

*Budget Accounting & Transparency (BAT) Working Group*

**Government Financial Management Blockchain**

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Any questions or inquiries about this whitepaper should be directed to the Working Group Leader, [Mr. Steve Olson](https://www.gbaglobal.org/members/solson/profile).

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A Acknowledgements

# Executive Overview

## Problems

This paper addresses two potential problems facing governments around the world. They are:

* The adoption and use of Cryptocurrencies are growing globally at an explosive rate. Entire financial ecosystems are developing around cryptocurrencies. Many government institutions and systems are not prepared to interact with these systems for the collection of taxes and the financial management of what will likely be major portions of their economy. And,
* Recent advancements in distributed ledger technology affords governments many opportunities significantly improve the integrity, transparency and trust of government financial systems. Inefficiencies resulting from double entry accounting systems often times results in errors reconciling accounts and opportunities for funds to be hidden or used in ways other than the public good.

## Solution

Blockchain technologies offers solutions for the collection, of tax and other revenue, budget management, allocation of funds to legitimate payees and the tracking and management of public money. Using blockchain technologies could reduce the cost to tax payers and reduce the admirative overhead of managing the collection, distributing and management of public funds. While costs are being reduced, the integrity of the financial management would also be improved.

## Proposal

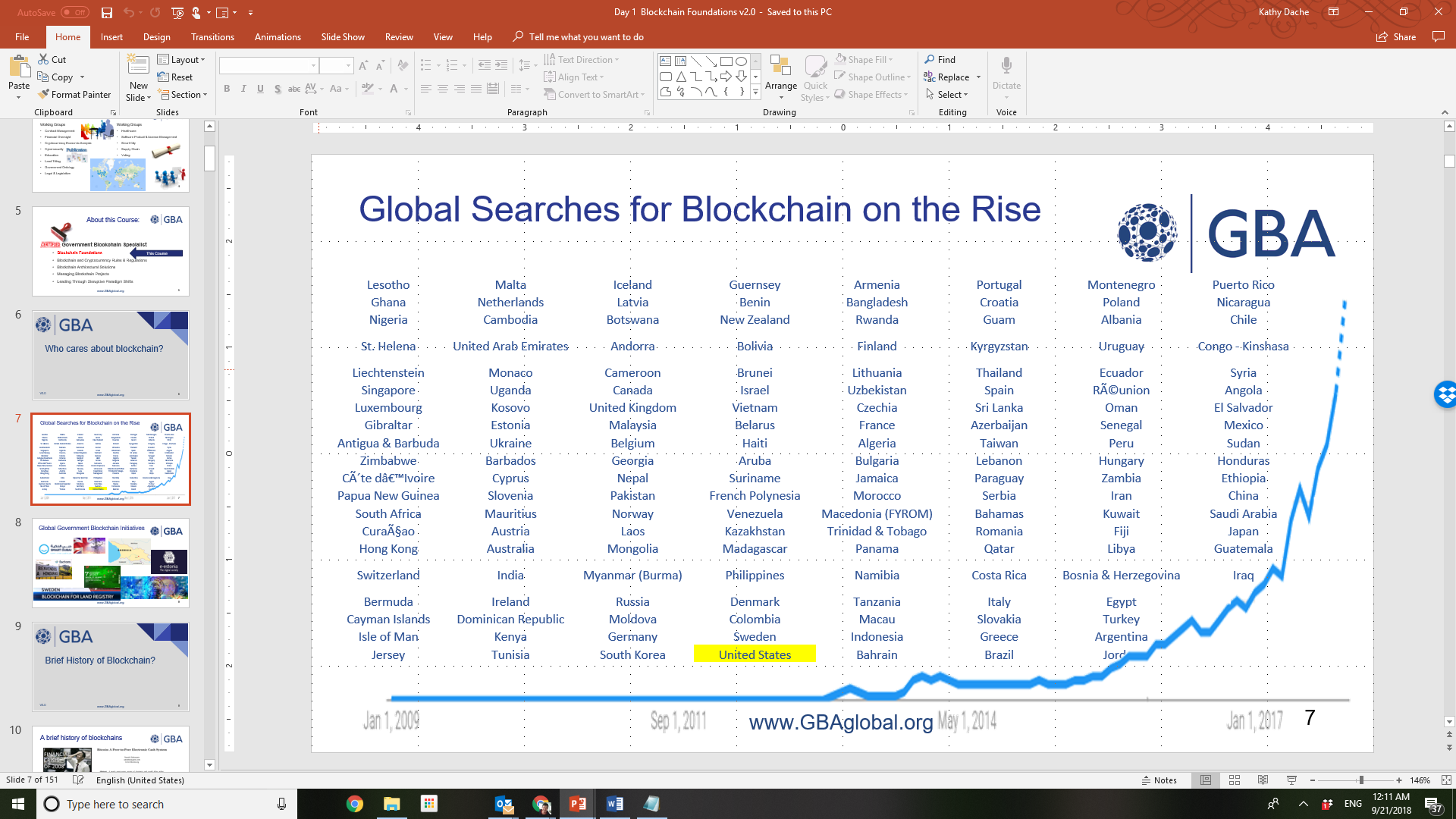
The [Government Blockchain Association](http://www.GBAglobalorg) Budget, Accountability & Transparency (BAT) Working Group proposes a project to receive grants from government organizations, collect requirements, and build a Government Financial Management System Blockchain that would allow government entities to use as a foundation for their unique implementation of their own government financial management system.

