

Smart Contracts for Project Managers - Boom or Bust?^{1, 2}

Mégane Gouin

ABSTRACT

Nowadays, projects operate in a growing global, complex, networked and regulated scope. Thus, there is an increasing importance for synchronization, communication, and control. Contracts need to fit in this changing environment. Contracts can play a meaningful role in the project's success. Smart contracts hold tremendous potential in improving project management. The fundamental aim of this research is to evaluate how and to extend smart contracts can affect project management. The paper ran a literature review on recent research to assess the main challenges with traditional contracts. Then, the paper established the awaited impact of smart contracts on several aspects of the project manager's activity. Finally, the paper analyzed how each effect and action of smart contracts can contribute to project management performances. The obtained results have shown that smart contracts could literally improve project management in many ways such as the automation of transactions, the monitoring, and management of data.

Keywords: Smart contract, Contractors, Contracts automation, Blockchain in project management, Distributed workflow, Contractual practices.

INTRODUCTION

"Pacta sunt servanda"³, early rules of trades and barter have existed since ancient times. Modern laws of contracts are traceable from the industrial revolution (1750 onwards). From decades to decades, as society has advanced and technology has evolved, both the aspect and the role of contracts changed. Today, the Internet is just emerging and traditional contracts start to show their limitations.

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³ "Agreements must be kept" in Latin.

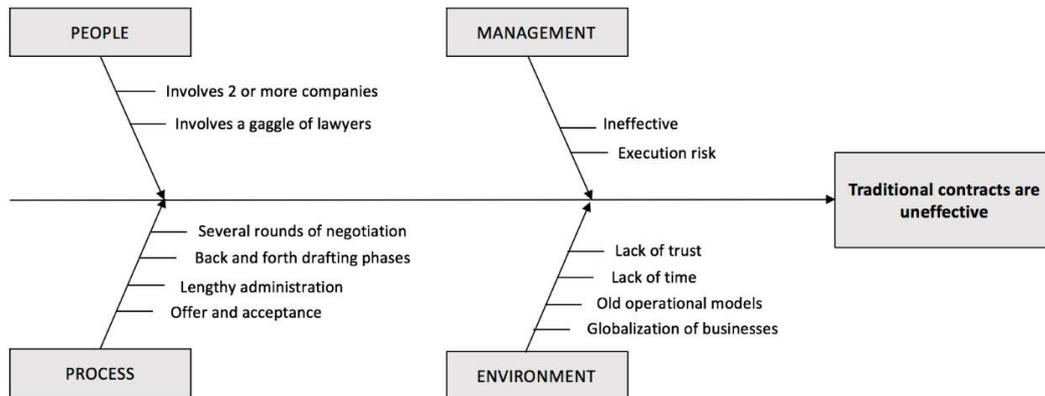


Figure 1: Fishbone diagram (By author)

Traditional contracts, as an old and complex process, is facing increasing issues, as shown in figure 1. For project managers, these problems result in delivered past deadlines, over budget and/or which end in lengthy legal battles over contractual disputes. Meanwhile, an emerging type of contract is taking advantage of technology improvement, and starts to be in the heart of today's business landscape.

"Some people say that 2017 is the year of the pilot for blockchain technology"⁴. That means that anytime in the near future will be the year of production. Blockchain is starting to change the way we do business, and will soon change the way we manage projects. Project management tools start with Blockchain using features known as smart contracts. In 1994, Nick Szabo published an article in which he outlined the concept of Smart Contracts⁵. Today, dozens of year later, as technology has caught up, smart contracts came back and served as the subject of different experimentations. At first, Szabo defined smart contracts as machine-readable transaction protocols which create a contract with pre-determined terms. Within a newer definition, a smart contract is "a set of promises, specified in digital form, including protocols within which parties perform on these promises"⁶. Simply, a smart contract is a self-executing contract with the term of agreement between buyer and seller being directly written into lines of code. Since a smart contract removes reliance on a third party, when establishing business relations, the parties making an agreement can transact directly with each other. Smart contracts are described as the most significant transformation of commerce since the Internet. They are even causing experts to rethink how legal documents are written.

