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Are smart contracts the future of contracts?
by Swati Dangi
Featured Paper

Are Smart Contracts the Future of Contracts?[1, 2]

Swati Dangi

ABSTRACT

Contracts are an integral part of the corporate world, and even for individuals dealing with all types of big and small businesses or even other individuals. This paper explores if and why smart contracts will replace traditional contract systems in the near and upcoming future. In this paper, the author analyses the working of both traditional and smart contracts. The paper explains the working of the blockchain technology which is the basis of smart contracts, and explains what contracts are, and how they are related to projects, programmes, and portfolios. The paper compares other alternatives to smart contracts with the help of Multi-Attribute Decision Making Matrix and selects the best one using selection criteria method. Finally, the author summarizes the paper with the advantages and disadvantages of traditional and smart contracts.

Key words: Contracts, Smart Contracts, Blockchain, Project Management

INTRODUCTION

A contract is generally defined as *"An agreement between two or more persons, which created an obligation to do a particular thing. Its essentials are competent parties, subject matter, legal consideration, mutuality of agreement, and mutuality of obligation."* [3]

"A contract is a binding agreement between two or more parties. It has several legal elements, such as an **offer** made by one party; **acceptance** of the offer by another party; **intention** to create a legal relationship by the parties; and **consideration** for the offer. An **agreement** can be formed in writing, through a discussion by parties (oral), or it can be implied". [4]

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[1] Editor's note: This paper was prepared for the course "International Contract Management" facilitated by Dr Paul D. Giammalvo of PT Mitratata Citragraha, Jakarta, Indonesia as an Adjunct Professor under contract to SKEMA Business School for the program Master of Science in Project and Programme Management and Business Development. http://www.skema.edu/programmes/masters-of-science. For more information on this global program (Lille and Paris in France; Belo Horizonte in Brazil), contact Dr Paul Gardiner, Global Programme Director, at paul.gardiner@skema.edu.

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"Contracts have always required middlemen or brokers till now and creating them can be a time and money consuming process. Moreover, there are litigious elements related to contracts that can either be exploited or can just make matters more complicated than easier when they are actually needed most."[5]

But nowadays everyone trusts technology more than people. A **smart contract** eliminates the middlemen (lawyer, bank, etc.), or you can say it is a platform between buyers and sellers without a broker. It works as a digital notary for contracts where no lawyer is required to ensure that the agreements are met. It has a self- executing nature, and is based on a code.[6] Smart contracts save money in business as no extra pay or share is going to the broker as these are by very definition decentralized, i.e., they are not controlled by anyone.[7] It is a safe, uninterrupted, and secure network, and your information is most likely to be never lost in smart contracts as they work on blockchain technology and the code is written on a blockchain.[8]

Now, what is blockchain? In simple words, it is an incorruptible digital ledger of economic transactions that can be programmed to record not just financial transactions but virtually everything of value. "It is basically a growing list of records, called blocks, which are linked using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data. By design, a blockchain is resistant to modification of the data". [9] Thus, it is a secured database and it cannot be hacked or modified as every node downloads the copy of the contract and every single modification is stored.

In smart contracts the output of a project or agreement is already fixed, so we already know what to expect. It helps in the management of any workflow related to this project or agreement as we have a proper work breakdown structure - it has all the set stages, marked dates, and payment details. Once a phase is completed it automatically transfers the payment to the concerned person/department. Delays or scheduled progress can be noted easily, and the payment can be sent accordingly.

	Definition	Example
Project	**Project** is defined to be "an investment that requires a set of logically linked and coordinated activities performed over a finite period of time in order to	Converting all existing traditional contracts into smart contracts, and to ensure that all the contracts made in the future are smart contracts

