

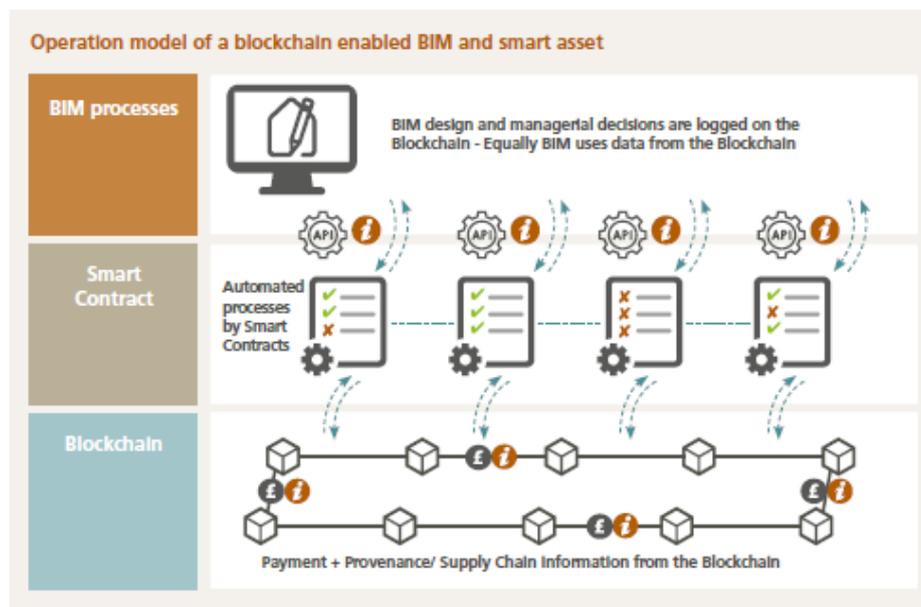


Figure 10 Potential blockchain applications with BIM and Asset Management²⁰

²³ Institution of Civil Engineers. (2018, December). Blockchain technology in the construction industry. Digital Transformation for High Productivity. Page 27, 36. Retrieved November 21, 2019, from <https://www.ice.org.uk/ICEDevelopmentWebPortal/media/Documents/News/Blog/Blockchain-technology-in-Construction-2018-12-17.pdf>

3. E-Contracting / Contract Management Software

Software Advice (www.softwareadvice.com) and PCMag (www.pcmag.com) elaborated a ranking of software based on the following attributes.

PCMAG	Software Advice
Contract Authoring Contract Templates	Contract drafting
Contract Lifecycle Management	Lifecycle management
Email Alerts Audit Logs	Alerts and notifications
	Compliance management
Analytics and Reports	Analytics and reporting
OCR File Scanning Version Control Workflow Automation Native eSignatures	Document management
Advanced Search and Categorization	Contract search
Collaboration and Task Management	Third-party integration
DocuSign Integration	
Adobe Sign Integration	
Easily Customizable App UI	
API Available	
Granular Access Controls	
Lowest Price	
Free Trial	

Table 1 Attributes to assess contract management software²⁴

The author will list only the contract management software that is in both rankings.

²⁴ By the Author.

PCMAG	Software Advice
Agiloft	Agiloft Contract Management Suite
ContractWorks	ContractWorks
Concord	Concord
ContractSafe	ContractSafe
Blueridge Software Contract Assistant	Contract Assistant
Contract Hound	
Updraft	
Coupa Contract Lifecycle Management	
Great Minds Software Contract Advantage	
Onit Contract Management	
	PandaDoc
	Signable
	ManageEngine ServiceDesk Plus
	Curate
	Conga Contracts
	Contractbook
	Icertis
	Fluix
	Gatekeeper
	Contract Insight Contract Management
	Ironclad
	Outlaw
	HarmonyPSA
	ContractRoom
	Contract Logix CLM

Table 2 List of Contract Management Software²⁵

The contract management software for the current research are:

- Agiloft Contract Management Suite
- Concord
- ContractSafe
- Contract Assistant
- ContractWorks

Also, as an example, the following public institutions developed e-contracting platforms such as:

- a. Wisconsin Department of Transport (WisDOT) from the U.S.A.