# Introduction

## Background

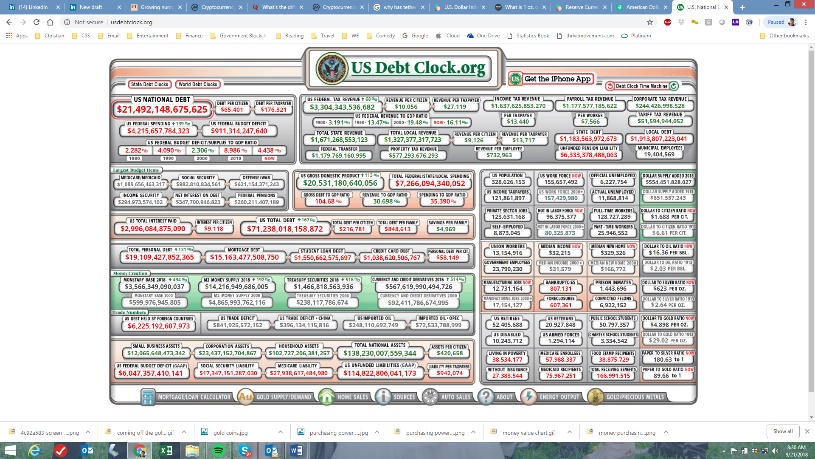
In 2018 the federal, state, and local governments budget for revenue is $7.18 trillion. However, it is estimated that $3.3 trillion will be collected by the Federal Government and about $2.8 trillion will be collected by state and local governments. In other words, the budget is $7.18 but governments will only receive $6.2 trillion.[[1]](#footnote-1) All of these governments around the country have developed information technology systems, processes, laws and regulations to help facilitate the collection of taxes, establishment of budgets, appropriation to programs and oversight of spending. All of these systems manage the movement of US Dollars. That obviously made sense when nearly everyone in the country used USD.

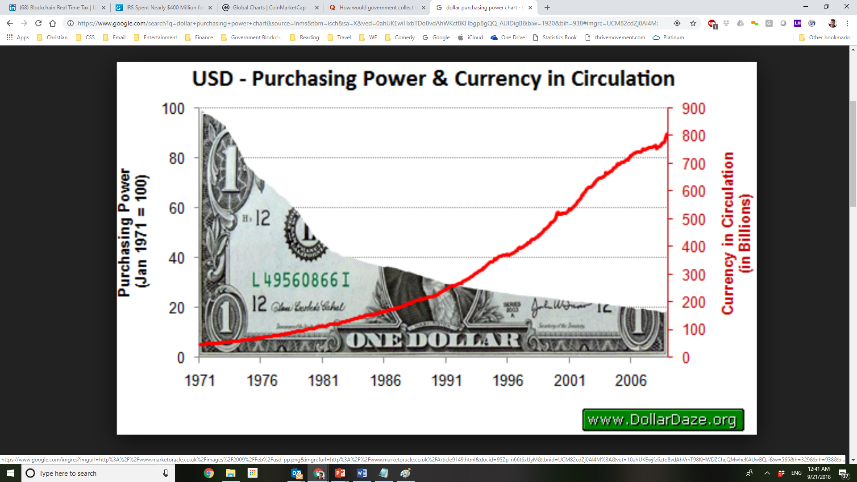
However, starting in 2009 a new type of currency was introduced and began to be used in the US. Bitcoin was the first cryptocurrency, a new form of digital money that does not require a third-party transaction processor. Since then over 2,000 cryptocurrencies have been developed with a total market cap of over $200 Billion. Additionally, the adoption of cryptocurrencies has been a global phenomenon. For example, in less than ten years it has gone from zero to 2% of the global GDP. That is astonishing. The chart below shows the countries in order of total number of searches for blockchain.

