

# DISCUSSION OF APPLICATION OF BLOCKCHAIN AND MACHINE LEARNING IN FINANCIAL TRANSACTIONS

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## I. INTRODUCTION

The adoption of blockchain technology across the financial services industry has the potential to revolutionize how governments, institutions, and individuals conduct transactions. Many regulators appear reluctant to address blockchain development out of a fear of stifling innovation, yet remain committed to strong enforcement action when bad actors use the technology to facilitate illegal activities. It is the burden of compliance officers to adapt to technological change while ensuring that their institutions remain compliant with the current regulatory framework. The application of machine learning techniques to monitor transactions on a blockchain may improve the efficiency and effectiveness of an institution's anti-money laundering/counterterrorist financing ("AML/CTF") compliance program. In this article, Navigant explores the possibility of mitigating financial institutions' AML/CTF risks through the combination of blockchain technology and machine learning.

## II. BLOCKCHAIN'S RELATIONSHIP TO AML/CTF RISK

The blockchain first described in Satoshi Nakamoto's [white paper](#) is a decentralized distributed ledger that contains an immutable record of all previous transactions.<sup>1</sup> The concept of a blockchain continues to evolve as interest in its adoption grows. However, the blockchain environments seeing the widest adoption in the marketplace still include two crucial components found in the original paper: (1) a consensus mechanism and (2) a ledger of information consistent across the entire network.

The Federal Financial Institutions Examination Council [defines settlement risk](#) as "the possibility that the completion or settlement of individual transactions or settlement at the interbank funds transfer or securities settlement level more broadly, will not take place as expected."<sup>2</sup> Financial institutions have spent decades developing payment protocols that seek to mitigate settlement risk. Blockchain's implementation across the international financial system would eliminate the need for some of these costly and inefficient processes.

1. Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System," [www.bitcoin.org](http://www.bitcoin.org), <https://bitcoin.org/bitcoin.pdf>.

2. FFIEC: IT Examination Handbook Infobase, "Wholesale Payment Systems," <https://ithandbook.ffiec.gov/it-booklets/wholesale-payment-systems/wholesale-payment-systems-risk-management/credit-risk/settlement-risk.aspx>.



Proponents of blockchain argue that the replacement of these old processes could also mitigate risks related to money laundering and terrorism financing. Below are some of the enhancements that are often highlighted:

- A. Eliminating the need for intermediaries
- B. The immutability of the blockchain to provide an up-to-date and accurate audit trail
- C. With proper know-your-customer procedures, easily identifiable transacting parties

### III. REGULATORY CONCERNS

As with any disruptive technology, regulators must weigh the possible enhancements to the international financial system against traditional risks associated with securing the legitimacy of transactions. Concerns that transactions could be utilized to facilitate and promote money laundering and terrorism financing are often of paramount concern. The Financial Crimes Enforcement Network ("FinCEN") has provided regulatory guidance on the use of virtual currencies and digital assets issued on a blockchain. A sampling of FinCEN publications related to this area is provided below:

TITLE	ISSUE DATE
<a href="#"><u>Application of FinCEN's Regulations to Persons Administering, Exchanging, or Using Virtual Currencies</u></a> <sup>3</sup>	March 18, 2013
<a href="#"><u>Application of FinCEN's Regulations to Virtual Currency Mining Operations</u></a> <sup>4</sup>	Jan. 30, 2014
<a href="#"><u>Application of FinCEN's Regulations to Virtual Currency Software Development and Certain Investment Activity</u></a> <sup>5</sup>	Jan. 30, 2014
<a href="#"><u>Application of Money Services Business Regulations to the Rental of Computer Systems for Mining Virtual Currency</u></a> <sup>6</sup>	April 29, 2014
<a href="#"><u>Request for Administrative Ruling on the Application of FinCEN's Regulations to a Virtual Currency Trading Platform</u></a> <sup>7</sup>	Oct. 27, 2014
<a href="#"><u>Request for Administrative Ruling on the Application of FinCEN's Regulations to a Virtual Currency Payment System</u></a> <sup>8</sup>	Oct. 27, 2014
<a href="#"><u>Application of FinCEN's Regulations to Persons Issuing Physical or Digital Negotiable Certificates of Ownership of Precious Metals</u></a> <sup>9</sup>	Aug. 14, 2015

3. FinCEN, "Application of FinCEN's Regulations to Persons Administering, Exchanging, or Using Virtual Currencies," March 18, 2013, <https://www.fincen.gov/resources/statutes-regulations/guidance/application-fincens-regulations-persons-administering>.