²⁵ By the Author.

In 2015, WisDOT and consultant representatives created an E-Contracting committee focused on delivering a new e-contracting system. The committee also has as an objective to have a standard scope definition process.

Through a platform called MASTERWORKS, the project has two phases of implementation, the e-contracting phase, and the construction management phase.

The e-contracting phase includes integration with previous Contract Administration Reporting Systems (CARS) to include the planning, design, development, and implementation of these functions:

- Project delivery estimating
- Consultant registration/contract solicitation/contract selection/contract development/contract execution
- Contract progress
- Evaluation
- Management reporting
- Access to a reporting and analysis data warehouse concept and
- Integration with financial and other project-related systems to provide and track various performance measures and other tools used for estimating and negotiating contracts.

It is still in the phase of development. More information in this link www.wisconsin.gov

b. U.S. Department of Transportation – Federal Highway Administration

This institution developed updates in law and policy regarding electronic documents and bidding processes.

Step 4

As observed from previous descriptions of different alternatives, standard contracts bring supporting documents between various parties, and only ConsensusDocs has an online platform for sharing and storing these forms.

What standard contracts can do to comply with e-contracting?

The author will use a GAP Analysis to determine what standard contracts have to do to comply with the e-contracting environment based on the features that contract management software has.

The current status and the desired status of standards contracts are:

Standard Contract Formats		
Attributes	Current State	Desired State
Contract drafting	Download contract forms and modifies them by each party in a different environment	Drag and drop clauses from a database of approved contract clauses or sections
Lifecycle management	The approval process, creation of amendments, and payments in different platforms or printed documents, difficult to track	The track approval process, elaboration of new addendums, and transactions in one platform
Alerts and notifications	Alerts or notification by email, reports or external platforms	Send automatic notifications when reaching determined intervals. Also, when deadlines of specified contracts are close to the end date.
Compliance management	Approvals happen in different platforms or processes are not well identified by project teams despite workflows approved	Approval workflow process defined and implemented in one platform.
Analytics and reporting	Collection of project data from different platforms. Elaboration of reports and dashboards with various tools	Collect and elaborate reports and dashboards with project data of contract status, contract durations, account executive performance, and incomes. Collection of data like: - Approvals rejected due to not compliance of rules (for example, the blockchain did not reach 51% of validation) - Approved payments - Number of Transactions executed - Penalties executed
Document management	Documents stored in physical files or electronically (PDF or Docx) in different environments. They are challenging to find the last versions of documents.	Storage of all documents in one platform. Version control of different copies of the same contract or project documents Access validation is required, so information is protected and easy to track all participants who accessed that information.
Contract search	The codification of documents is not well implemented. Storage of contracts or project documents in different platforms	Easy search of documents or contracts
Third-party integration	The integration of other systems like CRM, ERP, Supply Chain as part of the process, but only Supply Chain integrates into some contract documents only as a supporting document.	Integration with other systems, like CRM, ERP and supply chain management platforms

Table 1 Current State and Desired State of Standard Contracts²⁶

²⁶ By the Author.

FINDINGS

Step 5

What are the steps that standards contracts should follow to meet the desired state?

Attributes	Action Steps
Contract drafting	<ul style="list-style-type: none"> - All the forms are in a text software (for example, in MS Word extension) and loaded to a platform, and participants can drag and drop any clause required for different relationships or types of contracts. - Information required to fulfill like name, dates, durations, milestones and other relevant information, can be entered like if we were codifying a smart contract, to agree between parties the clause for a specific section of the contracts
Lifecycle management	<ul style="list-style-type: none"> - A load of forms for change orders and amendments as draft contracts. - As in contract management software, approvals do not require a physical signature or printed documents.
Alerts and notifications	<ul style="list-style-type: none"> - Codify as part of the code if a blockchain (smart contract) to notify a warning when, for example, the blockchain did not reach 51% of approval of a transaction or Notify when there is an approval for payment or money transfer.
Compliance management	<ul style="list-style-type: none"> - Replace physical signatures on paper for electronic signatures or like in blockchain, when a rule or agreement meets the specification, validation is automatic.
Analytics and reporting	<ul style="list-style-type: none"> - Creation of standard reports or standard dashboards.
Document management	<ul style="list-style-type: none"> - A cloud or blockchain platform can store all the information.
Contract search	<ul style="list-style-type: none"> - The cloud or blockchain platform allows browsing all documentation
Third-party integration	<ul style="list-style-type: none"> - Implementation of a blockchain platform, and payments and currency transfers execute when rules or agreements meet the specifications.