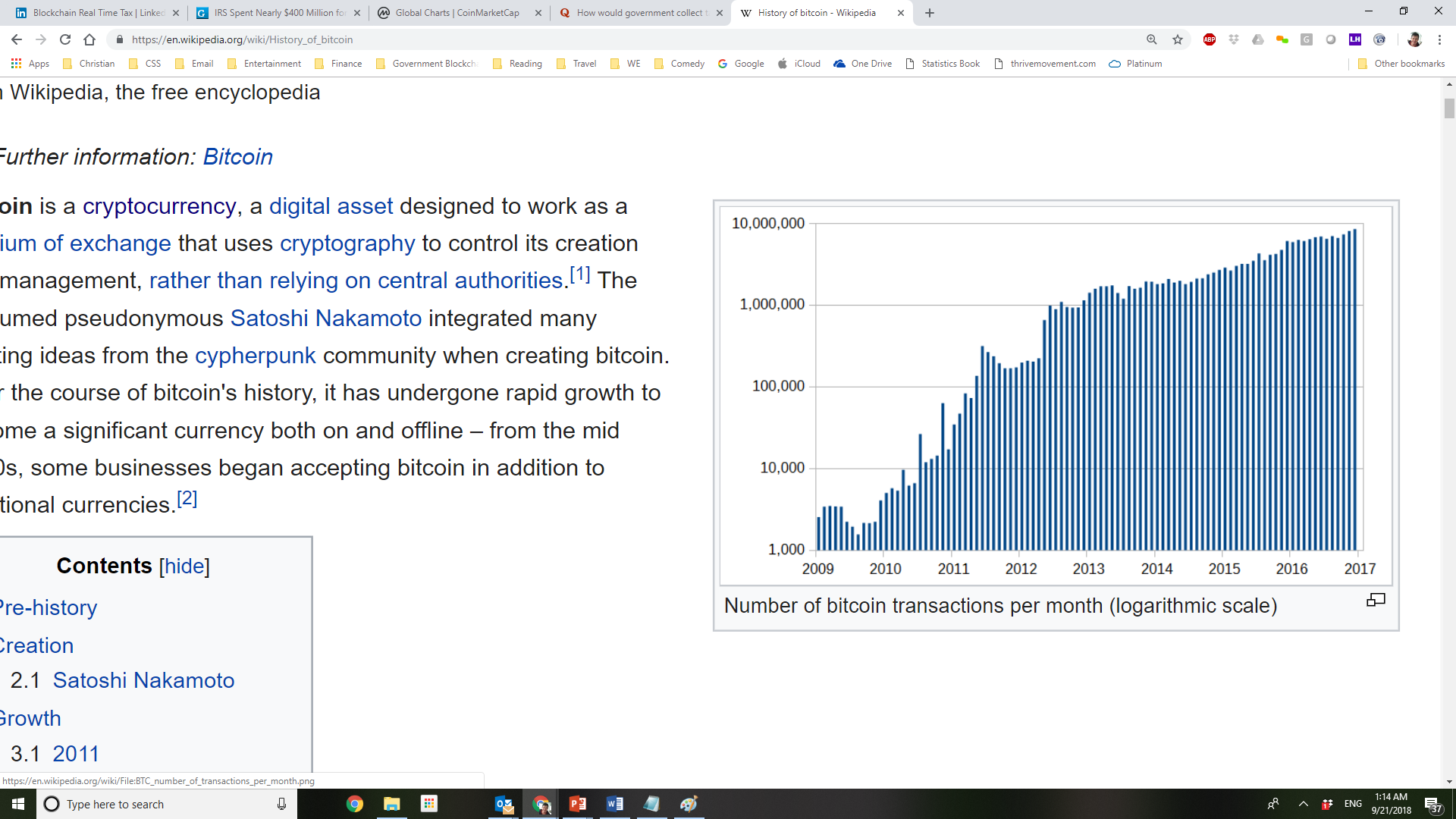


The United States is near the middle. That means that almost half of the countries in the world have searched for the term “blockchain” more than people did in the USA. It is clear to see that this phenomenon is a global trend.