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	accomplish a unique result in support of a desired outcome" [10]	
Program	**Strategic Program**: Deliver assets and benefits that are directly linked to attaining the sponsoring organization's future state[11]	Ensuring that customers should understand what is written in the contract. Also, the company can track project status within their internal teams as well as their major external clients.
	Operational Program: Deliver assets and benefits that are critical to the sponsoring organization's day to day operations[12]	New system needs to be made, so in-house talented resources are required to develop contracts, as it is very recent and upcoming technology; and there is a need for proper personnel and systems in place to ensure the security and safety of all the data.
	Multi-Project Program: Achieve synergies from projects with common traits such as shared resources, similar clients or product technology. [13]	There are multiple technologies such as computer vision (image recognition), natural language processing, chatbots (so that users can ask questions related to their contracts 24/7 without talking to a human being) feeding into the main automated contract ecosystem and they all involve similar profiles such as project managers, data scientists, data manager, data engineers. All these technologies are all tying into one project, i.e., to enable the company to have smart contracts base system, and thus all resources can be used to work across projects.
	Mega-Project: Deliver a specific asset to the sponsoring organization. [14]	A specific asset would be extremely strong in-house smart contract tool, something that can be used exclusively by this company to create smart contracts for their clients and internal/external projects.
Portfolio of Assets	**Informational Asset**: Controlled by functional groups like IT, engineering. [15]	Secure IT environment, cloud servers, hardware servers, secured laptops, software, and tools.

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	Human Asset: Controlled by HR	Project managers, IT personnel, data scientists/engineers/architects, data managers, informational security personnel
	Physical Asset: controlled by either operation ("plant manager") or other functional entities such as "heavy equipment shop" [16]	The physical location/office of all the project team.
	Financial Asset: controlled by accounting or finance. [17]	Budget allotted for developing the contract, payroll of the employees.
	Intangible Asset: Difference between a company's book value and market capitalization value is controlled by sales and marketing or public relations departments. [18]	Posing themselves as a thought leader in this tech domain by conducting seminars and conferences that can be used to attract new minds and to let the world know the plans that the company has.
Portfolio of Project	**Portfolio of Project** is an investment portfolio. The objective being is to minimizing the risk and maximizing the return. Any organization, be it owner or contractor has a portfolio of assets available to dedicate to projects, with the objective being to develop the best "mix" of projects which will generate the most favourable return on those "assets." [19]	Our final product is a smart contract-based ecosystem, and to get an ideal final product up and running multiple technologies will need to be developed (different portfolios of multiple products), but the core tech can work with just a part of these side products. Even if a few non-core technologies are interrupted or fail, still the core smart contract product can be assembled without compromising the full project.

Table1: Definitions and connection with PPP[20]

Now, imagine you are searching for a house, and you liked one and decided to buy it. Now to pay for that house, you need to have an agreement between the buyer (you) and the seller. For the payment, you need to do a bank transfer, a lawyer for all the legal procedures, and a broker, all of which will cost you, the buyer, money. So, the total amount you will have for the house will be the net cost of the house, plus all the surcharges of the concerned middlemen.

With the help of these smart contracts, the agreement will be made on the blockchain with the terms that are agreed by both buyer and seller. Once the terms are set on blockchain in the form of code they cannot be changed or modified. As per the contract, once the amount mentioned in the agreement is transferred to the seller, the buyer will be the owner of the property due to its self-executing nature. Moreover, the buyer will not have to pay any intermediate cost.

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Let's take one more example of how it will help in project management for a construction project. Such projects can be broken down in several branches such as vendors, suppliers, workers, etc. Let's take an example of how a smart contract will work for paint supplier in a construction project. The project manager will ask his coder to agree with an agreement between the company and the paint supplier, and the agreement will contain all the required costs, all the milestone dates, the required quality and color of the paint, etc. An agreement will be made with the consent of both the parties. The smart contract will read this agreement and then according to the specifications outlined in it, it will check the supplies and will proceed with the payment if all the material is as per the specification and if not, it will not transfer the money. If the supplier sends the supply late, then it will reduce the amount to be transferred due to the late delivery clause mentioned in the contract.

These are oversimplified examples of potential applications of smart contracts, and they can be used in various sectors such as property agreements, Health Insurance, government elections, insurance, etc.

This paper will answer the following questions:

1. How smart contract will be beneficial.
2. How it will help in project management

METHODOLOGY

❖ **Step 1 – Problem statement**

To summarize, this paper aims at analyzing the traditional and smart contracts and explain why and how smart contracts are better & will be beneficial than traditional once. To do so, I will answer the following questions:

➢ What are the advantages and disadvantages of traditional contracts?
➢ What are the advantages and disadvantages of smart contracts?
➢ Why is it better to replace traditional contracts with smart contracts?