⁴ Merriam Webster, 2011: 'A digital database, containing information (such as records of financial transactions) that can be simultaneously used and shared within a large decentralized, publicly accessible network.'

⁵ Nick Szabo, American cryptographer. The original text 'Smart Contracts' is available at: <http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart.contracts.html>

⁶ Szabo, 1996

Since olden days, there is project management. The profession is continuously evolving. Firstly, due to the attributes of new projects, business landscape and client requirements, secondly, due to the improvement of new tools and technology. No doubt, blockchain technology will impact project management. Project management focuses on particular business operations that have a precise end date and typically their own budget and revenue flows. Because these projects are temporary and often unique, they frequently require work from outside contractors. This makes contract management a vital part of the project management business. Usually, a basic project requires at least 5 different types of contracts.

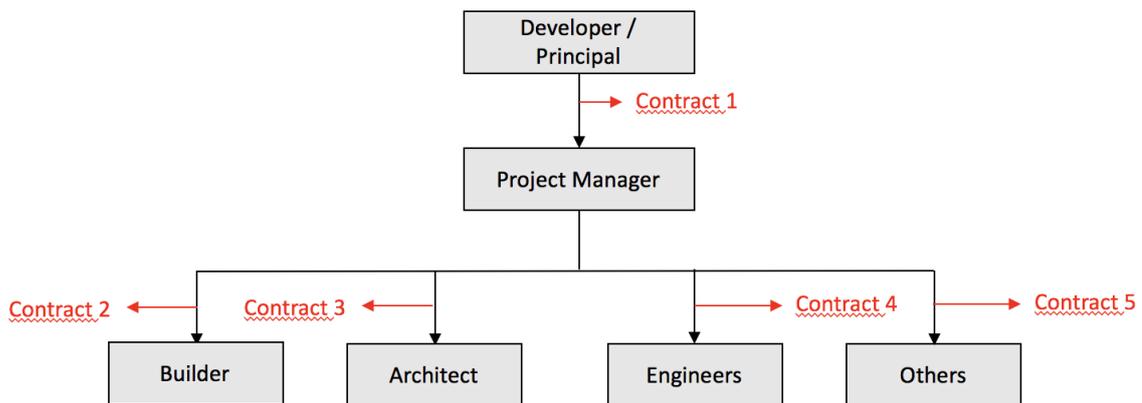


Figure 2: Project hierarchy applied to construction (By author)

One industry in particular will be turned on its head, the construction industry. The use of blockchain technology and smart contracts will result in almost unimaginable improvement in three primary areas:

1. Financial transactions and processing
2. Billing and prompt payments
3. Implementation of contractual terms and agreements

Nonetheless, the human determines the effectiveness of a given tool. A project manager who can implement smart contracts will be able to offer significant benefits to the principle. Hence, project managers need to be ready to manage the power of smart contracts, which represents the first blockchain technology challenge.

We must now determine how the project manager should handle smart contracts in order to meet the project's requirements, in an efficient and effective way. By the end of this research, we should be able to assess the overall impact of that technology on project management.

METHODOLOGY

This research adopts a compensatory Multi-Attribute Decision Making (MADM) method, including both a qualitative and quantitative approach based on four stages (Figure 3). It defined the basis on what and how information is collected and how results are analyzed in order to reach the main aims of this paper.