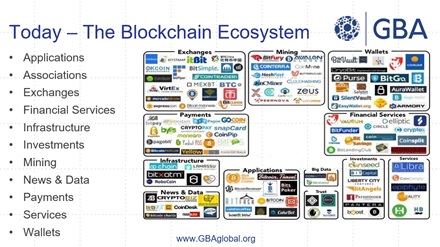
Why are cryptocurrencies seeing such explosive growth in adoption? The answer is directly related to how the US government manages money. Every year the US Government spends more money than it receives. The problem is political. Legislators typically get reelected if they increase spending in their district and keep taxes low.

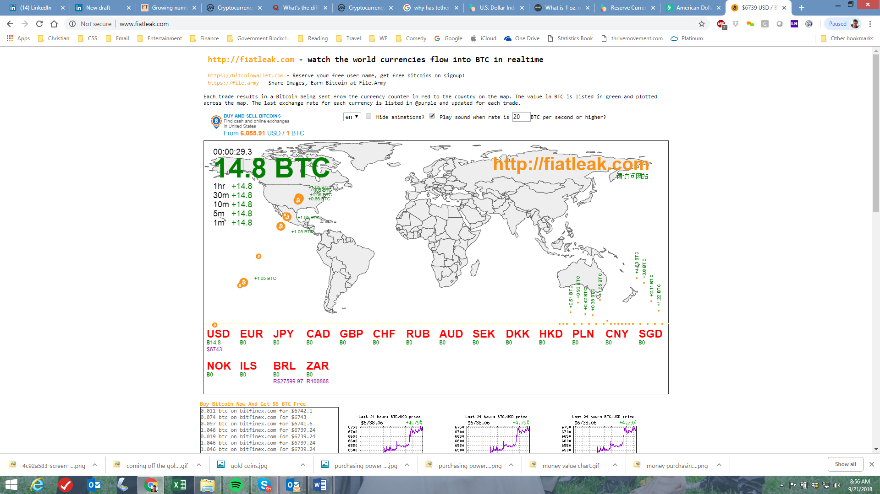
What this means is that every day, the US debt grows. The interest on the debt grows. As of September 21, 2018, the amount owed by every tax payer is $176,000. In fact, the amount that we owe to just pay the interest on the debt is more than every US Program except the US Department of Defense Program.

The US Government typically responds by increasing the debt (and paying higher interest charges). Or increasing the money supply through fractional reserve lending. As the money supply increases (and the supply of money goes up) the value of the money goes down. Everyone who has USD in their wallet has lost value whenever the supply of money is increased. So, the purchasing power of the dollar continues to erode every day. So many people have begun to look for other alternatives.

On the other hand, the value of crypto currency, while volatile, has steady increased. For example. The first bitcoin transaction was on 22 May 2010 when two pizzas were sold for 10,000 BTC. In the next five days, the price grew 900% from $0.008 to $0.08 for 1 bitcoin.[[2]](#footnote-2) Today the price for one bitcoin is thousands of dollars. All the metrics around cryptocurrency point to the same conclusion. Numbers of users, wallet download, transactions and other indicators show a steady increase in adoption of cryptocurrencies. It is estimate that approximately 20% of all college students own cryptocurrencies.

This is even though it is still harder to use cryptocurrencies than it is to use FIAT currencies. The technology and regulatory frameworks still make it difficult to use cryptocurrencies. However, that is rapidly changing.

Every day more and more organizations release technologies and applications that make using cryptocurrency easier and easier. Bitcoin and other cryptocurrencies are being used for major transactions involving hundreds of thousands of dollars. Today, there are entire ecosystems of businesses, technologies, processes and organizations that are emerging as entirely new economies inside and outside of the borders of the United States.

As this happens, more and more transactions will move from the traditional fiat banking system into this new eco system. As people see the continuous erosion of fiat currencies around the world and the continued increase in the value of cryptocurrencies, and as the supporting technologies and infrastructure continue to improve, money will continue to leak from the old system into the new one until it hits a tipping point. And, when that happens, it will happen fast.

