Smart Contracts

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What are Smart Contracts?

A smart contract is a self-executing digital agreement that enables two or more parties to exchange money, property, shares, or anything of value in a transparent, conflict-free way while avoiding the need for a third party.

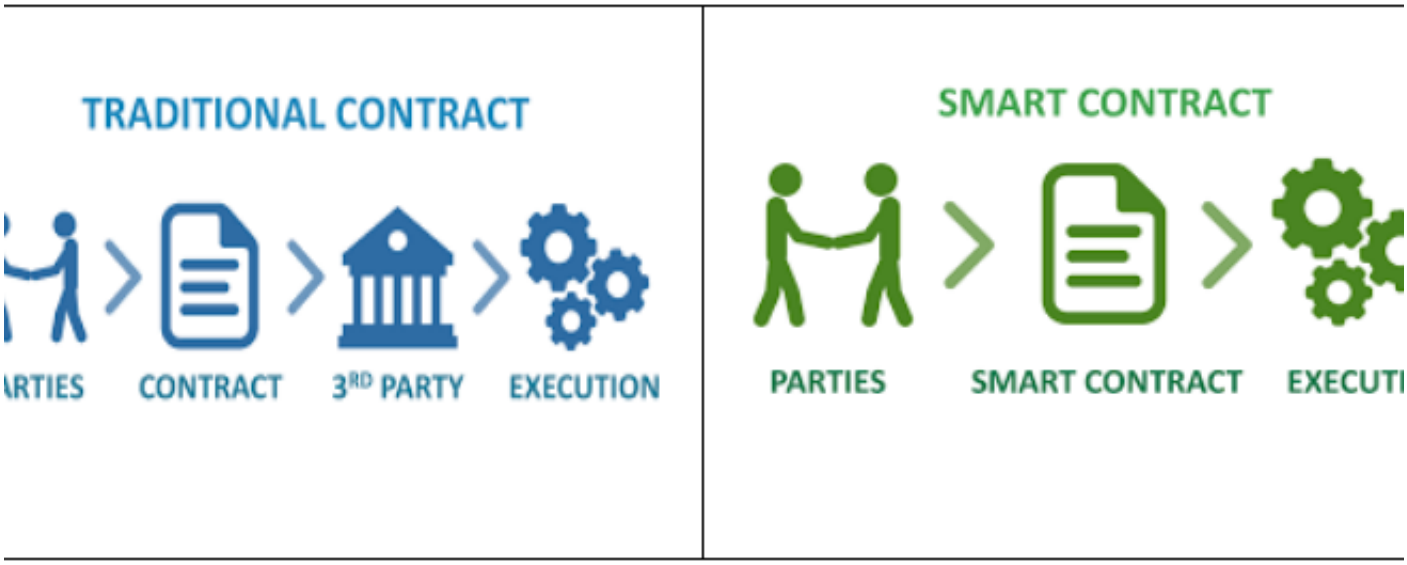
To lay it out in the simplest way, you can compare smart contracts to a vending machine.

With smart contracts, you simply drop a "coin" (e.g. bitcoin or other digital currency) into the "vending machine" (i.e. ledger), and your escrow, deed, contract, goods, driver's license, or whatever the contract is for, simply drops into your account.

Ordinarily, if you have a complex transaction involving significant money, you would need to go to a lawyer or a notary, have them set up an escrow account, pay them, and wait while they do the work and ensure the contract terms are satisfied. Only once your lawyer has done the work to ensure everything is executed correctly will you get the document/goods/money, etc.

The smart contract does all the work to determine whether the conditions of the order were satisfied.

Ideally, smart contracts both define the rules and penalties around an agreement and automatically enforces those obligations.



Smart contracts can eliminate the need for 3rd parties and automate a wide range of payment and property transfers

Smart Contracts – Are They Contracts? Are They Smart?

Smart contracts have a misguiding name - they're not really smart as in “this little girl is smart”. And they're not really contracts as in pages and pages of legalese.

They are really pieces of code (software) that codify business logic and at the core they facilitate three functions:

- one they store rules
- two they verify rules and
- three they are self executables – (i.e. they run automatically when something changes)

Smart Contracts – What are they good for?

Not Just for Digital Currencies

Technology leaders envision many applications for blockchain-based smart contracts, from validating loan eligibility to executing transfer pricing agreements between subsidiaries. Importantly, before blockchain this type of smart contract was impossible because parties to an agreement of this sort would maintain separate databases. With a shared database running a blockchain protocol, the smart contracts auto-execute, and all parties validate the outcome instantaneously and without need for a third-party intermediary.

