1 Smart contracts: the ultimate automation of trust?

Smart contracts could become a transformational wave in banking
A theoretical concept developed in 1994, the materialisation of contracts capable of enforcing themselves, is now facilitated by blockchain technologies. The ability of smart contracts to alter the way in which many traditional processes are performed is potentially immense. However, standardisation and wider adoption of the blockchain is needed to turn this potential into reality.

What are smart contracts?
The term, smart contract, refers to any contract capable of automatically enforcing itself, without a third party between individual participants. Smart contracts are written as computer programs rather than in legal language on a printed document. The program can define strict rules and consequences in the same way that a traditional legal document would, but unlike a traditional contract it can also take information as an input, process it through the rules set out in the contract, and take any actions required of it as a result.

The concept was defined in 1994 by cryptographer Nick Szabo, but in practice remained unrealised because the technological infrastructure needed to support it did not yet exist. Nowadays, the advent of crypto protocols and the blockchain is changing that, and as a result the idea is seeing a revival.

In brief, smart contracts are modular, repeatable and autonomous scripts, usually running on a blockchain, which represent unilateral promises to provide a determinate computation. These scripts are stored in the blockchain at a particular address, which is determined when the contracts are deployed to the blockchain. When an event prescribed in the contract happens, a transaction is sent to that address and the distributed virtual machine executes the script's operation codes (or clauses), using the data sent with the transaction.

Smart contracts can be coded to reflect any kind of data-driven business logic: from actions as simple as voting for a post in a forum, to the more complex such as loan collateralisation and futures contracts, and to the highly complex such as repayment prioritisation on a structured note. A flow chart for applying business logic with smart contracts would be the following:

Figure 1.1
Applying business logic with smart contracts

1. Contract terms
2. Event(s)
3. Value transfer
4a. Settlement
4b. Settlement

External to smart contract

Source: BBVA Research
Smart contracts: use cases in financial services

While there have been hundreds of proposed use cases for smart contracts, some of the most (directly or indirectly) relevant to financial institutions would include:

- **Loans** could be stored as smart contracts in the blockchain, together with the collateral ownership information. If the borrower misses a payment, the smart contract could automatically revoke the digital keys that grant his access to the collateral.

- **Inheritances** could be automated by setting the allocation of assets after death. It might be as simple as moving an adjustable slider that determines who gets how much. Once the smart contract can verify the triggering condition — in this case, death — the contract goes into effect and assets are divided up.

- **Escrow.** Smart contracts can easily be set up as escrow accounts that monitor an exchange between two parties. The buyer of some goods or services would transfer the payment to the contract account. The contract would monitor external services (i.e. GPS tracking) and, when ownership has been transferred from the seller to the buyer, the contract would automatically release the funds to the seller.

- **Cryptocurrency wallet controls.** Wallets controlled by contracts could include many different types of complex controls, from daily withdrawal limits to granting and revoking access for specific entities. A generalisation of this will lead to the notion of **programmable money**, a type of money which can be set up to be spent only on certain kinds of assets, in a geographical area, between two dates, etc.

- **Capital Markets.** Securities based on payments and rights that are executed according to predefined rules can be written as smart contracts. There are already experiments for the issuance of **smart bonds** and the management of private stock markets. Contracts that monitor the performance of digital or non-digital assets can also be used as futures, forwards, swaps and options.

Smart contract issues

Implementation of smart contracts is far from easy, due to relevant issues related to their definition:

- **“Real world” enforcement.** Smart contracts are simply software and as such they can “enforce” or, better, administer the state of the data to which they have access on the blockchain. Yet, beyond that, they have little reach. For the foreseeable future, they will not be enforceable in any court and few parties will be able to rely on smart contracts alone to structure all of the terms of a commercial transaction.

- **Flexibility.** Smart contracts seem to assume that parties can determine all aspects of the negotiations at the onset of their transaction. But in the real world, contracts often end up being imprecise, because what happens after parties reach an agreement is often unpredictable. Smart contracts should have mechanisms to allow parties to amend their agreements when mutually desired.

- **Adoption.** The most significant benefits of smart contract adoption come when numerous commercial entities begin to automate their interactions, by using smart contracts and a blockchain that is purpose-built for multi-party interaction. Given that only a limited number of individuals currently have the technical proficiency to develop and deploy smart contract systems, this is a real challenge.