What does this mean for the thousands of IT systems, laws, regulations, institutional interfaces and operating procedures for every government in the world? They will **ALL** be impacted. Many will need to be entirely overhauled.

# Generic Government Financial Management Process

## Revenue Collection

All governments collect various types of revenue through taxation, licensing, permits and even lotteries and gambling. However, the explosion of cryptocurrency and blockchain technologies have resulted in many different responses. Some have responded negatively by trying to shut it down or put the genie back in the bottle.

However, many governments around the world have had an epiphany.  It has dawned on them that all this activity in the cryptocurrency space is creating massive amounts of wealth.  But, failing to legitimize the value of the cryptocurrencies and digital assets are also keeping those revenues in grey markets and out of the treasuries of government institutions.  That is beginning to change.  Here are a few examples of governments taking a look at cryptocurrencies and blockchain from a revenue collection perspective:

* **Ukraine** - In 2018, twenty-three government officials in the Ukraine have initiated a bill that would tax digital assets including cryptocurrencies and tokens.  This initiative aims at accomplishing three things.  They are to legitimize cryptocurrencies, establish a stable regulatory framework, encourage economic activity and increase revenues to the national government.  According to the bill, starting in 2019, an additional $43 million will be raised annually.  Going even further, in May 2018, Head of Ukraine’s National Securities and Stock Market Commission (SSMCS) Timur Khromaev revealed that the commission will consider recognizing cryptocurrencies as a financial instrument, stressing the need for the legal recognition of cryptocurrencies, which was subsequently supported by the Financial Stability Council in July.
* **Arizona, USA** - Senate Bill 1091 which would allow state taxes to be paid in Cryptocurrency has passed and is on its way to the Arizona House of Representatives.  Arizona State Republican Rep. Jeff Weninger, who co-sponsored the bill, said the tax measure intends to turn the state into a center of “blockchain and digital currency technology in the future”. Referring to the tax bill, Weninger said "It's one of litanies of bills that we're running that is sending a signal to everyone in the United States, and possibly throughout the world, that Arizona is going to be the place to be for blockchain and digital currency technology in the future."
* **Georgia, USA** - In 2018 the State of Georgia considered a bill introduced by [Senator Michael Williams](https://www.gbaglobal.org/members/willia259/profile/) that would allow for state taxes to be paid with cryptocurrency.
* **Switzerland (Chiasso & Zug)**- Two cities in Switzerland are collecting tax payments in cryptocurrencies.  First Zug and soon the city of Chiasso will begin accepting cryptocurrencies for tax payments in January of 2019.

But, beyond this, some governments have begun to compete for wealthy taxpayers.  And, they realize that income sources are becoming divorced from physical locations in ways that were totally unimaginable 20 years ago.   For example, Puerto Rico and Estonia are two places that are drawing huge sums of capital from outside of their borders.  Puerto Rico has tax policies that attract crypto millionaires and Estonia has an E-Residency program that allows anyone to virtually move into their economy by paying a small fee.  Some have projected that Estonia could become one for the wealthiest countries in the world because of their approach to blockchain and digital assets.

What does this mean for government revenue officials?  Clearly, crypto currencies are here to stay. Further, cryptocurrencies facilitate the use of smart contracts that could automate the collection of revenues, increasing transparency, reducing administrative costs and providing more resources to citizens and constituents. Cryptocurrency will continue to become greater and greater segments of the global economy.  Some governments have already recognized this and are working to prepare for that reality.  The real question is, when that day comes, will our governments be ready?

## Budgeting

One of the most difficult things that governments have to do is budget.  The reason is because the act of budgeting requires tough choices.  Some governments are required by their constitution to live within their means.  When the United States was on the Gold Standard, that was true.  However, since then the government could simply increase the money supply or the debt and could in effect, say yes to everything.  That is great for politicians that can continue to vote for government programs without raising taxes.  But, it's not so great for taxpayers. Every time they increase the money supply, the value of the dollar in every wallet and bank account diminishes.  It is a form of taxation without raising taxes.