❖ **Step 2 – Feasible Alternatives and Attributes**

There are problems with the existing traditional contracts and proposed a smart contract as an alternative by comparing both the alternatives.

- Verbal contracts[21]
- Written contracts[22] (Traditional contracts)

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❖ **Step 3 – Selection of criteria**

- Offer: One of the parties make a promise to do or refrain from doing some specific action in the future. [23]
- Consideration: Something of value is promised in exchange for the specific action or nonaction. [24]
- Acceptance: the offer is accepted unambiguously through words, deeds or performance.[25]
- Capacity: the legal ability of a person to take financial and legal decisions. [26]
- Mutuality: the parties understood and agreed to the basic substance and terms of the contract. [27]
- Security: Transactions are encrypted and stored on a distributed ledger intended to be immutable. [28]
- Economy & speed: Automation reduces transaction times and unnecessary manual processes. [29]
- Transparency
- Self-execution
- Flexibility

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❖ **Step 4 – MADM Analysis:**

Selection of criteria	Verbal contract	Traditional contracts (Written contracts)	Smart contracts
Offer	Medium	High	High
Consideration	Medium	High	High
Acceptance	Medium	High	High
Capacity	Medium	High	Medium
Mutuality	Medium	High	High
Security	Low	Medium	High
Economy & Speed	Medium	Medium	High
Transparency	Medium	Medium	High
Self-execution	Low	Low	High
Flexibility	Medium	Medium	Low

Table 2: Multi-Attribute Decision Making Matrix: Features of the alternatives (A)[30]

In the above table, we can see the total of verbal contracts is very less compared to the traditional (Written contracts) and smart contracts, and we can notice that through the table that the smart contracts are a better option for contracts.

Selection of criteria	Offer (A)	Consideration (B)	Acceptance (C)	Capacity (D)	Mutuality (E)	Security (G)	Economy & Speed (H)	Transparency (I)	Self-execution (J)	Flexibility (K)	Total
Offer (A)		1	1	1	1	1	1	1	1	1	9
Consideration (B)	0		0	0	0	0	0	0	1	1	2
Acceptance (C)	0	1		0	1	1	1	0	1	1	6
Capacity (D)	0	1	1		1	1	1	0	1	1	7
Mutuality (E)	0	1	0	0		0	1	0	1	1	4
Security (G)	0	1	0	0	1		1	0	1	1	5
Economy & Speed (H)	0	1	0	0	0	0		0	1	1	3
Transparency (I)	0	1	1	1	1	1	1		1	1	8
Self-execution(J)	0	0	0	0	0	0	0	0		0	0
Flexibility (K)	0	0	0	0	0	0	0	0	1		1

Table 3: Selection criteria[31]

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❖ **Step 5 – Analysis and comparison of preferred alternatives:**

In this, we will grade the attribute as Low (0), Medium (1) and High (2) and will also differentiate the basis of positive (Green), neutral (Yellow) or negative (Red). We will calculate the total of all the alternatives which will help us select the better alternative.

Selection of criteria	Verbal contract	Traditional contracts (Written contracts)	Smart contracts
Offer	1	2	2
Consideration	1	2	2
Acceptance	1	2	2
Capacity	1	2	1
Mutuality	1	2	2
Security	0	1	2
Economy & Speed	1	1	2
Transparency	1	1	2
Self-execution	0	0	2
Flexibility	1	1	0
Total	8	14	17

Table 4: Multi-Attribute Decision Making Matrix: Features of the alternatives (B)[32]

In the table below, we will take the value from table 3 – 0 (Low), 1 (Medium), 2 (High). For Offer, best case is 2, and the worst case is 1, and for the self-execution best case is 2, and the worst case is 0.

