# Journal

Control the Risk!

AGA

Internal Control Over Blockchain
Can Reduce the Burden of Financial Audits and Reporting

By Craig Fischer, Chetan Hebbale, Justin Poll and Mike Wetklow

Distributed ledger technology (DLT), more commonly known as blockchain, is gaining momentum in government. From its consideration as a digital tool and platform for climate solutions to its possibilities for improved security and access to sensitive research and development data, blockchain could impact compliance activities and create valuable opportunities for the government financial management community. One area of financial management likely to be affected as blockchain matures is audits — specifically, reducing the burden associated with audit-related activities through the added transparency blockchain offers.[1]

Blockchain and other next-gen technologies are disrupting the status quo — part of a larger, ongoing transformation. Google CEO Sundar Pichai acknowledged that rapid technology advancement is driving a need to "invest in upskilling and pump the brakes at times to best serve humanity."[2] This phenomenon began with the development of personal computers and the internet in the 1970s through 1990s. Called the Fourth Industrial Revolution, it is defined as "a new era that builds and extends the impact of digitization in new and unanticipated ways."[3]
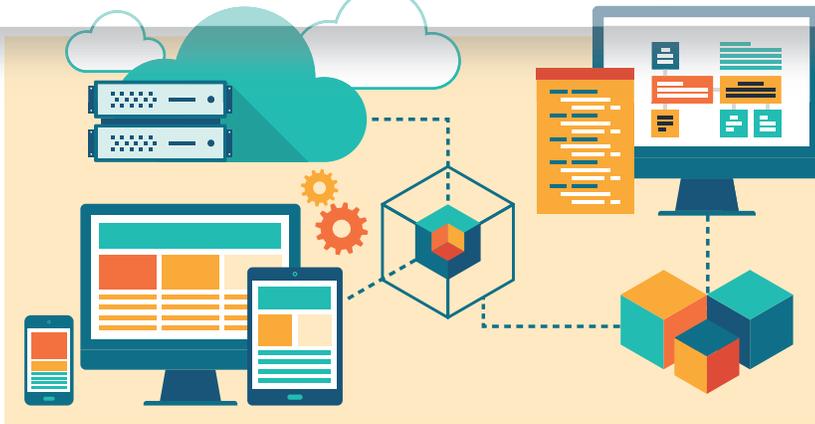
"The distributed ledger reduces the need for audit by 97%... Auditors in the future will be competing on the basis of productivity, which will essentially mean who has the fastest hardware and software. And fraud, in the classical sense, will be all but impossible."

— David Yermack

Several pieces of legislation, such as the U.S. Innovation and Competition Act and the Endless Frontiers Act, acknowledge the phenomenon with an aim to invest in technology infrastructure and enhance American competitiveness in innovation. Also, in a May 2021 *New York Times* interview, President Biden reportedly said, "I think circumstances have changed drastically. We're at a genuine inflection point in history. We are experiencing a Fourth Industrial Revolution, which encompasses developments ranging from the rise of information technology to shifts in the global competitive environment."[4]

Blockchain, a developing foundation of this revolution,[5] is also starting to appear in leading university curricula, as shown in **Figure 1**, to prepare the future workforce. With so much emphasis on it, blockchain must become an essential topic among today's government financial professionals to encourage upskilling, technological advancement, and future global competitiveness.

State Governments: Labs of Democracy

State governments have also been exploring the use and application of blockchain. One Washington think tank noted, "State governments have recognized the technology's potential for the delivery of public services and are at various stages of implementation."[6] State governments are often called "laboratories of democracy"[7] — and several are living up to that aphorism. For example, three states are making concerted efforts to better understand blockchain's potential for improving public services.

Illinois

In 2015, Illinois became one of the first states to create a consortium of state and county agencies to explore and understand blockchain. The Illinois Blockchain Initiative successfully launched five blockchain proof of concept (POC) implementations and opened the Chicago Blockchain Center to provide a platform to accelerate the instruction, innovation and development of blockchain technologies.