4. FinCEN, "Application of FinCEN's Regulations to Virtual Currency Mining Operations," Jan. 30, 2014, <https://www.fincen.gov/resources/statutes-regulations/administrative-rulings/application-fincens-regulations-virtual-0>.

5. FinCEN, "Application of FinCEN's Regulations to Virtual Currency Software Development and Certain Investment Activity," Jan. 30, 2014, <https://www.fincen.gov/resources/statutes-regulations/administrative-rulings/application-fincens-regulations-virtual>.

6. FinCEN, "Application of Money Services Business Regulations to the Rental of Computer Systems for Mining Virtual Currency," April 29, 2014, <https://www.fincen.gov/resources/statutes-regulations/administrative-rulings/application-money-services-business-0>.

7. FinCEN, "Request for Administrative Ruling on the Application of FinCEN's Regulations to a Virtual Currency Trading Platform," Oct. 27, 2014, <https://www.fincen.gov/resources/statutes-regulations/administrative-rulings/request-administrative-ruling-application-0>.

8. FinCEN, "Request for Administrative Ruling on the Application of FinCEN's Regulations to a Virtual Currency Payment System," Oct. 27, 2014, <https://www.fincen.gov/resources/statutes-regulations/administrative-rulings/request-administrative-ruling-application>.

9. FinCEN, "Application of FinCEN's Regulations to Persons Issuing Physical or Digital Negotiable Certificates of Ownership of Precious Metals," Aug. 14, 2015, <https://www.fincen.gov/resources/statutes-regulations/administrative-rulings/application-fincens-regulations-persons>.

In a recent article exploring the whether the regulation of blockchain could hinder innovation, the following concern was expressed: 'By definition, blockchain technology — the distributed ledger that underpins [bitcoin](#) and other cryptocurrencies — stores a permanent, tamper-proof ledger of transaction data. These data security benefits are sometimes put on the back burner as blockchain tech comes under regulatory scrutiny.'<sup>10</sup>

As former Securities and Exchange Commission ("SEC") Chair [Mary Jo White](#)<sup>11</sup> has noted, "Blockchain technology has the potential to modernize, simplify, or even potentially replace current trading and clearing and settlement operations." The SEC is assessing "whether blockchain applications require registration under existing Commission regulatory regimes, such as those for transfer agents or clearing agencies."<sup>12</sup> In December 2015, the SEC requested public comment based on an Advance Notice of Proposed Rulemaking, Concept Release on transfer agent regulations, and how such systems fit within federal securities regulations.

Another area of concern for regulators is the ease with which cross-border transactions are facilitated over the blockchain. Penalties for violating sanctions enforced by the Office of Foreign Assets Control ("OFAC") can be severe. This enforcement power extends to payments made with [virtual currency](#).<sup>13</sup>

As regulators continue to decide how to address the adoption of blockchain, it is important that any payments made over a blockchain be in compliance with traditional regulations for money transmittal; including:

- A. The Bank Secrecy Act ("BSA")
- B. The USA PATRIOT Act
- C. The Foreign Account Tax Compliance Act ("FATCA")
- D. The Report of Foreign Bank and Financial Accounts
- E. OFAC regulations

## NOTES FROM THE SEC FINTECH FORUM

On Nov. 14, 2016, the SEC held a Fintech Forum where panelists discussed blockchain technology. The panel of five speakers unanimously agreed that if you are not already in the blockchain space, then you are behind. The Australian Stock Exchange is currently in the process of migrating processes to a blockchain. The panel believes this will improve clarity and transparency between the exchange and its regulators.

10. Ben Cole, "Blockchain Compliance Raises Questions of Regulatory Scope, Intent," TechTarget, <http://searchcompliance.techtarget.com/feature/Blockchain-compliance-raises-questions-of-regulatory-scope-intent>.

11. Keynote address at the SEC-Rock Center on Corporate Governance, Silicon Valley Initiative, Chair Mary Jo White, [March 31, 2016](#).

12. Ibid.

13. Joshua Garcia, "What is OFAC and How Does it Apply to Bitcoin?" Coin Center, May 3, 2015, <https://coincenter.org/entry/what-is-ofac-and-how-does-it-apply-to-bitcoin>.



## IV. MACHINE LEARNING

As institutions develop blockchain, it is important that they leverage the qualities of blockchain to enhance their ability to monitor money laundering and terrorism financing. Financial institutions can improve their monitoring abilities by deploying machine learning algorithms on a blockchain of transactions.