Table 2 Action Steps to convert to Desired State for Standard Contracts²⁷

Step 6

Based on the action steps mentioned in the table above, FIDIC, AIA, and EJCDC might adopt those recommendations to convert or create and electronic environment.

A good example is ConsensusDocs. It has created an online platform, and they are having a transition to an electronic environment where they are implementing some of the action steps.

²⁷ By the Author.



Figure 11 ConsensusDocs Cloud Platform²⁸

The current state of this cloud shows that ConsensusDocs implemented:

- Select and Configure ConsensusDocs
- Work Flow
- Audit Trail
- Electronic Signatures
- Configurable Systems
- Legal Record
- Linking

This example shows that it is possible to convert from supporting physical documents to a collaborative platform.

Of course, there could be more improvement in the future where blockchain could play an essential role in managing contracts. Specifically:

1. Authorizing prompt payment

²⁸ ConsensusDocs. (2017, November 22). ConsensusDocs Contract Management & Cloud Collaboration [Video file]. Retrieved from https://www.youtube.com/watch?v=rhy-2Rv-N14&list=PLh1Zw529bwfDYtsTqUdOrZgcb_1r8MUKl&index=4

2. Validating QA/QC test results and compliance/non-conformance reports
3. Documenting Change Orders
4. Documenting, verifying and resolving disputes
5. Managing punch-lists
6. Managing testing, commissioning, handover, and acceptance of completed deliverables.

Step 7

The Cooperative Research Center (2008) conducted a project to determine the legal and security issues of the elaboration and management of building and construction contracts in an electronic environment. Besides, they assessed the level of compliance and the promotion of best practices of the eTendering systems of Queensland Department of Public Works and Brisbane City Council against the technical and legal guidelines published previously by the Construction Innovation research.

The report identified the following risks:

1. Time of contract formation
2. Place of contract formation
3. Attribution of electronic communications – Authority to contract
4. Statutory requirements for guarantees to be in writing
5. Regulatory requirements for guarantees to be signed
6. Electronic amendments to construction contracts
7. Electronic notices
8. Accessibility of the project collaboration system
9. Intellectual property
10. Affinity of technology
11. Confidentiality
12. Disagreements between the service provider and the contracting parties
13. Admissibility of evidence
14. Disputes between the contracting parties
15. Evidential weight
16. Proof of time

17. Authentication of contracting parties
18. Disclosure
19. Duty to preserve evidence
20. Statutory obligations to maintain records
21. Access to records to after project completion
22. Record-Keeping responsibilities of government agencies

We can assess with a Pareto analysis if the action steps suggested for standard contracts would have an impact, reducing, mitigating, or avoiding the risks mentioned above.

CONCLUSIONS

This research wanted to find answers to the following questions:

- **What do owners have to do to be able to adapt their FIDIC, AIA, EJCDC, or CONSENSUS DOCS to e-contracting?**

Owners can create platforms or use platforms as ConsensusDocs has to manage all the supporting documents offered by FIDIC, AIA, and EJCDC.

Owners use contract management software to store, track, search and report the different contracts they manage, but still, some forms are various for each software. Standard contracts forms could be loaded and improve the relationship between parties for different types of contracts.

Owners can also implement blockchain platforms to store, validate, and execute specific transactions to make faster and trustable the communication between parties. It is essential to determine what clauses from FIDIC, AIA, EJCDC, or ConsensusDocs could transform into code for using smart contracts.

