

THE LEGAL REGIME OF SMART CONTRACTS IN PUBLIC PROCUREMENT*

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Abstract

This article attempts to critically review the applications of smart contracts in public procurement. The literature on the topic is characterized by an emphasis on potential advantages and uses of this emerging technology, while it lacks in the concrete practical implementations of smart contracts in public procurement. In this context, we wish to realistically outline the legal regime of smart public procurement contracts. For this, we analyze the potential use of blockchain and smart contracts in public procurement at two stages: contract award and contract execution. Our article also discusses case studies of smart public procurement contracts, in order to assess their compatibility with and their impact on the EU public procurement system.

Keywords: public procurement, smart contracts, blockchain, digital administration, sustainability.

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1. Introduction

This research attempts to critically review the possible use of smart contracts in public procurement. The literature praises such technologies to be fit for public procurement processes, without showing exactly how could this be implemented in practice. Based on a review of the existing literature we have tried to imagine applications where said technologies may find usability and bring about important benefits.

Smart contracts are an emerging technology, based on blockchain, a decentralized and distributed ledger. The specificity of the smart contract stems from the automatic execution of its clauses, based on IF+THEN formulas (Casallas *et al.*, 2020, p. 64). These contracts are secure and immutable, as, in principle, no one can forge or modify them.

The literature on smart contracts in public procurement is rather homogenous in praising the use of this technology in public procurement. The articles focus on discussing the advantages of smart contracts and their potential application in public procurement. Smart contracts are commended as having the potential to positively impact public procurement, in aspects of cost, duration, efficiency, transparency, competition, opportunities for SMEs, as well as sustainability (for more on this topic, see: Agustin, 2019; Bienhaus and Haddud, 2018; Davtyan-Davydova *et al.*, 2020; Debono, 2019; Glavanits, 2019; Myeong and Jung, 2019; Nin Sánchez, 2019; Özkan *et al.*, 2021; Weingärtner *et al.*, 2021).

However, only a few writings discuss the real effectiveness of this technology and whether smart contracts may be more efficient than the instruments already used in EU public procurement (Sanchez-Graells, 2019a, 2019b).

Despite the high interest for the topic, we believe that the actual application of smart contracts in public procurement is not yet very well explained by the literature (Carvalho, 2019). Therefore, this article wishes to shed light on a simple, yet essential, issue, that of the use of the smart contracts in public procurement.

In the following sections, we will establish a conceptual framework for our analysis (2), we will explain the legal regime of public smart contracts (3), and we will analyze the possible use of blockchain in the public procurement at the two stages: contract award (4) and contract execution (5), and we will draw some conclusions (6).

2. A conceptual framework

It is important to note the fact that multiple concepts are used and intertwined in the technical and legal literature: ‘smart contract’ and ‘blockchain’. We need to make some conceptual clarifications before discussing the application of smart contracts and blockchain in public procurement.

Simply put, a blockchain is a digital ledger database, stored across computers that are part of the network. First of all, smart contracts are based on blockchain. A smart contract uses blockchain as its technical infrastructure. Smart contracts are a set of promises that are automatically executed when predetermined conditions are met. From a technical point of view, smart contracts could automate any process that can be presented as an IF+THEN

formula. However, in this paper having a legal perspective, we would look at the smart contract as a technology that automatizes legal promises.

The literature that refers to smart contracts and procurement does not make this distinction. They use ‘smart contracts’ as being both the procedure for concluding a contract and the execution of the contract in practice. However, in public procurement, the meeting of the wills of public authorities and the private operators is subjected to specific conditions. The award procedure is conducted unilaterally by the public authority, and only the contract concluded afterwards is bilateral. Therefore, we propose a needed conceptual distinction that would fit the public contracts theory: before a contract is signed, it is logical to refer to blockchain technology when discussing digital means of awarding the procurement contract. As a result of this award, the concluded contract could be a ‘smart contract’.

3. The ‘hype’ of smart contracts and their legal regime

One of the most cited and well-recognized definitions of a smart contract, coined two decades ago by the computer scientist Nick Szabo, states that ‘a smart contract is a set of promises, specified in digital form, including protocols within which the parties perform on this promise’ (Szabo, 1996). Therefore, a smart contract relies on promise, the fundamental element of contractual law. In the context of smart contracts used in public procurement, it is important to note first its contractual, bilateral nature.