	Undesirable- (Worst Case-Attribute Value) / (Worst Case-Best Case)		
	Desirable- (Attribute Value -Worst Case) / (Best Case-Worst Case)		
	Value	Formula	Dimensionless Value
Offer	1 - Medium	(1-1)/ (2-1)	0
	2 - High	(2-1)/ (2-1)	1
Consideration	1 - Medium	(1-1)/ (2-1)	0
	2 -High	(2-1)/ (2-1)	1
Acceptance	1 - Medium	(1-1)/ (2-1)	0
	2 - High	(2-1)/ (2-1)	1
Capacity	1 - Medium	(1-1)/ (2-1)	0
	2 - High	(2-1)/ (2-1)	1
Mutuality	1 - Medium	(1-1)/ (2-1)	0
	2 - High	(2-1)/ (2-1)	1
Security	0 - Low	(0-0)/ (2-0)	0
	2 - High	(2-0)/ (2-0)	1
	1 - Medium	(1-1)/ (2-1)	0

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Economy & Speed	2 - High	(2-1)/ (2-1)	1
Transparency	1 - Medium	(1-1)/ (2-1)	0
	2 - High	(2-1)/ (2-1)	1
Self-execution	0 - Low	(0-0)/ (2-0)	0
	2 - High	(2-0)/ (2-0)	1
Flexibility	0 - Low	(0-0)/ (1-0)	0
	1 – Medium	(1-0)/ (1-0)	1

Table 5: Multi Attribute Decision Making Matrix : Non-Dimentional Scaling Technique (A)[33]

Selection of criteria	Verbal contract	Traditional contracts (Written contracts)	Smart contracts
Offer	0	1	1
Consideration	0	1	1
Acceptance	0	1	1
Capacity	0	1	0
Mutuality	0	1	1
Standardization	0	0	1
Security	0	0	1
Economy & Speed	0	0	1
Transparency	0	0	1
Self-execution	0	0	1
Flexibility	1	1	0
Total	1	6	9

Table 6: Multi Attribute Decision Making Matrix : Non-Dimentional Scaling Technique (B)[34]

Now, we will compare each alternative with one another:

Traditional contract vs. Verbal Contract	6/1	6
Smart contract vs. Verbal Contract	9/1	9
Smart contract vs. Traditional contract	9/7	1.3

Table 7 : Multi Attribute Decision Making Matrix : Non-Dimentional Scaling Technique(C)[35]

From the two above tables, we can see that the score of Smart contracts is 9 and it is nine times better than verbal contracts and 1.5 times better than Traditional contracts.

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There is a big difference between verbal and other two contracts, and we can easily say it's not a feasible type of contract. We can see that smart contracts are 1.5 times better than traditional contracts. So, the author decided to give advantages and disadvantages of both types of contracts.

Advantages and disadvantages of Traditional contracts and Smart contracts

Inherent disadvantages of traditional contracts	How smart contracts fix these
Boilerplate, the standard contractual language that is usually found at the end of a contract, is not read by many people who might consider it to be jargon. The problem is not usually what has been put in the boilerplate but what is left out, which can put the person blindly signing the contract at legal risk. So, it becomes necessary to thoroughly read all boilerplate to watch for sections that one does not agree with.	As smart contracts are computer-generated, it is the code or the platform (app/website) user interface that explains clearly the obligations of the parties involved.
Traditional contracts can be used to favor one party, as the word "standard" doesn't mean that the contract has been reviewed and agreed upon by an association of attorneys. The company issuing the contract might have done the standardization, making the contract its standard contract, with high chances of favoring the company.	There are many different types of smart contracts available these days. One can choose whichever fits their need and change it according to the use case.
	As everything is done by the prescribed program code, intermediaries are eliminated, thus reducing costs and increasing speed.
	Smart contracts are encrypted and are distributed among nodes in a decentralized registry, thus guaranteeing that it cannot be lost or tampered with or cyberattacked.
	Due to the absence of hand-filled form, no mistakes can be made due to a misunderstanding on the part of a human or not understanding the handwriting.