Wyoming

The Wyoming Blockchain Coalition is a public-private partnership to educate its state's citizens about the power of blockchain to cut costs, streamline administrative processes, and spur new businesses. Their efforts led to 13 laws to enable blockchain, making Wyoming the only state with a comprehensive legal framework for individuals and companies to develop and release blockchain technology.

California

In 2018, California took its first step in DLT use and regulation by commissioning the California Blockchain Working Group to evaluate its uses, risks, benefits, legal implications and best practices. In July 2020, the working group published "Blockchain in California: A Roadmap," a significant measure in analyzing the potential of blockchain for government and business throughout the state.

Testing Blockchain to Administer Federal Grants

As we look to what's in store for federal financial management, we envision a future in which:

- The government is an efficient steward of its financial resources.
- The government provides accurate financial information.

Figure 1. Blockchain Coursework in Universities

University	Course
Massachusetts Institute of Technology	Blockchain Technologies: Business Innovation and Application
Cornell University	Blockchain Essentials
Duke University	Duke Summer Blockchain Innovation Program
Harvard University	Introduction to Blockchain and Bitcoin
University of California-Berkeley	Blockchain Technologies and Applications for Business
University of Oxford	Blockchain Strategy Program
George Washington University	Become a Blockchain Developer

◆ Financial interactions with the government are modern, inclusive, seamless and secure.

As we strive to identify new technologies and practices that better serve the public, we are learning that blockchain might be able to achieve all three citizen expectations.

In 2019, the Bureau of the Fiscal Service (Fiscal Service) and the National Science Foundation (NSF) began to develop a "smart grants" application in response to requests by grants administrators at various research universities to simplify the process for receiving and reporting on federal grants. As a POC, the project used the blockchain tokenization feature, shown in **Figure 2**, to represent the attributes of a federal grant award. Because a token's history can be traced, it increases transparency along the path of federal funds to make reporting easier. Currently, when prime grant recipients transfer funds to sub-recipients, awarding agencies have poor visibility of the sub-grants.

Our POC suggests greater transparency is possible through blockchain. The awarding agency transfers the grant token to the prime grant recipient, who may then pass along a portion of the token to a sub-grantee. If the sub-grantee requests a drawdown of funds to cover expenses, the grant-making agency redeems the token for cash. Visibility into each transaction eliminates the need for additional reporting.

Smart Contracts for Grants

Another key feature of blockchain is smart contracts, which allow digitized agreement terms and conditions to be self-executed once the predefined rules between parties are met. The POC envisioned a smart contract for each grant letter to automate enforcement of spending controls and payment rules and to simplify reporting. In essence, the POC aims to adapt this functionality to create smart grants and indicates blockchain could transform government operations by tackling some of government financial management's biggest challenges, especially those concerning internal controls. It certainly confirmed two notions: 1) blockchain can improve the

detection and prevention of improper payments; and 2) blockchain can reduce the reporting burden for grant recipients.

1. Reducing Improper Payments

During the initial tokenization of the grant award, the blockchain was designed to expand the amount of data captured by the grantee to include line-item detail of specific categories of spending for the award (e.g., travel, salary, equipment.) The detail not only enabled deeper visibility into the use of federal funds at the prime and sub-grantee level, but also enhanced compliance, because the automated control limit prevented grant recipients from requesting funds for uses that were not permitted by the grant award. While current payment systems can only run limited validation checks, such as availability of funds, the line-item detail embedded in the token can check spending against the terms and conditions of the award.

The POC blockchain also demonstrated potential to expand controls to check the eligibility and integrity of federal grant recipients earlier in the award process. For instance, by integrating the blockchain application with other services that aim to reduce fraud and improper payments (e.g., Do Not Pay, suspension and debarment) the blockchain can verify whether a grantee or sub-grantee is eligible for an award before it is disbursed.