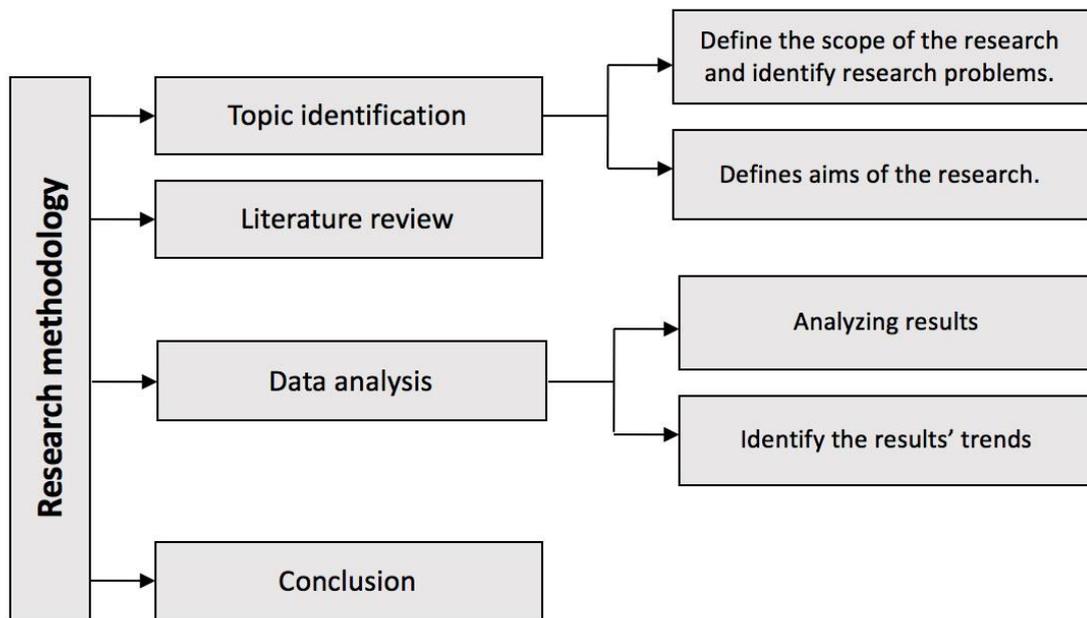


Figure 3: Research methodology (By author)

The qualitative research is a powerful way to start by underlying trends, thoughts and performance about smart contracts in project management. It will help to reach a deeper understanding and form a solid foundation to proceed with quantitative research afterwards.

The literature review was mainly performed using paper and electronic sources on project management (i.e.: PMI, PM World Library, Planning planet), blockchain technology (i.e.: Blockchain blog, Ledger journal), contracts (Consensus docs, AIA) and reliable news articles and websites.

Data analysis is critical to confirm whether the aim of the research was obtained or not. Data was analyzed, modelled and transformed to discover useful information, informing conclusion and supporting decision-making.

1. Problem definition

The primary objective of this paper is to identify how smart contracts could improve project management. To fulfil this aim, the paper is going to answer the following questions:

- How and to what extent could smart contracts affect project management?
- What are the current challenges project managers are facing with traditional contracts, and how smart contracts can solve them?
- What are the limitations of using smart contracts for the benefits of project management?

2. Feasible alternatives

To answer the questions above, a comparison of project management using traditional and smart contracts need to be conducted. The comparison is to determine whether:

- Smart contracts make project management more effective than the traditional ones
- Smart contracts don't add value to traditional contracts in project management

3. Development of the outcomes

Foremost, before going more in-depth in our analysis, it's necessary to clarify the link between contracts and project management. While the legal and risk management functions matter, they are not the principal objective of contracts. As reported by the International Association for Contract and Commercial Management (IACCM), in business-to-business contracts, nearly 80% of the terms, are not significant legal concerns, but rather business and financial terms. In modern research of inter-firm relationships, it has been proved that contracts work as a means of communication, coordination, collaboration and control. Contracts communicate "important information inside and between organizations; define relationships; establish organization structures; create shared meaning; motivate; bring organizational learning; create, allocate and protect value."⁷ . Contracts and the contracts process can also serve as a tool for aligning expectations, building incentives for success, managing performance, uncertainty and risk. Thus, it appears that contracts can be used as tools for **planning and managing projects**. Therefore, even if there are not all used in this manner, it's the responsibility of the project manager to assign a specific role to contract during the implementation stage.

⁷ Haapio, H. (2007). An ounce of prevention—contracting for project success and problem prevention. Paper presented at PMI® Global Congress 2007—North America, Atlanta, GA. Newtown Square, PA: Project Management Institute.

3.1 Project management and traditional contracts

Contract negotiation is a vital part of the project manager's job activity. Huge projects engage a number of participants, all with possibly conflicting interests. Human likes make risky deals. Frequently, people make engagement they can't keep, sign a contract without reading it or even without understanding it. Cultural and legal landmines are a challenge, and not everybody is able to manage them. Once in a while, even experienced professional makes the mistake of crafting contracts that allocate risk to project participants, which are not able to handle it.