- **What changes or modifications do FIDIC, AIA, EJCDC, or CONSENSUSDOCS need to do to adapt their standard documents for more “E-contracting friendly”?**

The actions recommended to FIDIC, AIA, EJCDC, and ConsensusDocs to convert to e-contracting are:

- A load of all the forms are in a text software (for example, in MS Word extension) to a platform and participants can drag and drop any clause required for different relationships or type of contracts.
- Information required to fulfill like name, dates, durations, milestones, and other relevant information, can be entered as if we were codifying a smart contract, to agree between parties the clause for a specific section.

- A load of forms for change orders and amendments. As draft contracts.
- As in contract management software, approvals do not require a physical signature or printed documents.
- Codify as part of the code if a blockchain (smart contract) to notify an alert when, for example, the blockchain did not reach 51% of approval of a transaction or Notify when there is an approval for payment or money transfer.
- Replace physical signatures on paper for electronic signatures or like in blockchain, when a rule or agreement meets the specifications, validation is automatic.
- Standardize reports or dashboards.
- A cloud or blockchain platform can store all the information.
- The cloud or blockchain platform allows browsing all documentation
- Implementation of a blockchain platform. Payments and currency transfers execute when rules or agreements meet specifications.

FOLLOW ON RESEARCH

We can analyze what clauses in each of the standard contracts listed above can transform in code to use them in a smart contract, so they can facilitate the validation, approval, or payment when reaching the agreement or rule.

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APPENDICES

Appendix 1 - Standard Contracts

1. Standard Contracts

1.1 FIDIC (Fédération Internationale des Ingénieurs-Conseils / International Federation of Consulting Engineers)²⁹³⁰

The primary documents elaborated by FIDIC are the following:

1.1.1. The Orange book

Design and Build Turnkey 1st Ed (1995). Part I: General Conditions; Part II: Guidance for the Preparation of Conditions Particular Application.

1.1.2. The Red Book

Construction Contract 2nd Ed (2017). Building and Engineering Work designed by the Employer. General Conditions; Guidance for Preparation of Particular Conditions; Forms of Letter of Tender, Letter of Acceptance, Contract Agreement and Dispute Adjudication/Avoidance Agreement

1.1.3. The Yellow Book

Plan and Design-Build Contract 2nd Ed (2017). Electrical & Mechanical Plant & For Building & Engineering Works Designed by the Contractor. Structure: General Conditions; Guidance for the Preparation of particular conditions & Annexes (Forms of securities. Forms of Letter of Tender. Contract Agreement. Dispute Adjudication/Avoidance Agreement).

1.1.4. The Silver Book

EPC/Turnkey Contract 2nd Ed (2017). Conditions of Contract for EPC Turnkey Projects. Structure: General Conditions; Guidance for the Preparation of particular circumstances & Annexes (Forms of Letter of Tender. Forms of securities. Contract Agreement, and Dispute Adjudication/Avoidance Agreement).

1.1.5. The Pink Book

European International Contractors (EIC). Contractors Guide to the MDB Harmonised Edition (June 2010).

1.1.6. The Gold Book

Design, Build and Operate Contract 1st Ed (2008). General Conditions; Particular Conditions Part A - Contract Data.

All these books contain the following structure:

- I. The Contract Agreement
- II. The Letter of Acceptance (this is the formal acceptance of the contractor's tender and marks the formation of the contract)
- III. The Letter of Tender

²⁹ National Building Specification (NBS). (2014, February 1). A brief introduction to FIDIC contracts. Retrieved from <https://www.thenbs.com/knowledge/a-brief-introduction-to-fidic-contracts>

³⁰ FIDIC. About us. <http://fidic.org/about-us>

- IV. Part II – the conditions of a particular application
- V. Part I – General Conditions of contract
- VI. The Specification and Drawings (Red Book), The Employer’s Requirements (Yellow Book), the Schedules (Red and Yellow Books)
- VII. Further documents (if any), listed in the Contract Agreement or the Letter of Acceptance.