A smart contract is permanent and immutable. No one can forge this operation once a transaction is concluded via a smart contract. The technological explanation behind this characteristic is that ‘smart contracts are copied to each node of the blockchain network’ (Naheed Khan *et al.*, 2021) and that ‘any attempt to interfere with an entry after it has been recorded will leave a trace’ (Allena, 2020, p. 1058). In principle, this makes it impossible to make modifications or changes to any node, all of them being connected. However, ‘a number of authors point to the possibility and the importance of including code within the smart contract that enables modifications to the smart contract’ (Debono, 2019, p. 22), mainly when the law or the obligations of the parties are not respected (Debono, 2019, p. 22).

Another characteristic of smart contracts that confers more immutability than a regular contract is its ‘automatic and independent execution of those terms of a contract that are programmable in relation to their functions through mathematical logic (IF + Then) and that make its clauses binding, unstoppable and automatic, and can be executed by external conditions’ (Casallas *et al.*, 2020, p. 64). Legally, this impacts the respect of the obligations and the risk of non-compliance with the contractual obligations. Moreover, this impacts dispute resolution, as the clauses should be automatically executed and the sanction or compensation in case of non-compliance could also be automatic, this way avoiding a forced execution of the contract. The immutability trait could also reduce human error and avoid disputes (Naheed Khan *et al.*, 2021), as well as diminish corruption, an important matter in public procurement procedures that is closely related to sustainability issues. As blockchain allows a perfect trace of all operations and transactions, the acts of

corruption could be reduced and easily identified (Casallas *et al.*, 2020, p. 68). Besides this, the automatic execution of the clauses ‘generates an impossibility or, at least, an increase in the difficulty of executing acts of corruption’ (Casallas *et al.*, 2020, p. 68). Smart contracts offer trust and transparency between parties, as all of the participants to a transaction operated *via* a smart contract possess the same degree of access to the network and no central authority can modify the data.

Thus, smart contracts present several particularities, granted by their technological dimension. The doctrine notes that, while ‘there is no doubt that public contracts form part of the contractual realm, (...) doubt has been cast as to whether smart contracts can be considered as a contract’ (Debono, 2019, p. 18). Even though they represent a disruptive technology, that reforms the *status quo* of the legal practice, smart contracts should fulfill the main elements of a contract. The constitutive elements of a contract could vary across different legal systems; however, some necessary common conditions would be: ‘agreement, consideration, competence and capacity, legal object and purpose’ (Governatori *et al.*, 2018, pp. 379–380), with certain variations. A smart contract comprises the main elements of a contract, but digitally, inside a blockchain — this being the main difference from standard contracts:

‘Blockchain technology overlaps traditional contracts by including the terms of agreements between two or more parties, but surpasses them thanks to smart contracts by automating the execution of agreements in a distributed environment when conditions are met’ (Naheed Khan *et al.*, 2021).

Therefore, smart contracts have a contractual nature but, as a disruptive technology, present several characteristics that distinguish them from this juridical standard. Public contracts, for their part, may present particularities from the private contract. Therefore, before designing the possible applications of smart contracts in public procurement, we should explore the legal regime of a smart public contract.

The smart contract presents a double dimension: on one hand, its technical structure and, on the other hand, its legal regime. As presented above, the legal regime of the smart contract corresponds to a private law contract, with slight adaptations. The idea of the blockchain resides in eliminating intermediaries: ‘Central to this revolution is the idea of ‘contracting without the state’ by entering smart contracts based on blockchain technology’ (DiMatteo *et. al.*, 2019, p. 4). However, ‘this escape from the law is mere illusion, as law will continue to play a vital role in private transactions’ (DiMatteo *et. al.*, 2019, p. 4). Therefore, one possible argument is that smart contracts are incompatible with the public law regime.

4. Blockchain in the award phase of public procurement contracts

The literature presents the use of blockchain in automating the verifications of selection and award criteria. For example, some articles discuss its use in tender bidding more generally (Deshpande *et al.*, 2020). Another author designs the possibility of creating ‘reputation lists accessible to all participants’ (Elalaoui Elabdallaoui *et al.*, 2021, p. 214).