They also increase the debt limit.  The US has raised the debt ceiling approximately 90 times in the 20th century.  This is practically an automatic process since politically it is virtually impossible to vote against it. Voting against it would cause the US Government to default on their obligations and consequently crash the entire economy.  So, when they increase the debt limit, we go further into debt.  We need more money to pay the interest and where do we get it?  We increase the money supply (devaluing the dollar) or we borrow more.  The problem is systemic.  There are porous boundaries on the budgeting process.  The US government has made several attempts with balanced budget amendments and sequestration.  However, these attempts have failed. Legislators often give up and do not even pass a budget.  They will pass "Continuing Resolutions" which is not a thoughtful selection of financial priorities, it just kicks the can down the road, abdicating fiscal responsibility to legislators in the future.

However, if taxes were collected in the form of distributed cryptocurrencies like Bitcoin or Ether, only the amount collected could be spent.  The government could not simply create more.   If the government wanted more, it could mine cryptocurrencies (a topic for another day - See the [GBA Mining & Cryptocurrency Working Group](https://www.gbaglobal.org/groups/mining-cryptocurrency-working-group/)).  Cryptocurrencies are forms of tokens.  If any tokens were used in the budgeting process, it could be done using Smart Contracts.  Smart Contracts could manage the budgeting process using consensus algorithms in ways to shield politicians from unpopular votes while at the same time bringing trust and transparency to the budgeting process.

The entire paradigm of how budgeting works would need to be overhauled. But, that might be good. Since, in many parts of government, it simply does not work. Moving government budgeting processes to a blockchain based system could be exactly what we need to maintain financial solvency.

## Appropriations

Another area where populations distrust their own governments is in the disbursement of public funds. Governments are not very good at managing large sums of money. The layers of bureaucracy create many opportunities for money to be hidden, lost or stolen. Here are just a few examples:

* The IMF, UK, Ireland, Ireland & Sweden have suspended aid to Zambia because $4.3 million that was meant for poor families had gone missing from the Social Cash Transfer program. Other irregulates exist in Zambia's Health and Education Ministries where shell companies were established to divert funds.
* In August of 2018 the [Project On Government Oversight](https://www.pogo.org/), reported the scathing findings of previously unpublished government investigations into contract mismanagement committed by the Defense Contract Management Agency (DCMA). The reports paint a disturbing picture of systemic failures and sloppy management, casting doubt on the agency’s ability to protect taxpayer and government interests in the **trillions of dollars’** worth of contracts it administers.[[3]](#footnote-3)

Citizens around the world know this and is why they distrust their government. Government leaders also know that they must mend these gaping holes in the public’s money bags. That is why governments around the world are turning to blockchain for solutions. For example:

* The Digital Transformation Agency (DTA) of the Australia government has budgeted $700,000 to explore how blockchain and smart contracts can be used for government transactions including payments, escrow, notarization, voting, registration, and process coordination. They believe that the use of blockchains could target improved government service delivery, and private blockchains could be used to facilitate information sharing and process coordination across agencies within government.[[4]](#footnote-4)
* The government of Dubai, UAE has announced its goal that by 2020 all visa applications, bill payments and license renewals will be done via blockchain.

## Tracking

Blockchain technologies facilitate new elements of trust. For this reason, the BAT group envisions a series of applications associated with budget legitimation, execution and control.

One or more frameworks may be developed. To increase efficiencies, the reuse of modules would be widely encouraged. Yet we are quick to acknowledge the specific requirements of each jurisdiction. Still, the commonalities of blockchain may yield overarching hierarchies.

## Control

Lacking stable accounting, an associated budget system would be weakened. Thus, a strategic coordination of interfaces toward one or more systems would be key. To smooth public/private transactions, the automation of contractual re-order points may prove efficient. Other interfaces may help maintain a budgetary base. For instance, the quick liquidation of encumbrances–both on the revenue and expenditure sides–may be beneficial. One or more methods of payments will likely emerge. Security, including non-repudiation of staff, vendors and constituents, should be standardized. These are but a few of the envisioned blockchain applications.

## Execution

The strength of “actual” versus ”expected” comparisons facilitate budget execution. And, of course, unexpected cost should be reported forthwith. The need for adjustments or re-organizations could be facilitated. With common modules/interfaces it is possible that funds could move intra- or intergovernmental. The “smart contract” elements of blockchain may facilitate action upon contingencies. The subsequent pre- and post-auditing of transactions may be accommodated.