In litigation related to project failure, one recurring theme is communication failure, which can easily occur when people representing different native speakers or geographies are involved. Even native speakers of the same language might have difficulties in understanding each other, for example if they are not from the same professional background.

After the negotiation and signing of a contract, the parties must follow their agreements. The contact documentation becomes the blueprint for the project. Contracts must translate into desired performance. Here, the role of the project manager is central. Nevertheless, with the traditional way of contracting, any of the numerous involved contracts can be lost, forget, hacked, tampered with, fall into the wrong hands or be dishonored. Also, whenever a type of claim is made, financial or not, it must be manually checked against the specific contract before it is managed.

3.2 Project management and smart contracts

3.2.1. How do Smart contracts work?

A fully established definition for smart contracts has yet to be formed, and the official legal status for smart contracts is not entirely clear. In this research, we define smart contracts as digital programs, based on the blockchain consensus architecture, which will self-execute when the terms of the agreement are met, and due to their decentralized structure are also self-enforcing and tamper-proof. Diverging from contracts concluded in form of action, speech or writing, a smart contract is a computer program built on code. Nevertheless, the smart contract operates with a similar logic to traditional ones, as the will of both parties to enter the agreement is needed in order for it to be valid. In addition to traditional contract terms and conditions listed in the agreement, smart contracts are capable of actions such as collecting data from outside resources and processing it according to the terms specified in the contract, as well as adopting concrete solutions based on the results of this procedure. There is indeed reason to note that the term "smart contracts" is also commonly used in connection with many other programs in the blockchain and not only those resembling a formal agreement. Smart contracts are thus automatic programs built on code which has been placed in a blockchain to perform specific processes.

3.2.2. Smart contracts and project management

The value of blockchain and smart contracts comes from the trust they create and the data they capture and share.

a. Automate transactions

Just like how blockchain technology allows people to trade cryptocurrencies by recording all of the financial transaction quickly and securely, smart contracts are specifically designed to store and implement contractual information in the same way. Smart contracts not only define the rules and penalties around an agreement as traditional contracts do, but automatically enforces those obligations.

b. Effective monitoring

In project, there is a considerable link between project success and effective monitoring. Historically, in all big project failures, ending up with huge delays and cost overruns, there was a lack of good practices in monitor and control project work. Contrarily, periodic reviews are the key on successful projects. Variances and forecast should be measured regarding the project performance baselines, and corrective actions need to be taken if necessary, in order to meet the project management goals. Goals linked to schedule, cost, scope, quality etc. Measurement and adaptation are key to finish the project on time and on budget. Thanks to smart contracts features, significant improvements are expected from any reliable project organization. Indeed, because it will enable trust between the stakeholders and project management, they will participate proactively on project reviews, and thus, help to successfully complete the project. Then, project managers in reliable projects will apply best practices in project monitoring and control.

c. Data management

In today's environment, a huge amount of data is generated on every single project. However, due to either the reluctance or inability to efficiently share the right data to the right people at the right time, much of it remains hidden. Because of the lack of visibility into reliable real-time data, projects are suffering from broken handoffs, errors, omissions, extended lead times and unexpected bottlenecks. Blockchain is able to capture where a property is at any point in time, identifying who has care, custody and control, and recording the state that is inside. This system works without the boundaries imposed by disparate systems of traditional contracts. Information is collected in a peer-to-peer network where transactions are approved through consensus and the important messages are reported to all the stakeholders in the project, thanks to the democratization of all the project data. With smart contracts, benefits are collected up and down the supply chain, from just-in-time planning and inventory management to dispute resolution, reduced wastage and quality controls.

4. Selection of criteria

At this stage, both traditional and smart contracts have been explained and analyzed in relation with project management. Now, we are going to compare them side-by-side to assess the effectiveness of Smart contracts in project management.