The evaluation of the most economically advantageous tender through this technology is also a topic of the literature (Pellegrini *et al.*, 2020).

Concerning blockchain, one author states that ‘all activities on the project, from the call for tender, procurement of material, choice of contractor, the status of the work will be stored on the blockchain’ (Sriram *et al.*, 2021, p. 157).

Finally, the idea of automatization through blockchain and smart contracts is present in various forms and degrees: from the automatization of ‘different stages of public procurement procedures attempting to fix their biggest current weaknesses’ (Weingärtner *et al.*, 2021), to the proposal of transforming the entire selection process into a smart contract (Casallas *et al.*, 2020).

In our view, before discussing the application of this technology into the current legal framework of EU public procurement, it is essential that smart contracts and blockchain are explained and conceptualized properly.

As stated above, a blockchain technology is a digital ledger, stored across computers that are part of the network. A smart contract is a contract concluded and executed using blockchain technology. Firstly, the smart contracts would need to be concluded as a result of an award procedure, which is organized according to the EU Directives. The idea that by ‘smart contract’ we understand both the award procedure and the execution of the contract is debatable. In our opinion, it should be made clear that the award of public contracts is a unilateral procedure, organized by state authorities according to specific rules, and that automation of such procedure may be done using blockchain technology, but it is not a ‘smart contract’. Smart contracts, on the other hand, can be an already concluded procurement contract, which is executed, oversaw and even remedied transparently, using blockchain technology.

Is blockchain fit for awarding public contracts under the public procurement legal regime? The problem lies in the practicalities of smart contracts in public procurement. In this context, the question is where should the smart public contracts be awarded? In the electronic procurement systems already developed by the different jurisdictions? On separate platforms using blockchain technology?

The best option for integrating smart contracts into the procurement procedures may be the already existing digital infrastructure, therefore on the electronic procurement platforms of the member states. We believe this would be an optimal solution, as smart contracts should enhance the current electronic procurement framework and add value to it, thus leveraging the existing system and not replacing it.

We hold that the systematic use of blockchain technology is more appropriate in signing contracts for procedures without negotiation (open or restricted procedure). It is nevertheless possible to foresee the use of smart contracts in the case of a competitive procedure with negotiation or in a competitive dialogue, when the results of such negotiations are encrypted in the ledger.

In this context, the automatization of the process through blockchain would apply to verifying the fulfilment of conditions laid down in article 57 (the exclusion grounds), article 58 (the selection criteria), as well as article 67 (the award criteria) of Directive 2014/24.

Currently, economic operators have to state that they do not fall in any of the exclusion grounds and that they conform to the selection criteria *a priori*, through the European Single Procurement Document (ESPD). The public authorities verify the conformity of the ESPD with the original documents *a posteriori*, by checking the documents that attest the information stated in the ESPD. In the context of automatized checks, the blockchain technology can provide an avenue for checking the validity of proofs presented. The system could automate the verifications of the exclusion grounds and the selection criteria by checking the original documents referenced in the ESPD in real time (that is, before determining the winning tender). The blockchain technology could verify the respect of the exclusions grounds and rule out any economic operator that does not comply with this condition (see also: Nin Sánchez, 2019).

When it comes to selection criteria, the smart contract could also perform automatic checks on the elements listed in the contract notice. Nevertheless, selection criteria, just as contract award criteria, embody to some extent a degree of subjective appreciation. In order to work, the formula of the smart contract should be expressed in a mathematically measurable manner (Carvalho, 2019). This could present a degree of complexity in many cases. For example, the contract award criteria of staff experience would be easily transposed into a formula, by expressing the period in months or years. Other aspects that could be verified using blockchain technology are the ones expressed in exact or determinable periods of time, such as the ‘delivery date’ (Directive 24/2014/CE, art. 67(2), c)) ‘delivery period or period of completion’ (Directive 24/2014/CE, art. 67(2), c)).

However, the award criteria present in article 67(2), namely ‘quality, including technical merit, aesthetic and functional characteristics, accessibility, design for all users, social, environmental and innovative characteristics and trading and its conditions’ (Directive 24/2014/CE, art. 67(2)) are more difficult to verify using a mathematically verifiable formula. Among these, there are some more subjective than others, such as the aesthetic dimension.