2. Reducing the Reporting Burden

Research for the POC showed that the SF-425 Federal Financial Report is one of the more time-consuming reporting requirements for university grant administrators. A common post-award reporting form for grantees, it is submitted quarterly, semi-annually or annually, depending on the terms of the grant, to give an accounting of a single grant or a consolidated grant portfolio of a specific federal agency. The SF-425 reports how much federal money the recipient requested, the
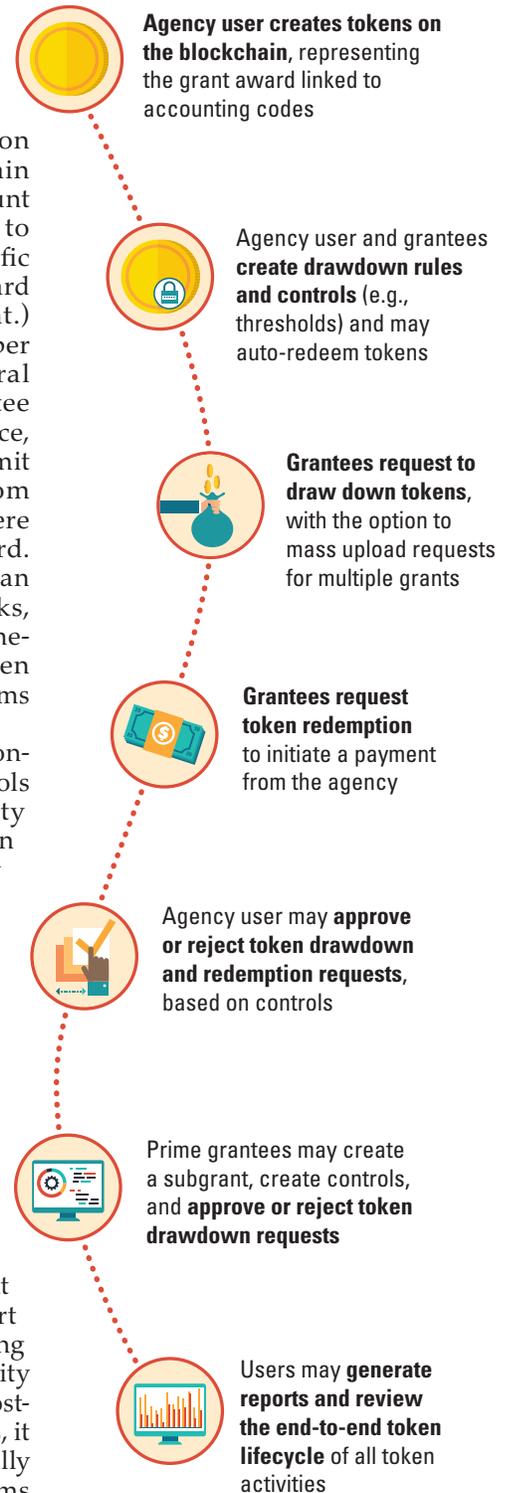
Figure 2. Blockchain Tokenization

Agency user creates tokens on the blockchain, representing the grant award linked to accounting codes

Agency user and grantees **create drawdown rules and controls** (e.g., thresholds) and may auto-redeem tokens

Grantees request to draw down tokens, with the option to mass upload requests for multiple grants

Grantees request token redemption to initiate a payment from the agency

Agency user may **approve or reject token drawdown and redemption requests**, based on controls

Prime grantees may create a subgrant, create controls, and **approve or reject token drawdown requests**

Users may **generate reports and review the end-to-end token lifecycle** of all token activities