According to Deloitte’s “Getting smart about smart contracts” the table below indicates a wide range of potential uses for smart contracts.

Range of use case applications for smart contracts

		What the smart contract can do
l services	Trade clearing and settlement	Manages approval workflows between counterparties, calculates trade settlement amounts, and transfers funds automatically
	Coupon payments	Automatically calculates and pays periodic coupon payments and retur principal upon bond expiration
	Insurance claim processing	Performs error checking, routing, and approval workflows, and calculat payout based on the type of claim and underlying policy
	Micro-insurance	Calculates and transfers micropayments based on usage data from an of Things-enabled device (example: pay-as-you-go automotive insuranc
nces and are	Electronic medical records	Provides transfer and/or access to medical health records upon mult-si approvals between patients and providers
	Population health data access	Grants health researchers access to certain personal health informatio micropayments are automatically transferred to the patient for particip
	Personal health tracking	Tracks patients' health-related actions through IoT devices and automic generates rewards based on specific milestones
ogy, media, com	Royalty distribution	Calculates and distributes royalty payments to artists and other associ parties according to the contract
and es	Automnomous electric vehicle charging stations	Processes a deposit, enables the charging station, and returns remainir when complete
ector	Record-keeping	Updates private company share registries and capitalization table reco distributes shareholder communications
dustry	Supply chain and trade finance documentation	Transfers payments upon multi-signature approach
	Product provenance and history	Facilitates chain-of custody process for products in the supply chain wh party in custody is able to log evidence about the product
	Peer-to-peer transacting	Matches parties and transfers payments automatically for various peer applications: lending, insurance, energy credits, etc.
	Voting	Validates voter criteria, logs vote to the blockchain, and initiates specific as a result of the majority vote

Reduce Manual or Duplicative Tasks:

When should companies employ blockchain-enabled smart contracts rather than existing technology? They can be a worthwhile option where frequent

transactions occur among a network of parties, and manual or duplicative tasks are performed by counter-parties for each transaction. The blockchain acts as a shared database to provide a secure, single source of truth, and smart contracts automate approvals, calculations, and other transacting activities that are prone to lag and error.

Automatic execution

One of the most significant benefits smart contracts have over regular contracts is that the outcome is automatically executed when the contract conditions are realized. There is no need to wait for a human to execute the result.

Other Major Benefits of Smart Contracts

Speed and real-time updates. Because smart contracts use software code to automate tasks that are typically accomplished through manual means, they can increase the speed of a wide variety of business processes.

Accuracy. Automated transactions are not only faster, but less prone to manual error.

Lower execution risk. The decentralized process of execution virtually eliminates the risk of manipulation, nonperformance, or errors, since execution is managed automatically by the network rather than an individual party.

Fewer intermediaries. Smart contracts can reduce or eliminate reliance on third-party intermediaries that provide “trust” services such as escrow between counterparties.

Lower cost. New processes enabled by smart contracts require less human intervention and fewer intermediaries and will therefore, reduce costs.

New business or operational models. Because smart contracts provide a low-cost way of ensuring that the transactions are reliably performed as agreed upon, they will enable new kinds of businesses, from peer-to-peer renewable energy

trading to automated access to vehicles and storage units.

Smart Contracts – How They Work

How Smart Contracts Function

"Smart contracts" is a term used to describe computer code that automatically executes all or parts of an agreement and is stored on a blockchain-based platform. The code itself is replicated across multiple nodes of a blockchain and, therefore, benefits from the security, permanence and immutability that a blockchain offers. That replication also means that as each new block is added to the blockchain, the code is, in effect, executed.

If the parties have indicated by initiating a transaction that certain parameters have been met, the code will execute the step triggered by those parameters. If no such transaction has been initiated, the code will not take any steps. Most smart contracts are written in one of the programming languages directly suited for such computer programs, such as Solidity.

At present, the parameters and the execution steps for a smart contract need to be specific and objective. In other words, if "x" occurs, then execute step "y." Therefore, the actual tasks that smart contracts are performing are fairly rudimentary, such as automatically moving an amount of cryptocurrency from one party's wallet to another when certain criteria are satisfied.

As the adoption of blockchain spreads, and as more assets go "on chain," smart contracts will become increasingly complex. They will need to be capable of handling sophisticated transactions. Developers are already stringing together multiple transaction steps to form more complex smart contracts.