A dimension of high interest that should be explored is the implementation of smart contracts in the ‘techniques and instruments for electronic and aggregated procurement’ (Directive 24/2014/CE, Title II, Chapter II). In this context, the techniques and instruments that deserve an in-depth analysis are: dynamic purchasing systems, electronic auctions, electronic catalogues and centralized procurement.

What is of utmost importance to be explored is whether the implementation of smart technology into the electronic and aggregated procurement techniques would bring advantages compared to the current procedures, which are also in majority of countries pretty much digitalized. The advantages could be: a better traceability of the procedure and increased trust in the procedure. However, for this to happen, the blockchain technology should be more than a niche discussion.

There are known attempts in the world to use this technology in public procurement. For example, the Peruvian Government already implemented the use of blockchain and smart contracts into centralized procurement and electronic catalogues. Peru Compras, the central purchasing body of Peru states that it is the first state entity that uses block-

chain and smart contracts in e-procurement, reporting positive effects on cost, duration, competition, as well as lowering corruption and bureaucracy (Peru Compras Information Notice, 2019). The procurement process is digitized on an immutable ledger and is dependent on LAC-Chain, which is a blockchain ecosystem led by the Inter-American Development Bank. LAC-Chain is a private blockchain which has nodes managed by the Inter-American Development Bank (Peru Reports, 2019). Besides significant savings, procedure duration was lowered to a minimum of 6.6 days, and the number of submitted tenders was raised to 70.8 per purchase (compared to 3 offers in the classic procedure), according to the same webpage. The system can be monitored by citizen through Peru Observa, an open data portal (Peru Compras Information Notice, 2019).

Another trial project was developed in Columbia, entitled the ‘Transparency Project’ (CMS Law Webpage), developed with the Inter-American Development Bank (the same institution that contributed to Peru Compras) and the World Economic Forum. This project created a blockchain software that allowed for record keeping, real time auditability, automation through smart contracts and enhanced citizen engagement (World Economic Forum Report, 2020).

The digital process insures three main objectives (CMS Law Webpage): (1) Non-alterability of tenders. The tender documents cannot be modified after publication, except through a separate entry. (2) Traceability. “The bidders will submit encrypted proposals that will be stored in a decentralized storage system so that, in case they are modified or manipulated, there is a record of what each of the bidders presented, modified or attempted to manipulate. No proposal will be submitted after the closing of the bidding process, and this term may not be modified or altered after its expiration by any of the parties involved in the process”. (3) Automatic evaluation of offers. The software will “automatically evaluate bid offers to meet minimal evaluation and enabling requirements, and immediately will publish the results of the qualified bidders. Depending on the nature of the selection process, the evaluation of the scoring requirements will be carried out automatically by the system or manually. In any case, if it is done manually, the record of the scrutiny and assessment that is made of each of the proposals will remain in the system. Any intervention, action and decision that take place during the procedure will be permanently and publicly recorded in indelible and unchangeable records.” (CMS Law Webpage).

Our opinion is that the system in Colombia resembles very much the regular e-procurement systems in Europe. For instance, Romania’s SEAP (Electronic Public Procurement System) insures exactly the same features — non-alteration of bids, traceability and automatic evaluation of tenders (price). So, the question is whether the smart contract system in Colombia is anything else than a functional e-procurement system.

There are two major groups of countries as regards the adoption of digitalized procurement. First, the majority of developed countries have put already in place a system for awarding electronically public contracts. The systems are designed with the ‘e-Procurement Golden Book of Good Practice’ (PWC, 2013) in mind, and they fulfill all or most of the criteria put forward there of an effective electronic procurement system. In this context, the question is whether blockchain technology would bring something new or better at the table.

In our opinion, there is no sufficient information in the literature or in the practice to draw this conclusion. Those countries that have a working e-procurement system that is transparent, ensures traceability of award procedures and accessibility, provides users with trust and there is no need for its replacement, only improvement. How can blockchain technology bring about this improvement? The existing literature confines itself in discussing the matter only theoretically, so we could not find yet proof for such a conclusion. However, the matter deserves further research.