1.2 AIA Contracts Documents³¹

AIA Contract Documents divides in six alphanumeric series by document use or purpose.

A-Series: Owner/Contractor Agreements

B-Series: Owner/Architect Agreements

C-Series: Other Agreements

D-Series: Miscellaneous Documents

E-Series: Exhibits

G-Series: Contract Administration and Project Management Forms

A better understanding of applications of these forms is when they are organized by family as follows:

1.2.1 Conventional

It applies when the project has a contract with the architect for design and the contractor(s) for construction. It is suitable for small and large projects for the conventional delivery approach design-bid-build.

1.2.2 1.2.2 Construction Manager as Adviser (CMa)

This family document applies when a fourth prime player participates and act as an independent adviser on construction management. The CMa enhances the level of expertise used to managing a project from start to finish. These documents apply to small and large projects in the private or public sector.

1.2.3 2.3 Construction Manager as Constructor (CMc)

Under this approach, the functions of the Constructor Manager and the Constructor merge and assume direct control over the construction work by direct contracts with the subcontractors. These documents apply to small and large private sector projects.

1.2.4 Design-Build

The owner obligates the design-builder to design and construct the project. The latest sign contracts with architects and construction contractors as required. These documents apply to small and large projects.

1.2.5 Integrated Project Delivery

It is a collaborative approach of all participants through all phases of design and construction. AIA provides three levels of collaboration:

³¹ American Institute of Architects. (n.d.). The History of AIA Contract Documents. Retrieved from <https://www.aiacontracts.org/contract-doc-pages/21531-the-history-of-aia-contract-documents>

- a. Transitional forms: After constructor manager agreements and offer a first step into IPD.
- b. Multi-party Agreements: A single agreement that the parties can use to design and build a project using IPD.
- c. Single Purpose Entity: A SPE creates a liability company for planning, designing, and constructing the project. It shares risk and reward in a fully integrated collaborative process.

Only large private sector commercial projects use these documents.

1.2.6 Interiors

This family of documentation is applicable for Furniture, Furnishings, and Equipment procurement services and procurement combined with architectural interior design and construction services.

Procurement is independent of architect's services.

AIA Document B152 applies to the design of both FF&E and architectural interiors. AIA Document B153 is for design services related to FF&E. Small and large tenant projects use these documents.

1.2.7 International

These documents are for U.S. Architects working in international projects in foreign countries. They cannot work as architects but as consultants. These documents apply to small and large projects.

1.2.8 Program Management

When the owner hires one or more additional consultants to assist in the design and construction. This program manager enhances the level of expertise applied to manage a program from start to finish.

1.2.9 Small Projects

These documents are suitable for residential, short commercial, or other projects relatively low cost and brief duration (less than a year from the start of design to completion of construction).

1.2.10 Digital Practice Documents

These documents apply for digital data or Building Information Modeling (BIM).

1.2.11 Construction Administration and Project Management Forms

This group of documents is useful for all project delivery methods. The forms include are:

- a. Qualifications statements
- b. Bonds
- c. Requests for information
- d. Change orders
- e. Construction change directives
- f. And payment applications and certificates

These documents apply for small and large projects.

1.3 ConsensusDocs³²

ConsensusDocs document series include:

200 Series: General Contracting

To address the relationship between an Owner and a Constructor for a given project. There are also agreements between Owners and specialty contractors. Besides, there are supporting documents for this kind of contracts such as:

- a. Change Orders
- b. Payment and Performance Bonds
- c. Schedule of Values
- d. Payment Applications
- e. Qualifications statements
- f. Electronic Communications Protocol
- g. Other supporting administrative documents

300 Series: Collaborative

The documents include:

- a. Multi-party Integrated Project Delivery Agreement
- b. Building Information Modeling
- c. Lean Construction
- d. Green Building
- e. Joining Agreement for Integrated Project Delivery

400 Series: Design-Build

Set of contracts to cover the relationship between Owner and Design-Builder and Design-Builder to Subcontractors. Also, there are supporting documents for this kind of relationships such as:

- a. Change Orders
- b. Payment and Performance Bonds
- c. Certificates of Completion
- d. Payment Applications
- e. Qualifications statements
- f. Other supporting administrative documents

500 Series: CM at Risk

Set of documents to address a contractual relationship between Owner and Construction Manager. It also includes a series of forms to coordinate with design professionals, construction managers, and subcontractors.