Smart contracts are presently best suited to execute automatically two types of "transactions" found in many contracts: (1) ensuring the payment of funds upon certain triggering events and (2) imposing financial penalties if certain objective conditions are not satisfied. In each case, human intervention, including through

a trusted escrow holder or even the judicial system, is not required once the smart contract has been deployed and is operational. This results in reducing the execution and enforcement costs of the contracting process.

Nonetheless*, we are, at the very least, many years away from code being able to determine more subjective legal criteria,* such as whether a party satisfied a commercially reasonable efforts standard or whether an indemnifications clause should be triggered and the indemnity paid.

Smart Contracts Impacting Business - Potential Examples

Procure-to-Pay Gaps

Smart contracts could eliminate the so-called procure-to-pay gaps. When a product arrives and is scanned at a warehouse, a smart contract could immediately trigger requests for the required approvals and, once obtained, immediately transfer funds from the buyer to the seller. Sellers would get paid faster and no longer need to engage in dunning, and buyers would reduce their account payable costs. This could impact working capital requirements and simplify finance operations for both parties. On the enforcement side, a smart contract could be programmed to shut off access to an internet-connected asset if a payment is not received. For example, access to certain content might automatically be denied if payment was not received

Trade clearing and settlement

Blockchains provide a single ledger as the source of truth, and smart contracts offer the ability to automate approval workflows and clearing calculations that are prone to lag and error—thus reducing errors, cost, and the time to settlement. Trade clearing and settlement often entails labor-intensive activities that include various approvals and/or complex internal and external reconciliations. Banks maintain substantial IT networks, but independent processing by each counter-party causes discrepancies that lead to costly resolutions and settlement delays.

The opportunity to streamline clearing and settlement processes with the blockchain and smart contracts is immense. In 2015, the Depository Trust & Clearing Corp. (DTCC) processed more than $1.5 quadrillion worth of securities, representing 345 million transactions.10 Santander Bank's innovation fund, Santander Innoventures, expects blockchain technology to lead to $15–20 billion in annual savings in infrastructure costs by 2022. Seven start-ups, retaining funding of more than $125 million, have platforms or services targeting this space: The list of more than 35 investors behind these companies is equally impressive; it includes not only major venture funds such as Khosla Ventures and SV Angel, but also large banks such as Citigroup, JP Morgan, and Santander, and other organizations such as NASDAQ and the DTCC itself.

Wall Street has also been busy exploring this space. More than 40 global banks within the R3 consortium participated in testing that included clearing and settlement activity, and many of those banks have pursued further trials individually. The Australian Securities Exchange is also working on a smart contracts-based post-trade platform to replace its equity settlement system, and four global banks and the DTCC recently ran a successful trial of a smart contracts solution for post-trade credit default swaps.

Supply chain and trade finance documentation

Blockchains can make supply chain and trade finance documentation more efficient by streamlining processes previously spread across multiple parties and databases on a single shared ledger. All too often, supply chains are hampered by paper-based systems reliant on trading parties and banks around the world physically transferring documents, a process that can take weeks for a single transaction. Letters of credit and bills of lading must be signed and referenced by a multitude of parties, increasing exposure to loss and fraud. Current technologies haven't addressed this issue because digital documents are easy to forge; even current IT systems at banks simply track the logistics of physical documents for trade finance. A blockchain can provide secure, accessible digital versions to all parties in a transaction, and smart contracts can be used to manage the workflow of approvals and automatically transfer payment upon all

signatures being collected.