Second, other countries have not yet developed an effective e-procurement system. Is blockchain the solution for them? The leap from offline procurement to blockchain procurement is a huge one. It has the advantage of burning stages, but it requires more capabilities from contracting authorities and an understanding of how blockchain works by all users. Designed and operated in a friendly manner for users, it could contribute to modernization of procurement. Nevertheless, the obstacles are also quite important — the lack of digitalization of public administration, the accessibility for all users, etc.

In the European Union, an important principle, stated by article 22 of the Directive 2014/24/EU is the non-discriminatory application of the means of communication, that should be ‘generally available and interoperable with the ICT products in general use and shall not restrict economic operators’ access to the procurement procedure’. Even though article 22 offers subsequent exceptions, they should be of limited application. Therefore, if blockchain technology were to be used in public procurement, it should be available to any economic operator in an open and non-discriminatory manner.

As this technology is not currently largely used neither by public authorities, nor by all economic operators, it is more complicated to visualize their large spread and non-discriminatory availability in public procurement. In order to overcome this difficulty, the infrastructure of smart contracts should be made available by the state in a centralized manner, and be easily accessible by any economic operator. Private operators should not be expected to provide their own infrastructure, but should be able to access or download it from the public authority. However, making this technology available and operable for all public authorities and private operators would be a challenge.

In conclusion, availability and equal access to the technology of blockchain is an important obstacle that may hinder the adoption of such technology in public procurement.

5. Smart procurement contracts — the execution phase

The public contract has various definitions and legal regimes throughout the different member states. ‘These notions however do not necessarily coincide’ (Caranta, 2021, p. 4). One aspect that varies is the ‘degree of public power (...) going beyond the private law contract rules grounded on parity between the contractual parties’ (Caranta, 2021, p. 4). However, the EU public contract concept encompasses the national ones: ‘by using ‘public contract’ the EU directives do not commit to any specific notion used in any of the Member States’ (Caranta, 2021, p. 4). We have, therefore, established, that the EU

definition of public contract does not confine to the definitions given by the national systems (more on this topic: Bovis, 2012, p. 260).

The legal regime of the EU public contract, as Christopher Bovis states, ‘(...) apart from the obvious written format requirement, are: i) a pecuniary interest consideration given by a contracting authority, and ii) in return of a work, product or service which is of direct economic benefit to the contracting authority’ (Bovis, 2012, p. 260). These two conditions do not pose any difficulty in relation to a smart contract.

Firstly, the pecuniary interest can be present in a relationship built on the infrastructure of a smart contract. Secondly, integrating the object of a contract — a work, product or service — into a blockchain structure is possible, just as regular civil contracts, that have various objects, can be transformed into a smart contract. Moreover, the condition of the ‘direct economic benefit to the contracting authority’ (Bovis, 2012, p. 260), presents a monetary interest; this material dimension does not present any conflict with a potential blockchain-based structure of the contract. Hence, up to this point, we can argue that the characteristics of the smart contract are compatible with the characteristics of a public procurement contract.

What is different from private law contracts, is the public power of the contracting authorities, which unbalances the procurement contracts. Here, the smart contracts may be harder to adapt, as the preeminence of public interest in public contracts may trump the essential equality of the smart private law contracts.

For regular procurement contracts, the smart contract could bring clarity on the contractual obligations, could execute payments automatically after the provision of the works, services or supplies is confirmed in the system.

More uses of smart contract may be foreseen in framework agreements or in the dynamic purchasing system, due to their special characteristics: multiple mini-contracts and the continuous procurement of works, supplies or services, respectively.

Concerning the use of smart contracts in the execution of the public procurement contract, the main advantages revolve around the monitoring and the evaluation of the execution.

Firstly, one main use of smart contracts in public procurement would be in auditing the procedure (Akaba *et al.*, 2020). By using a smart contract as a legal fundament for the procurement, all the information would be traceable and auditable. In turn, this would enhance the transparency of the procedure.

Moreover, it is easy to validate and to verify documents (Georgioska, 2020) stored in a smart contract, as they are stored digitally. Nevertheless, any digital and secure form of storage could insure the traceability and accessibility of documents.

Another application of smart contracts in the execution of public procurement contracts is in the area of record keeping (Weingärtner *et al.*, 2021). Smart contracts could offer reliable and secure data concerning dates, through independent timestamps (Nodehi *et al.*, 2020).