Figure 3. Tokenized Grant Reporting

Cash Flow Balances

Expenditure Data

Recipient Details

Program Income

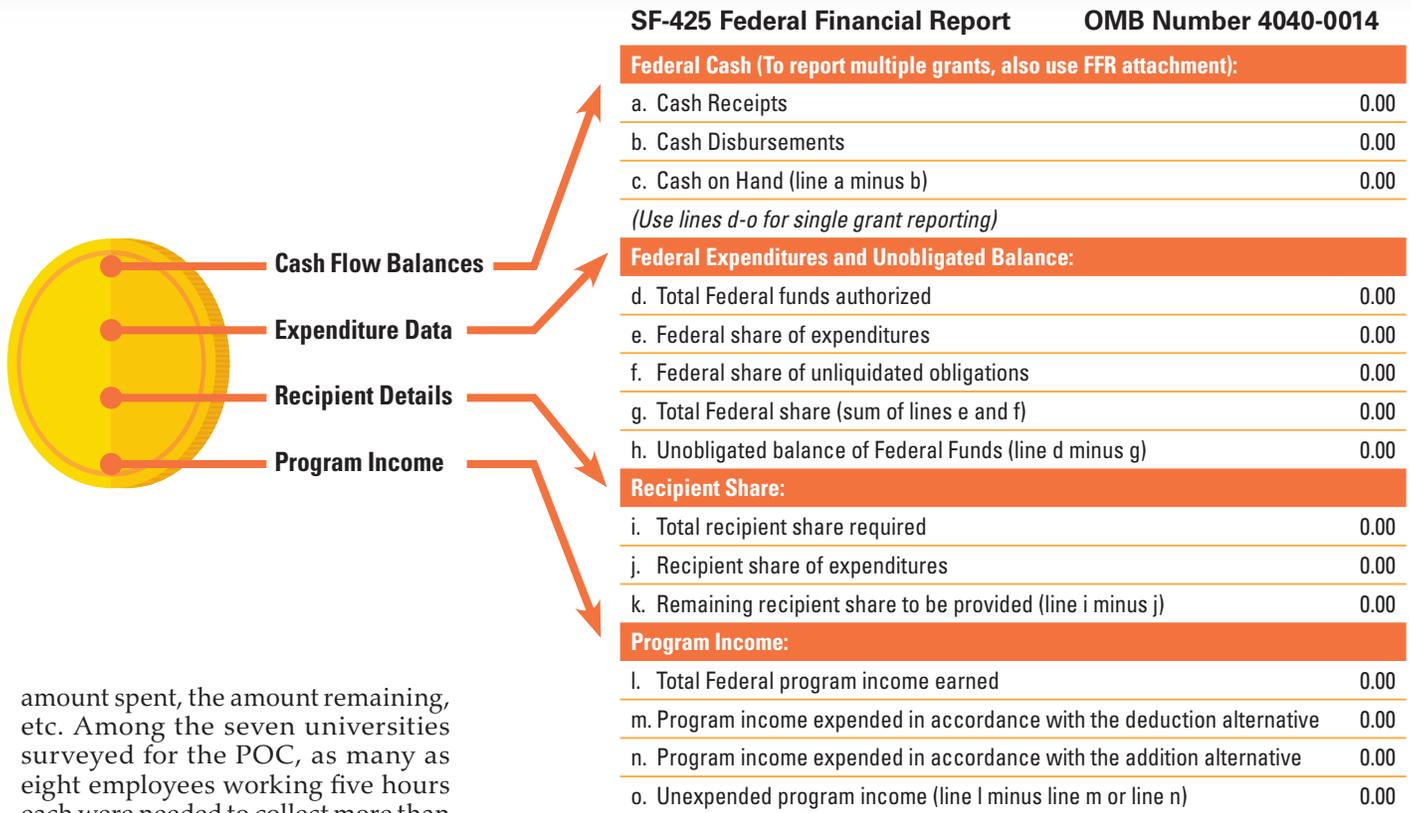| SF-425 Federal Financial Report	OMB Number 4040-0014
Federal Cash (To report multiple grants, also use FFR attachment):	
a. Cash Receipts	0.00
b. Cash Disbursements	0.00
c. Cash on Hand (line a minus b)	0.00
(Use lines d-o for single grant reporting)	
Federal Expenditures and Unobligated Balance:	
d. Total Federal funds authorized	0.00
e. Federal share of expenditures	0.00
f. Federal share of unliquidated obligations	0.00
g. Total Federal share (sum of lines e and f)	0.00
h. Unobligated balance of Federal Funds (line d minus g)	0.00
Recipient Share:	
i. Total recipient share required	0.00
j. Recipient share of expenditures	0.00
k. Remaining recipient share to be provided (line i minus j)	0.00
Program Income:	
l. Total Federal program income earned	0.00
m. Program income expended in accordance with the deduction alternative	0.00
n. Program income expended in accordance with the addition alternative	0.00
o. Unexpended program income (line l minus line m or line n)	0.00