## Legitimation

A budget is a plan. They may be short-, medium- or long-term. How each jurisdiction legitimizes, endorses and uploads appropriations/approvals varies. But, it is probable an enabling blockchain technology will emerge. We acknowledge prudent budgeting as a key element of leadership. Features may include distributed ledgers. immutability, and accountable reports of stewardship.

# Program Strategy

Accomplishing a task to find ways to collect revenue, budget, appropriate and track government funds using blockchain technologies requires a huge paradigm shift. There will be many obstacles along the way. Potentially the use of tokens and/or specialized cryptocurrencies would result. Legal, regulatory, procedural and political barriers are everywhere. This type of an endeavor will likely take a decade to accomplish. Yet, we envision a portability between government entities.

The program will approach this subject in four sequential phases. They are:

* Revenue Collection
* Budget Allocation
* Budget Appropriations
* Fiscal Tracking, Reporting & Oversight

With the use of design techniques and frameworks, common modules may be reused. The building blocks may lessen the need for testing. By using polymorphism, inheritance and encapsulation (PIE) more resilient additions to the frames could result. PIE, as well as techniques of Abstraction and other techniques, are commonly used by software engineers. Doing so may facilitate organizational change.

# Revenue Collection

The first pilot project will be to develop an open source platform that allows local government entities like US States to manage revenue producing programs like lotteries, fee for services or local tax collection services. The open source platform would be a public blockchain that would allow individuals to interact with the system with fiat or cryptocurrency. The system would hold and dispense the money via a smart contract. Then the system would automatically disburse the funds, address administrative, tax and earmarked fees (PATEF) based on the smart contract. The application would also be open source so that no one contractor would or could control the access to or distribution of the funds. The smart contract would ensure that all proper payments and fees were paid as part of the distribution. The system would allow for full transparency that the funds were properly managed. However, there would be no disclosure of the identity of the recipient. This would maintain the privacy of the individual while ensuring the integrity of the system. The administrative fees would be held in a special fund and accumulated. Periodically, they would be disbursed for the next phase, budget allocation.

# Budget Allocation

The second project would focus on using smart contracts to budget the remaining funds in accordance with legal and legislative priorities. The funds would be allocated to accounts on the blockchain. They would remain there until they were appropriated by an authorized contracting official.

# Budget Appropriations

Once an authorized contracting official has the approval and all of the conditions of the smart contract were met, the funds would be converted to the appropriate currency (US Dollars or Cryptocurrency) and distributed to the entity. The smart contract may include conditions such as the successful completion of project milestones, timed payments or performance payments based on objective data feeds from reliable sensors or sources.

# Fiscal Tracking, Reporting & Oversight

Since most of the data will be on the blockchain, this would allow software applications, websites and external systems to be able to have read access. Data analytics tools, AI and machine learning techniques can be used to scan the data and look for any incidents of unusual activity that could be flagged for investigation. This is besides the consensus mechanisms build into the blockchain. Only individuals with the appropriate private keys would have access to data on the site. Special permissions will need to be provisioned for law enforcement and auditors until the system can demonstrate integrity independent of outside auditors. Ultimately, the goal would be to build integrity into the system and not audit it after the fact.

# Public-Private Partnership Projects

## Establish Funding Sponsors (Grants)

This whitepaper will be used to solicit grants from public institutions to form a Public-Private Partnership (PPP) with GBA members organizations. The GBA-PPP will establish open source standards and technology that will be available to all members of the GBA-PPP. Moneys received from local government entities will be used to pay for administrative fees, hardware, technology and services. The GBA will pool grant money received from multiple states to fund this project. All public organizations that fund the program with grant money have full access to program plans, status and deliverables.

## Requirements Solicitation

The entities that provided grant funding for the PPP will receive first priority in providing requirements for the blockchain platform. Requirements will be collected, prioritized and managed in accordance with a defined requirements analysis and management process to ensure that they are necessary and sufficient to satisfy all existing stakeholders and can scale to meet the needs of future stakeholders.

## Planning

Depending on the specific business case being addressed, enabling legislation may be necessary to administer a program using a blockchain system. The planning phase would likely include a policy / legislative review in addition to the normal IT project planning considerations. A receptive bureaucracy to run the program would be likely. In some jurisdictions, a new entity may need to be formed.