In order to realize which of these two alternatives is more accurate and whether Smart contracts adds value, the following comparison criteria has been selected:

- **Timeless**, to analyze which method is faster to implement and to use at different stages of project management.
- **Data collection, record making/keeping, reporting**, to assess which process is more effective in project management in terms of creating and maintaining documentation and reports to have better accessibility, availability, speed of data collection and speed of information generation.
- **Cost** (man hours), to analyze which practice is the less expensive for the company. The volume of staff needed is directly proportional with man hours.
- **Simplicity**, to assess which method is easier to use by professionals, in terms of time, and amount of personnel needed.
- **Communication quality to gather required information**, to evaluate each form's quality of communication in terms of clarity and content.
- **Level of expertise required**, to see which system requires the most expertise to manage the project.
- **Automation of processes**, to assess which method brings more benefits from the use of computerization and IT tools.
- **Reliability**, to know which method performs better and more effectively.
- **Trustability**, to check which method is perceived by project managers as the most effective.

These criteria are assessed in the following table, using a Multi-Attribute Decision Making (MADM), known as “disjunctive reasoning”. That proceeding will help rank criteria according to their importance, the impact of smart contracts features in project management.

	Timeless	Data collection, record making, reporting	Cost	Simplicity	Communication quality	Level of expertise required	Automation of processes	Reliability	Trustability	Ordinal ranking
Timeless	0	0	0	1	1	0	1	1	0	4
Data collection, record making, reporting	1	0	1	1	1	1	1	1	1	8
Cost (man hours)	0	0	0	1	0	0	1	0	1	3
Simplicity	0	0	1	0	0	0	0	0	0	1
Communication quality	1	1	1	1	0	0	1	1	0	6
Level of expertise required	1	0	1	0	0	0	0	0	1	3
Automation of processes	1	1	0	0	1	0	0	1	0	4
Reliability	1	1	0	1	1	1	1	0	1	7
Trustability	0	1	0	0	0	0	1	0	0	2

Table 1: Ranking smart contracts features according to their importance in project management (By author)

In this table, data collection, record making, reporting was rank the highest, as it is necessary to manage a project effectively. Reliability and communication quality were also high ranking, proving that communication is key on a successful project and that end results are the most important. Timeless, cost and automation of processes are important but no as the other criteria. Trustability was ranked low as the individual perception are less critical when compare to real performance criteria. Finally, simplicity is not a key aspect of the assessment.

FINDINGS

5. Analysis and comparison of the alternatives

By now, we have been able to identify quantitative criteria to compare both method, and to rank them by importance order. To further support the results, we apply an additive weighting technique to find out whether Smart contracts outperforms or improves project management. Table 6 shows the results.

Criteria	Ordinal ranking	Normalized weight (A)	Project Management with Traditional contracts		Project Management with Smart contracts	
			(B)	(A) x (B)	(C)	(A) x (C)
Timeless	4	0,10	0,33	0,03	1	0,10
Data collection, record making, reporting	8	0,21	0,33	0,06	1	0,21
Cost (man hours)	3	0,08	0,33	0,02	0,67	0,05
Simplicity	1	0,03	0,33	0,00	0,67	0,02
Communication quality	6	0,16	0,33	0,05	0,67	0,10
Level of expertise required	3	0,08	0,33	0,02	0,33	0,02
Automation of processes	4	0,10	0,33	0,03	1	0,10
Reliability	7	0,18	0,67	0,12	0,67	0,12
Trustability	2	0,05	1	0,05	0	0
SUM	38	1	SUM	0,38	SUM	0,72

Table 2: Comparing smart contracts and traditional ones using an Additive weighting technique
 (By Author)

From this analysis, we can see that smart contracts globally over perform project management compared to traditional contracts. Particularly, smart contracts score much higher on timeless, data collection, automation of processes and communication quality criteria. Both method requires the same level of expertise, as the implementation phase is still the same, whether using the traditional or the smart contract. Smart contracts appear to be a bit harder to use, as it uses a new technology based on Blockchain, still unknown for most of us. Both method score equally on the reliability criteria, despite the performance differences. This is due to a lack of interest / information / experience using smart contracts in project management. The Trustability result confirm this hypothesis.

6. Selection of the preferred alternatives

Therefore, based on our literature review, on the disjunctive method and on the additive weighting technique analysis, we can say that smart contracts have a positive impact on project management. It brings a lot of benefits and can reach better performance levels.

7. Performance monitoring and post evaluation of result

To achieve all awaited outcomes from smart contracts, it should be implemented the right way.