³² Consensusdocs. About us. <https://www.consensusdocs.org/about/>

700 Series: Subcontracting

This set of documents address the relationship between Contractors and Subcontractors. Also, there are supporting documents for this kind of relationships such as:

- a. Change Orders
- b. Purchase Orders
- c. Interim Directives
- d. Payment and Performance Bonds
- e. Certificates of Completion
- f. Payment Applications
- g. Qualifications statements
- h. Other supporting administrative documents

800 Series: Program Management

These series of documents address the relationship between Owner to a Program Manager, Owner's representative, or CM as Agent. There is a document that allows the Owner to hire a Trader Contractor or Consultant. Also, there are supporting documents for this kind of relationships such as:

- a. Change Orders
- b. Interim Directed Changes
- c. Certificates of Completion

900 Series: Public-Private-Partnership

At this date, there is only one document for Public-Private-Partnership. Additionally, there is a document for Standard Operation and Maintenance to procure standalone O&M services.

1.4 Engineers Joint Contract Documents Committee³³

EJCDC documents include the following categories:

1.4.1 Construction Related Documents

The Construction Specification Institute (CSI) and The National Utility Contractors Association (NACA) endorsed these documents.

These series of documents assume the design Engineer participates during the construction. These documents also consider payment alternatives as Lump Sump or Cost-Plus Fee. They also include the following supporting documents:

1. Change Orders
2. Notice of Acceptability of work
3. Notice to Proceed
4. Warranty Bond
5. Field Order
6. Work Change Directive
7. Certificate of Substantial Completion
8. Contractors Application for Payment
9. Payment and Performance Bond

³³ Engineers Joint Contract Document Committee. <https://www.ejcdc.org/>

10. Qualification Statements
11. Instructions to Bidders
12. Other Supporting Documents

1.4.2 Design-Build Documents

This family of documents addresses agreements for Lump Sum and Cost-Plus Fee contracts. Also, they contain documentation such as:

1. Request for Proposals
2. Price Proposal Form
3. General Conditions
4. Performance Bond
5. Payment Bond
6. Owner-DB
7. DB-Engineer
8. DB-Subcontractor
9. Change Orders
10. Work Change Directive
11. Other Supporting Documents

1.4.3 Engineer Subconsultant Documents and Owner Engineer Documents

This family of documents contains agreements between Owner-Engineer and Engineer-Consultants (Geotech, architect, others). The structure comprises basic terms, plus contract-specific exhibits with a detailed scope of services. The document exhibits include compensation methods. It also includes documents such as:

1. Joint Venture Agreement
2. Peer Review Agreement
3. Program Management Agreement

1.4.4 Procurement Documents

The family of documents provides forms to obtain bids from prospective sellers, and for establishing a procurement contract itself.

For EJCDC, the term procurement refers to the purchase of Goods for installation in a facility or construction materials.

Besides, it also includes documents such as:

1. Instructions for Project Owners and Bidders
2. Bid Form
3. Buyer Seller Agreement
4. Performance Bond
5. Payment Bond
6. General Conditions
7. Supplementary Conditions
8. Notices of Receipt
9. Conformity of Goods

The terminology is from the Uniform Commercial Code (UCC).

1.4.5 Public-Private-Partnership

EJCDC reviewed dozens of P3 agreements in use. Also, it asked the advice of owners, attorneys, financiers, developers, contractors, and design professionals in the United States and abroad.

This document provides additional terms and contract documents as exhibits to address project-specific requirements relating to design, construction, financing, operation, maintenance, revenue, and management.

1.4.6 USDA Rural Utilities Service Preapproved Documents

It is a group of standards used by the U.S Department of Agriculture, under the Rural Utilities Service (RUS) Water and Waste Disposal program.

About the Author



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