amount spent, the amount remaining, etc. Among the seven universities surveyed for the POC, as many as eight employees working five hours each were needed to collect more than 15 data elements to report on a single agency portfolio for a consolidated SF-425. Just one portfolio! Yet institutions typically receive and manage many grant portfolios from various federal agencies.

With blockchain, grant information and payment data are stored on a token as shown in **Figure 3**, and travel with the grant throughout its lifecycle. Because additional data collection is unnecessary, populating a report becomes a one-click, automatic event. The cash flow balances, expenditure and recipient information can be pulled from the token when needed.

Challenges Ahead

While our POC identified benefits that improve federal financial management, it also revealed challenges that may be relevant to other endeavors with blockchain and emerging technology.

- **Federal agencies lack legal authority to pay sub-grantees directly.** According to the Office of Management and Budget (OMB) Uniform Guidance (2 CFR § 200), the prime recipient is expected to distribute payments to sub-recipients. Without a declarative statement to authorize it, an agency cannot redeem tokens and issue cash payments to sub-grantees.

- **The National Institute of Standards and Technology (NIST) establishes federal IT standards.** It remains unclear whether there are blockchain platforms that adhere to the current suite of federal IT standards that would be relevant to blockchain-based applications. For example, we found that the blockchain platform we used to develop the blockchain-based grant payment prototype does not currently meet parts of Federal Information Standard 140. Also, no best practices exist for what would constitute a federally compliant digital wallet and key management custody approach.

Change Management

In addition to the technical challenges we identified in using blockchain to facilitate grant payments, we also gained a better understanding of some change management challenges blockchain may bring, as shown in **Figure 4**. While many aspects of the blockchain prototype felt familiar to end-users, many did not. In a few cases, change management proved more challenging than using the technology:

- **Grantee Onboarding.** To receive and send blockchain tokens that represent the grant payment, end-users and agencies would be required to use a digital wallet designed specifically for blockchain applications. The deployment of digital wallets and the authentication of users would necessitate new processes and user training.

- **Data Standardization.** To achieve the reduced reporting burden envisioned with blockchain, agencies would likely need to collect more data upfront than is collected today. Given the vast and different purposes of federal grants, agreement on the appropriate level of reporting information from federal grantors and their grantees would entail significant data standardization.

Figure 4. Blueprint for Change: Internal Control Over Blockchain

	Current State Grant Payment Pain Points	Blockchain Prototype Findings	Areas for Further Exploration
Control Environment	• Multiple systems and non-standard business processes across agency and grant recipient levels • No single source of truth — constant reconciliation required to keep system records in sync with one another — frequent use of shadow systems	Blockchain could: • consolidate redundant features in grant and financial systems. • consolidate awards management and payment system. • keep remaining legacy systems in sync.	• Governance of the blockchain solution among stakeholders and their roles in the organization • Establishment of a blockchain network and deployment of node infrastructure • Service providers seeking FedRAMP certification
Risk Assessment	• Difficulty utilizing all existing data points in current state risk assessments — hard to integrate data points • Formats of many data points are not machine readable or query ready	Blockchain could: • expand the number of data points collected through tokenization. • integrate disparate sources and incorporate integrity checks earlier in the process.	• Data dictionaries to standardize grants codes
Control Activities	• Varying levels of automation throughout grant management process — many manual control processes still exist • Lack of visibility into or documentation of completion of control activities	Blockchain could: • automate compliance with terms and conditions of a grant award. • apply spending constraints at the line-item level to reduce risk of improper payments.	• The process for "cashing out" tokens • Deployment of digital wallet and user authentication solutions
Information & Communication	• Current systems don't communicate with one another across layers (i.e., agency with recipient; recipient with sub-recipient) • Manual intake required by recipient and sub-recipient for agency system outputs	Blockchain could: • serve as the underlying infrastructure to connect and standardize multiple systems. • provide transaction and expense data at multiple spending levels. • streamline grantee's intake of award. • enhance data mining capabilities for improved audits.	• API integration and specifications from the blockchain to various award and financial systems — agency, recipient, sub-recipient • Cost to implement blockchain at all levels
Monitoring Activities	• Agency can only access grant spending data or support documentation through periodic reporting or ad-hoc data calls • Costly, resource-intensive oversight and audit activities — cost limits annual agency reviews	Blockchain could: • simplify or eliminate current reporting processes. • enable quicker, more routine audits or other oversight activities.	• Automatic population of standardized grant reports (e.g., SF-425) from blockchain ledger data • Impact of blockchain on existing grant and/or audit regulations