Due to new approaches to achieve tasks, engage people and do business, blockchain is disrupting industries. Nonetheless, no matter the degree of automation inherent in a technology, people will always be responsible to implement it, regarding both personal needs and business requirements. This is why the project initiation phase represents the most crucial phase in the project cycle. The project manager has to define objectives, scope, purpose and deliverables along with the client and other stakeholders.

However, human nature might be the principal factor governing usage. Even if some brilliant minds got together and came up with a project management tool that includes awesome features of blockchain technology, who would use it and why? Plenty of the applications that we use today are habit forming. This is why, one of the first step to conduct a successful implementation is to think about building in some addictiveness to the tool that has real value to the organizations and the people in them. For larger entities, smart contracts could run in a permissioned blockchain, which offers an improved level of security over a shared database. Of course many questions still need to be answered, like the level of transparency between disparate groups of stakeholders.

I think there is a huge potential for a blockchain tool with customized dashboards, specific to the needs of the different players. There is a big potential for increasing the trust between disparate groups of project stakeholders, particularly for large projects that span countries or organizations. This trust could be created through the ability to manage discrete blocks of work, with smart contracts that are accurately scoped, with a quality manager assigned. If projects teams can trust the data that are reported to management and to stakeholders, it will inspire confidence in the tool and between the different team players.

CONCLUSIONS

This paper has assessed the used of smart contracts in project management compared to the traditional ones, to establish its impact. To fulfil the aim of this research, the following research questions were answered.

✓ **How and to what extent could smart contracts affect project management?**

Project management overlays the entire project lifecycle, from initiation to closing, and everything in between. No matter the industry in which the project relies on, the blockchain will disrupt it. Thus, the position of the project manager will just be as important as it never has been before. Smart contracts will allow the project manager to automate transactions, to monitor effectively and to manage data properly.

✓ **What are the current challenges project managers are facing with traditional contracts, and how smart contracts can solve them?**

In the analysis part, the results pointed out how smart contracts improves data and information management, automate processes and reduces time to manage contracts. Critically, the paper has addressed briefly how smart contracts solves major problems and challenges with traditional contracts, including:

- Inefficiency of managing hard copy documents
- Unavailability of records, ineffective record keeping
- Poor communication in data collection
- Lack of time to manage the huge numbers of contracts between the different team players

✓ **What are the limitations of using smart contracts for the benefits of project management?**

After discussing the key benefits of smart contracts, we should consider its weaknesses. The first limit is about the scalability. Indeed, there is no way to get back into the chain of transactions and delete something. So we need to manage carefully the data we enter into the tool. While blockchain validate the data, it doesn't validate its quality. We need to beware to the theory of motivation, and conduct regular and strategic meetings to build better relationship between the actively engaged project team. Information should be constructively shared and decision recorded in the blockchain.

The second limit is about security. Indeed, multiple Bitcoin hacks already happened. There is a perpetual reflection about whether these hacks were inside jobs or real security challenges. While blockchain might be the most secure technology, it relies on individuals to safeguards their keys.

FOLLOW ON RESEARCH

The aim of this research was to assess the overall impact of smart contracts in project management. However, smart contracts will probably be the first punch of a long disruption

list. Therefore, in a future research, it would be interested to assess the whole impact of blockchain technology on project management.

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About the Author



Mégane Gouin

Paris, France



Mégane GOUIN is a 21 year old French student, currently pursuing a Master of Science degree in Project and Programme Management and Business Development at Skema Business School.

Since her youngest age, she has a strong entrepreneur mindset and a powerful passion about digital. After gaining significant experience from different positions in different industries, she is now managing her own online media cofounded company, which specializes in live broadcasting horseball competitions and providing a Video On Demand Platform. As a strategic director, she is mainly responsible for implementing web projects, by managing a team of 5 people. With a huge competitive and team spirit, after being French Champion, she is playing her sport, horseball, at a professional level. Her numerous international experiences (internships, exchange semester) gave her the opportunity to develop her adaptability and to become a confident problem solver. Being open-minded and world oriented increased her innovative skills. Highly interested in project management and his main upcoming challenges, she is getting certified by Prince2, AgilePM, CAPM.

You can contact her at: gouin.megane@gmail.com or, <https://www.linkedin.com/in/meganegouin/>