- **Liability.** Smart contracts could pose an important challenge for regulators because they allow the creation of decentralised automated versions of P2P services like Uber or Airbnb, connecting people and handling payments without the need for a company in the middle. Regulators would be left with nothing to target, because there is no legal entity behind it.
Bottom line

The main purpose of smart contracts is to enable people to do business with strangers, usually over the internet, without the need for a trusted intermediary. The idea is that software can automate much of the process, allowing the enforcement of contractual promises without human involvement. The blockchain assures that everybody is seeing the same thing without one side having to trust the other side to be honest, because anything that is in the blockchain is unforgeable. This may sound like we won't need lawyers anymore. But smart contracts are an evolution of the legal system, not its replacement. The role of lawyers might shift from adjudicating individual contracts to producing smart contract templates on a competitive market. Contract selling points would be their quality, how customizable they are, and their ease of use. In the long term, we could see the surge of organized smart contract marketplaces that, in turn, would be fully managed through smart contracts, thus closing the circle.
DISCLAIMER
This document, prepared by BBVA Research Department, is provided for information purposes only and expresses data, opinions or estimates pertinent on the date of issue of the report, prepared by BBVA or obtained from or based on sources we consider to be reliable, which have not been independently verified by BBVA. Therefore, BBVA offers no warranty, either express or implicit, regarding its accuracy, integrity or correctness.
Estimates this document may contain have been undertaken according to generally accepted methodologies and should be considered as forecasts or projections. Results obtained in the past, either positive or negative, are no guarantee of future performance.
This document and its contents are subject to changes without prior notice depending on variables such as the economic context or market fluctuations. BBVA is not responsible for updating these contents or for giving notice of such changes.
BBVA accepts no liability for any loss, direct or indirect, that may result from the use of this document or its contents.
This document and its contents do not constitute an offer, invitation or solicitation to purchase, divest or enter into any interest in financial assets or instruments. Neither shall this document nor its contents form the basis of any contract, commitment or decision of any kind.
With particular regard to investment in financial assets having a relation with the economic variables this document may cover, readers should be aware that under no circumstances should they base their investment decisions on the information contained in this document. Persons or entities offering investment products to these potential investors are legally required to provide the information needed for them to take an appropriate investment decision.
The content of this document is protected by intellectual property laws. Its reproduction, transformation, distribution, public communication, making available, extraction, reuse, forwarding or use of any nature, by any means or process, are not permitted except in cases where it is legally permitted or expressly authorised by BBVA.
# Digital Economy Outlook

October 2015

This report has been produced by the Financial Inclusion Unit:

- **Chief Economist**
  - David Tuesta
david.tuesta@bbva.com

- **Javier Alonso**
javier.alonso.meseguer@bbva.com

- **Isabel Vegas**
isabel.vegas@bbva.com

- **Noelia Cámara**
oelia.camara@bbva.com

- **Pablo Urbiola**
pablo.urbiola@bbva.com

- **María Luisa Pérez**
marialuiss.perez.ortiz@bbva.com

With the contribution of:

- **Javier Sebastián**
  jsebastian@bbva.com

**BBVA Research**

<table>
<thead>
<tr>
<th>Group</th>
<th>Chief Economist</th>
<th>Area</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Developed Economies Area</strong></td>
<td><strong>Rafael Doménech</strong></td>
<td>Cross-Country Emerging Markets</td>
<td><a href="mailto:r.domenech@bbva.com">r.domenech@bbva.com</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Asia</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Le Xia</td>
<td><a href="mailto:le.xia@bbva.com">le.xia@bbva.com</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mexico</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Carlos Serrano</td>
<td><a href="mailto:carlos.serranoh@bbva.com">carlos.serranoh@bbva.com</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Turkey</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alvaro Ortiz</td>
<td><a href="mailto:alvaro.ortiz@bbva.com">alvaro.ortiz@bbva.com</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LATAM Coordination</td>
<td>Juan Manuel Ruiz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Argentina</td>
<td>Gloria Sorensen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chile</td>
<td>Jorge Selaive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Colombia</td>
<td>Juana Téllez</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peru</td>
<td>Hugo Perea</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Venezuela</td>
<td>Julio Pineda</td>
</tr>
<tr>
<td><strong>Emerging Markets Area</strong></td>
<td><strong>Carlo Scrofani</strong></td>
<td>Financial Systems and Regulation Area</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Santiago Fernández de Lis</td>
<td><a href="mailto:sfernandezdelis@bbva.com">sfernandezdelis@bbva.com</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Financial Systems</td>
<td>Ana Rubio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Financial Inclusion</td>
<td>David Tuesta</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Regulation and Public Policy</td>
<td>María Abascal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recovery and Resolution Strategy</td>
<td>José Carlos Pardo</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Global Coordination</td>
<td>Matías Viola</td>
</tr>
<tr>
<td><strong>Global Areas</strong></td>
<td></td>
<td>Economic Scenarios</td>
<td>Julián Cubero</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Financial Scenarios</td>
<td>Sonsoles Castillo</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Innovation &amp; Processes</td>
<td>Oscar delas Peñas</td>
</tr>
</tbody>
</table>

**Contact details:**

**BBVA Research**
Azul Street, 4
La Vela Building - 4 and 5 floor
28050 Madrid (Spain)
Tel.: +34 91 374 60 00 and +34 91 537 70 00
Fax: +34 91 374 30 25
bbvaresearch@bbva.com
www.bbvaresearch.com