🔶 **Integrating with Legacy Systems.** Our blockchain prototype was intended for integration with legacy systems, such as agency financial and grant systems. While this design affords a level of familiarity for end-users, some business process reengineering would be needed for the blockchain application and legacy systems to work together.

Preparing the CFO Community for Tomorrow

November 2020 marked the 30th anniversary of the CFO Act. From establishing CFO functions and implementing financial management systems to eliminating material weaknesses, reducing improper payments and implementing the DATA Act, the accomplishments of the financial management community stand on their own merits. Most notably, for fiscal year 2020, 22 of 24 federal agencies maintained clean audit opinions — despite the COVID-19 pandemic and an uncertain virtual work environment.

With this history of accomplishments in mind, the digitalization of the global economy spurred by the pandemic has made it clear that our future depends on technology and innovation. With so much government grant money in disbursement over the next few years, now is the time for bold and decisive action. Working together, innovators from universities,

"The blockchain will be to banking, law and accountancy [what] the internet was to media, commerce and advertising."[8]

— Joi Ito, Director
MIT Media Lab

NSF and the Fiscal Service plan to continue testing the federal use of blockchain technology to meet future financial management needs. Just as universities played an integral role in the development of the internet, they have a new opportunity to collaborate with government on blockchain. **J**

Endnotes

1. Arrowsmith, Ranica. "Audit Dead in a Decade?" *Accounting Today*, Oct. 31, 2018.

2. Harlow, Poppy. "We may have to slow down some 'disruptive' technology," *CNN*, June 14, 2019.

3. Schwab, Klaus. "The Fourth Industrial Revolution: What it Means, How to Respond," *World Economic Forum website (weforum.org)*, Jan. 14, 2016.

4. Brooks, David. "Has Biden Changed? He Tells Us," *New York Times*, May 20, 2021.

5. Foundations of the Fourth Industrial Revolution, *LinkedIn Learning*.

6. Desouza, Kevin C., Chen Ye and Kiran Kabtta Somvanshi. "Blockchain and U.S. State Governments: An Initial Assessment," *Brookings Institute*, April 17, 2018.

7. The term "laboratories for democracy" was popularized by U.S. Supreme Court Justice Louis Brandeis during New State Ice Co. vs. Liebmann.

8. MIT Media Lab Panel Discussion on Industries of the Future, Oct. 15, 2016. Archived on c-SPAN.org.

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Mike Wetklow, CGFM, with more than 25 years' experience in progressive leadership, management and audit in federal, state and local governments, currently serves as Deputy CFO of NSF, focused on transforming its financial management functions to include RPA, blockchain, cybersecurity and data analytics. Prior to this work, he led OMB efforts to develop the federal government's first formal ERM guidance and to update OMB Circular No. A-123; and at the Department of Homeland Security, he established internal control over financial reporting, eliminated pervasive material weaknesses, and obtained the agency's first balance sheet opinion in FY 2011. A member of AGA's Washington D.C. Chapter, Mike is currently upskilling in pursuit of a master's degree in data science at the University of Virginia. He holds an MPA in public sector finance and a B.S. in accounting from the University of Maryland at College Park.