### A. Machine Learning vs. Traditional Approaches

Traditionally, auditors manually assessed risks of financial transactions using a list of risk indicators. This approach primarily depends on an auditor's experience and is labor-intensive and time-consuming. Another often-used approach is a rule-based approach, which uses rules of risk indicators developed by human experts. A rule-based approach tends to generate many false positive alerts.

An efficient and effective method of detecting noncompliant or fraudulent financial transactions is the use of machine learning algorithms. Machine learning algorithms discern patterns and trends from historical data and these patterns are then applied to make predictions about future events and trends.

The purpose of machine learning is to help human investigators prioritize which transactions to look at more closely. The optimization of investigative resources will increase efficiency by focusing examiners on highly suspicious transactions that warrant the most attention.

### B. Supervised vs. Unsupervised Machine Learning

There are two types of machine learning techniques: supervised and unsupervised machine learning.

#### 1. Supervised Machine Learning

Supervised machine learning assumes the availability of a set of training data that consists of labeled financial transactions as noncompliant (fraudulent) or compliant (normal). A supervised learning algorithm builds a predictive model (or patterns) to distinguish the two classes: noncompliant and compliant transactions. This predictive model is then used to identify new noncompliant transactions.

#### 2. Unsupervised Machine Learning

Unsupervised machine learning does not require a set of labeled training transactions. A popular unsupervised learning technique used in fraud detection is anomaly detection. Anomaly detection makes an implicit assumption that noncompliant transactions are rare cases and are different from compliant transactions. In anomaly detection, transactions that deviate from behaviors of normal transactions are identified as potential noncompliant transactions.

Supervised learning is often more accurate and produces fewer false alerts, but it requires a set of labeled training transactions, which can be hard to collect. Also, a predictive model built using supervised learning fails to identify noncompliant transactions with patterns that have never happened before. Patterns of noncompliant transactions may change constantly; therefore, new predictive models have to be built on a continuous basis. On the other hand, an anomaly detection technique can detect noncompliance of new patterns, but it generates far more false alerts.

To develop an effective noncompliant transaction detection system, a hybrid approach may be applied. In the hybrid approach, rule-based, supervised learning and unsupervised learning approaches, are integrated into the detection system to complement each other. A rule-based approach may produce a large number of false alerts, so a supervised learning approach could be used to help reduce the false-alert rate. Supervised learning could use noncompliant transactions identified using rule-based and unsupervised learning approaches to build a more accurate predictive model.

## V. HOW FINANCIAL INSTITUTIONS CAN LEVERAGE BLOCKCHAIN AND MACHINE LEARNING TO ADDRESS AML/CTF RISKS

Machine learning technologies may be deployed in blockchain in two modes: batch mode and real-time mode. The batch mode looks back at historical transactions to identify noncompliant/fraudulent transactions. In real-time mode, models developed using machine learning algorithms monitor blockchain transactions in real time and make predictions for transactions that are likely to be noncompliant.

As discussed above, fraud detection makes an implicit assumption that noncompliant or fraudulent transactions are rare cases and are different from compliant and normal transactions. The availability of the entire chain of transactions increases the population size and has the potential for machine learning algorithms to train accurate predictive models for noncompliant/fraudulent transaction detection.

Supervised and unsupervised learning complement each other. Supervised machine learning assumes the availability of a set of training data that consists of labeled financial transactions as noncompliant (fraudulent) or compliant (normal). Blockchain technology can provide near real-time access to all validated transactions. The use of up-to-date training data facilitates more relevant supervised machine learning algorithms. On the other hand, unsupervised learning does not need labeled training data and could be applied to identify anomalous blockchain transactions, which are the transactions that deviate from normal blockchain transactions.

Blockchain creates an environment in which it is difficult for either side of the relationship to provide false information, e.g., unauthorized account creation, misappropriation of funds, double-billing, etc. This reduces the number of traditional noncompliant transactions, potentially reducing the frequency with which an institution needs to develop new predictive models.

## VI. HOW NAVIGANT CAN HELP

Although the future of blockchain regulation is uncertain, it will undoubtedly affect the way institutions develop, use, and benefit from this technology. It is critical that compliance officers understand blockchain and that they have a seat at the table as their institutions discuss its implementation and adoption. Compliance officers should understand the advantages and limitations of blockchain to their institutions' AML/CTF programs and should look for innovative ways, such as the application of machine learning, to improve upon its inherent benefits.

Navigant has a team of experts with experience in applying AML/BSA and OFAC/sanctions regulations to the latest technological innovations. Our team is available to perform gap analyses, conduct training, and provide cybersecurity consulting services.





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