But **traditional contracts** are not only riddled with problems, and they have their own set of **advantages** (which are not exclusive to them alone and are also present in smart contracts):

- Act as proof of the agreement between the parties involved
- Provide clarity to the agreement from the very beginning, thus helping in preventing future misunderstandings or disputes
- Provide security by having the terms of the agreement written down on paper and ensuring that the terms do not change
- Set the instructions for how disputes will be resolved
- Specify the conditions to end the contract before completion of the work

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And we should also note that **smart contracts** are not without their own array of **disadvantages**:

- Since it is humans who write the code, there are still chances of errors and mistakes. A smart contract is safe and effective only if the code is written correctly and precisely. Clerical errors from humans or them being tired while coding can put the whole system in danger.
- Currently, no government bodies are regulating smart contracts and blockchain. Therefore, there can arise potential issues when governmental institutions decide to make a legislative framework for smart contracts and the ones already existing don't match these frameworks.
- The programming of smart contracts needs an experienced coder to make fail-proof smart contracts that are adapted to the internal structure of the company. This can be a big investment.
- The consumers are unaware or suspicious of this new technology that not many people understand yet.
- As data is registered on the blockchain, it is impossible to make corrections. This would require creating a new smart contract altogether. And this actually might introduce mistakes into the system and make it less safe.
- Third-party agents from the world of traditional contracts do not simply disappear, they start playing a different role in the new environment, such as lawyers experienced in IT would be needed by the programmers of smart contracts for consultations for making new kinds of contracts.

❖ **Step 6 – Selection of preferred alternatives**

From the above table, saw that Smart contracts are better than the other two alternatives. Followed by Traditional contract and last verbal contracts.

Now, we will use another compensatory model technique: Additive Weighting Technique.[36] With the help of this, we can have accurate ration for the comparison of the alternative to select a better alternative. In order to apply the Additive Weighting Technique, we will use ranking from Table 2 – pairwise comparison of attributes. And mark those attributes in decreasing order and will calculate the sum of the ranking.

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	Step 1	Step 2		Verbal Contracts		Traditional Contracts		Smart Contracts	
	Ranking	Normalized weights (A)		(B)	(A)*(B)	(C)	(A)*(C)	(D)	(A)*(D)
Offer	9	9/45	0.2	0	0	1	0.2	1	0.2
Transparency	8	8/45	0.18	0	0	0	0	1	0.18
Capacity	7	7/45	0.16	0	0	1	0.16	0	0
Acceptance	6	6/45	0.13	0	0	1	0.13	1	0.13
Security	5	5/45	0.11	0	0	0	0	1	0.11
Mutuality	4	4/45	0.09	0	0	1	0.09	1	0.09
Economy & Speed	3	3/45	0.07	0	0	0	0	1	0.07
Consideration	2	2/45	0.04	0	0	1	0.04	1	0.04
Flexibility	1	1/45	0.02	1	0.02	1	0.02	0	0
Sum	45		1.00		0.02		0.64		0.82

Table 8: Multi Attribute Decision Making Matrix: Additive weighting Technique [37]

In the above table, we can see that we have alternatives equal to 0.02, 0.64 and 0.82 but none of them has a perfect score equal to 1.00. We can see that smart contracts are the best option with a score of 0.82, Second is a traditional contract, which we initially saw was as a reliable option. But with the help of the above table, we can see it's just an average alternative with a score of 0.64.

We can see that smart contracts are our best option, though it does not have a perfect score of 1.00 but gives us better security and transparency than any other contract.

❖ **Step 7 – Performance monitoring and post evaluation**

From the report, we analyzed that smart contracts are a better form of contracts. They are fast, economical, providing transparency, mutual, provide strong security and are self-executive in nature. We can say that in the future there will be the future of contracts due to its properties.

It is recommended to use smart contracts as they have fulfilled all attributes required and are helpful to both the parties. It is also helpful to track about the payment and the clause been completed due to transparency and its self-execution. Also, it helps the project manager with its work to provide payment as per the clause, once the work is complete, it will transfer the payment as per the work is done.

CONCLUSION

Through this paper, author-defined three types of available contracts, and compared all the alternatives with the help of feasible attributes. In the process, our best alternative remained best throughout the paper with the Multi-Attribute Decision Making (MADM) process. For any contract it's transparency and security are very important which we can see only in smart contracts along with its self-executive behavior.

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Finally, paper answered all the questions

- ➢ What are the advantages and disadvantages of traditional contracts?
- ➢ What are the advantages and disadvantages of smart contracts?
- ➢ Why is it better to replace traditional contracts with smart contracts?
- ➢ How will smart contracts be beneficial?

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Now, she is looking forward to working in an international environment where she can utilize her previous professional experience as well as international academic experience to perform at her best on exciting new projects.

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