In this sense, digital signatures (Georgioska, 2020) could also be provided through smart contracts, thus reinforcing digitalization, security, transparency and traceability of the information stored on the blockchain database.

Smart contracts could also be used to store delivery verifications (Weingärtner *et al.*, 2021). Once a verification is done, this information could be stored on the same smart contract as the rest of the procurement document and information. The delivery verification would be easily accessible for anyone who has access to the system.

The execution of a smart contract raises further issues. The automation of the contract implementation requires access of the smart contract to the payment system of the contracting authorities, who are mandated to pay any work, service or supply as soon as these are provided by the private party, the blockchain system being the only verification possible. Contracting authorities would need to gather new knowledge on smart contracts and their peculiarities.

One should question how the ineffectiveness of the contract as a sanction could be applied in the case of a smart contract. Would that be an automatic decision taken by the blockchain platform when certain conditions are met? Can this decision be challenged in court? Who oversees the incidents that occur during the automatic execution of the contract? Along the same lines, is the suspension of a smart public contract possible? These issues are relevant to the topic and should make the subject of further discussion in the doctrine. In our opinion, the control of the courts or review bodies should be maintained in case of smart contracts.

Other issues also revolve around remedies for smart public contracts. Specialized Complaints boards have been set up in multiple jurisdictions: '16 EU countries have set up specialized first instance public procurement review bodies (administrative and/or judicial). In the remaining countries, an existing judicial review body is responsible for the review of procurement procedures' (for an overview concerning the competent jurisdictions in EU public procurement, see: European Commission, National Review Systems in the Area of Public Procurement, First Instance). These bodies would have to examine, if necessary, issues revolving around the smart contract, therefore requiring increased competences. In this context, the need of specializing and training the courts and review bodies is even more important.

Smart contracts can enhance transparency and traceability of the public procurement supply chain (Bienhaus and Haddud, 2018). This is an essential issue when it comes to corruption, as well as to monitoring sustainability issues in the execution of the contracts, notably social issues, such as sub-contracting.

6. Conclusions

The first part of this article explored the relationship between smart contracts and the public procurement. In order to explore this relation, we provided a clarification of the concepts of 'blockchain' and 'smart contract' and pinpointed the particularities of smart contracts compared to the classical contracts. Subsequently, we discussed the legal regime of a smart public contract. Even though it is an emerging technology, with several specificities, its integration in the legal framework of public procurement is theoretically possible.

The second part of this article discussed the possible implications of using smart contracts in the context of the EU public procurement. We concluded that blockchain can be used for award phase and smart contracts for execution phase of the procurement process.

It would be interesting to notice the fact that smart contracts are implemented in e-procurement in systems that do not have a functional, efficient and used e-procurement portal, such as Peru or Columbia. In the European Union, where countries have developed a transparent e-procurement system, smart contracts have not yet been piloted. However, we note the incipient use of blockchain in EU countries, an example being the e-Estonia system (blockchain is used in the digitalization reform of Estonia (e-Estonia), with various applications, such as e-ID, e-residency, X-road (PWC, 2019)). Taking into consideration the differences between the public procurement legal system in Peru and the EU, one could argue that the smart contract does not bring more to the EU table than what the existing procurement systems provide in terms of efficiency.

Smart contracts seem to be more adapted for countries without an e-procurement system, that do not already have electronic procurement that ensures security, transparency and equal treatment and non-discrimination. For digital systems that already respect these principles (such as EU e-public procurement), the infrastructure can be also updated to accommodate smart contracts.

The issue of smart contracts in public procurement is a topic ‘under construction’, both conceptually and practically. One of the main issues is adapting their application to the current legal framework. In this context, regulatory sandboxes could offer a useful option. Regulatory sandboxes allow the creation and testing of innovative solutions ‘under the regulator’ oversight (UNSGSA, ‘Briefing on Regulatory Sandboxes’, 2018, p. 1).

However, at this point, the hype around using smart contracts and blockchain in public procurement is a bit unsubstantiated.

Further to this incipient research, we intend to explore how verifications of selection, qualification and exclusion criteria can be improved through artificial intelligence applications, that are more flexible and could be more easily applied in this context than blockchain. In further research, we will also question how much procurement procedures can be automatized by software and how much is essential human intervention and thus should remain a task for humans.

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