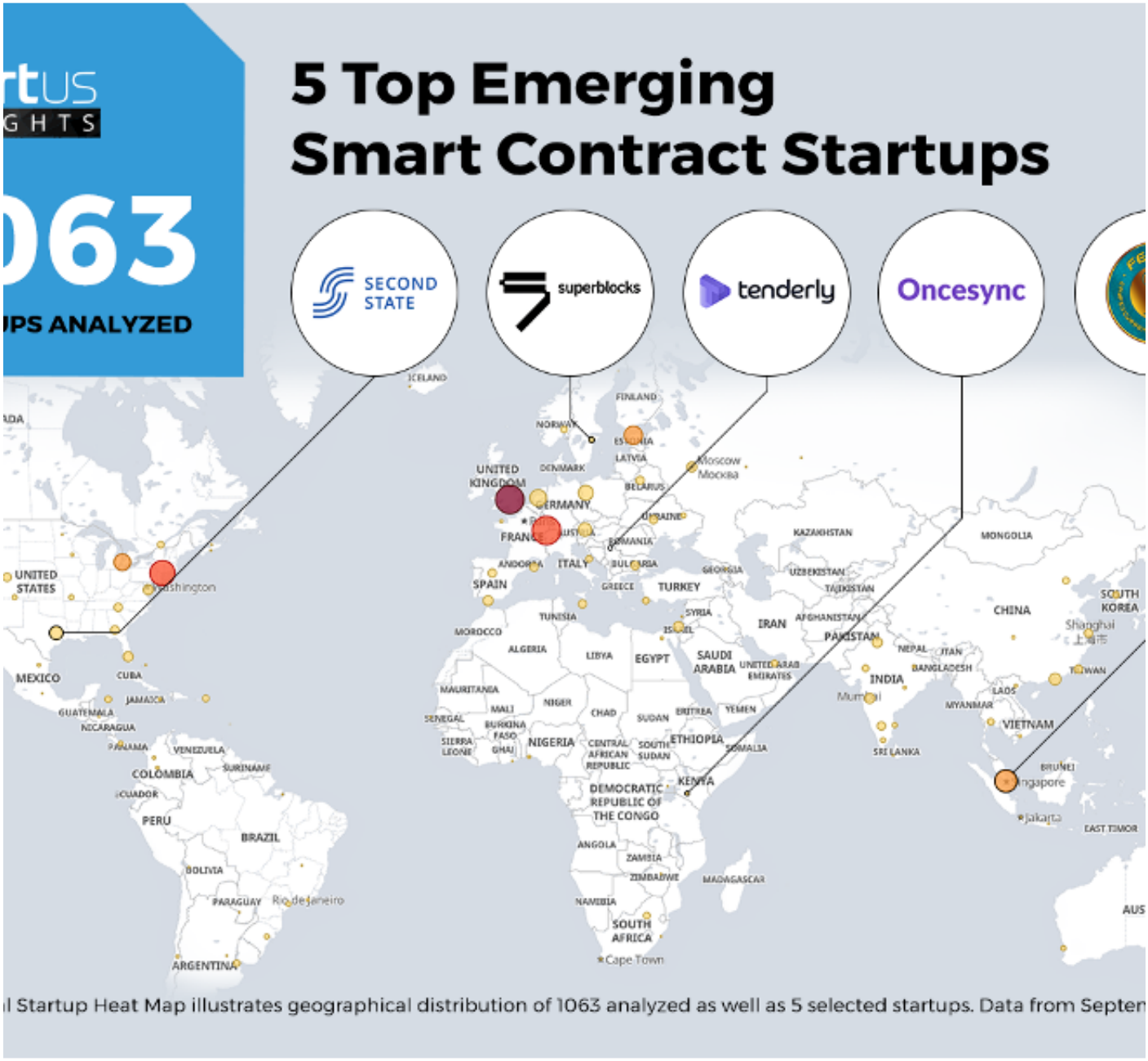
Because current paper systems drive $18 trillion in transactions per year, there's an attractive opportunity to decrease costs and improve reliability in supply chain and trade finance. Four start-ups have emerged in this area, all of which have noted engagement with banks in proof-of-concept activities. Funding has not been disclosed, but backers include three respected venture funds in addition to Barclays.

A number of corporations have also shown mounting interest in this area. Seven banks have revealed proof-of-concept testing, and the numbers noted by start-ups indicate more that haven't been publicly revealed. One start-up in particular noted implementation roadmaps with five banks as well as a major insurer. Barclays Corporate Bank recently partnered with one of the start-ups, Wave, a platform that stores bill-of-lading documents in the blockchain and uses smart contracts to log change of ownership and automatically transfer payments to ports upon arrival. Bank of America, Standard Charter, and the Development Bank of Singapore are also among the banks pursuing proof-of-concepts of their own.

Startup Activity

"Using our **StartUs Insights Platform**, covering 1.116.000+ startups & emerging companies, we looked at innovation in the field of blockchain. For this research, we identified 1.063 relevant solutions and picked 5 to showcase below. These companies were chosen based on a data-driven startup scouting approach, taking into account factors such as location, founding year, and technology among others. Depending on your specific criteria, the top picks might look entirely different.

The Global Startup Heat Map below highlights 5 startups & emerging companies developing smart contract solutions. Moreover, the Heat Map reveals regions that observe a high startup activity and illustrates the geographic distribution of all 1.063 companies we analyzed for this specific topic."



Competitor Activity

Avalara

At this time there is little readily available information that would indicate that Avalara is pursuing anything to do with Smart Contracts. All of the open material dates back to 2018 or earlier. At most they are working with firms who field

products related to blockchain but limit Avalara's involvement to determining and possibly reporting tax on transactions in the blockchain.

Sovos

"Global tax software leader Sovos today (4/14/20) announced it has joined the Accounting Blockchain Coalition (ABC), a partnership dedicated to educating businesses and organizations on accounting matters relevant to digital assets and distributed ledger technology, including blockchain."

"As a member of the ABC, Sovos will collaborate with industry leaders in accounting, law, tax, technology and higher education to help shape the leading resource for organizations involved with blockchains in accounting. The ABC also provides educational information and materials to the broader accounting industry on changes and updates to information regarding digital assets and distributed ledger technology"

No other items of note came from a general search of Sovos and Smart Contracts.

Thomson Reuters

Thomson Reuters has a couple activities of note related to Smart Contracts:

LONDON, October 17, 2019 – Thomson Reuters and OpenLaw are exploring the future of legal documents with a cutting-edge proof of concept that combines smart documents powered by blockchain technology with document automation.

The initial proof of concept shows how (TR's) Contract Express can be used to create a contract from a Practical Law standard document and turn specific provisions into smart contracts to be executed on the Ethereum blockchain, using the OpenLaw protocol. The efficiency and security of such smart contracts would facilitate real-time payments and swift settlements of financial transactions, enabling transformation of financial and commercial industries, as

one example.

"This proof of concept demonstrates how users could incorporate blockchain-enabled smart contract provisions into any legal template they create within Contract Express, including the many automated standard documents available from Practical Law," said Andy Wishart, Global Head of Drafting Tools & Productivity Solutions at Thomson Reuters. "And the process is seamless and intuitive to the extent that lawyers will not need specialized technical or blockchain expertise to create smart contracts."

"By bringing OpenLaw and Contract Express together in this way, we have demonstrated that smart contract technology can be integrated into the automation tools that lawyers are using today," said Aaron Wright, co-founder of OpenLaw."

This video explains how this smart contract proof-of-concept works.

How the POC connects ordinary contracts to smart contracts:

As explained to Artificial Lawyer the idea worked on the following basis: you take a contract template from the TR PLC platform; then this is set up for client use via contract automation platform (TR's) Contract Express; this is then connected to a similar, but perhaps less detailed, OpenLaw smart contract template, which allows key data points to be hashed on a blockchain.

The end result is a unified Contract Express-to-Ethereum contract data logging process with OpenLaw acting as the smart contract layer in the middle. Wishart said: 'This system pulls data through to OpenLaw, and brings two worlds together. At the same time, lawyers will be very familiar with Contract Express.'

He added that they have already automated several hundred PLC contract templates via Contract Express. However, only key parts of these documents would have to be codified via OpenLaw, such as names of parties, dates, and payment terms.

Conclusion

Key takeaways:

- Smart contracts are self-executing lines of code with the terms of an agreement between buyer and seller automatically verified and executed via a computer network.
- Nick Szabo, an American computer scientist who invented a virtual currency called "Bit Gold" in 1998,[1] defined smart contracts as computerized transaction protocols that execute terms of a contract.[2]
- Smart contracts deployed to blockchains render transactions traceable, transparent, and irreversible.
- Smart contracts are in the early stage of adoption with growing use on Etherium 2 and focused on simple transactions.

Are Smart Contracts Ready for Adoption?

Smart contracts are at an early phase, automating simple transactions. They do not have the ability to interpret subtle and ambiguous language as contained in standard contracts. It is probable that a smart contract will need to be associated with a traditional contract for terms that are too difficult and complex for current generation smart contracts for quite a long time to come. That being said, the ability to automate many manual steps exists and should be explored for the speed and accuracy they can bring to business transactions.

On a potential positive note, with the desire to automate contracts (which are much more numerous than the laws Vertex currently automates for calculating sales tax), there may be a large opportunity to assist customers in determining contract compliance. This may take the form of codifying contracts into computer logic and data content. This could be an adjacent area for Vertex to explore business opportunities.

Source articles for this page:

- Smart Contracts: Definition, Working, Writing & Deploying - The Engineering Projects
- *How Smart Contracts Will Change the World | Olga Mack | TEDxSanFrancisco*
- Getting Smart About Smart Contracts
- Decoder: Smart contracts
- *https://ethereum.org/en/smart-contracts*
- Smart contract
- What are Smart Contracts?
- An Introduction to Smart Contracts and Their Potential and Inherent Limitations
- What Are Smart Contracts on the Blockchain and How They Work
- 5 Top Emerging Smart Contract Startups | StartUs Insights Research