## Prototype

A prototype of the system will be built by the PPP and tested using dummy transactions to simulate actual user experiences and to evaluate capacity and availability management of the system. By developing a prototype, we may look towards modularity and reuse. Once engineered and parameterized, the users of a GBA framework would be able to extend. This system would be among the first instances of a larger frame. Note: we are careful not to ignore other open source frameworks (i.e. HyperLedger). However, we are domain specific—pertaining primarily to the domain of government.

## Design

The following attributes will be considered for the prototype design.

* **Scalable** - Solutions allowing for both private and public blockchains will need to be factored into the technical considerations. Various government agencies may have different requirements and will need to be part of the planning for scalability.
* **Interoperability** - The system will be designed to be an open blockchain platform that allows any state or government entity to interact with it using a customizable interface that will be built by the GBA-PPP members.
* The system will address budgeting, appropriations, auditing, tracking, and reporting requirements including revenue and expenditures. The system will address encumbrances and interfaces between financial institutions and intragovernmental transactions.
* **Intragovernmental Payment** - Based on a performance within a smart contract, monies may be released from the Federal to the State, or the State to the local jurisdiction. Currently, teams of administrative staff facilitate these releases of funds. And some state agency functions are simply “pass throughs” from the Federal to a local jurisdiction. The monitoring, and the contingencies for requests, can be daunting
* **Shared Common Ledger** - The chief executive of an entity (i.e. Governor, Mayor) seeks budgetary control. They may have central administrative staff (i.e. budget analysts) to monitor budgets. Yet, the transactions and contingencies may originate from remote and dispersed locations. The receipt of a faulty shipment, or an emergency acquisition, may alter the status of a budget. These incidents could be signaled promptly to departmental, as well as central administrative staff.
* **Transparency** - Jurisdictions may choose to portray the status of their budgets on a website or similar reporting. With provisioned permission, certain data elements may be revealed. The ability to audit transactions would be facilitated. Not all data of the agency would be on a blockchain. However, some data elements may be revealed to indicate overall governance. For example, in the Lottery case, the accumulation of funds --Prize, Administrative, Taxed, and Earmarked fees (PATEF)--could be revealed. The need for mid-course corrections (i.e. public policy) may also result.
* **Compliance** - Security in the government domain is of utmost importance. If a node (i.e. hardware) falls out of compliance, the host system would be signaled. And, if a new rule were to be implemented, it may be standardized within the blockchain. As with transparency (above), auditors may be provisioned to access node-based data.
* **Sensors** - Internet of Things (IoT) sensors may be invoked in hardware. Based on their outputs, fiscal activities may be triggered within smart contracts (via Chaincode). The private sector is quickly realizing the value of hardware-based sensors. One or more events may initiate based on changing conditions. A series of sensors may be prudent in administering the program. These early efforts may bridge engineering and information technology (non-hardware) staff.
* **Fund Mapping** - The articulation of fund mapping (i.e. tracking the source of funds) is prudent. Budget staff like stable sources of revenue. Via smart contracts, the rules would need to be carefully articulated. Chaincode, as in any automated system, would need to be tested/validated. However, the resulting modules could be encapsulated and reused. These blockchain capabilities exist, but it would be up to both the fiscal and technical teams to reach consensus on processes and subsequent agreements.
* **Incentives** - The incentives of the key players are somewhat conflicting. And this maybe smoothed with the use of smart contracts. For instance, in a Lottery, the gambler wants to win, whereas the revenue seeking entity needs to judiciously administer the program. Herein, the prudent use of Blockchain Smart contracts (via Chaincode) would be tested. The integrity of such code would be of the utmost importance.
* **Interfaces** – A series of interfaces between existing Revenue collection entities would likely be necessary. As with most government entities, the accuracy and projection of revenues is of the utmost importance.
* **Immutability** - Little could be more important than a prudent administration of a government financial system. The use of Smart contracts, as well as other Blockchain capabilities, far exceed any specific currency (i.e. Bitcoin or AltCoin). The use of an entity’s public or private blockchain needs to be debated. However, the requirements of Utility versus Security tokens may also need to be expressed. Overall, the prototype may facilitate other Blockchain applications.

## Deploy Government Financial Management Blockchain (Infrastructure)

Each member of the PPP will operate one or more nodes on the blockchain. As more government entities become part of the network, the capacity, security and reliability of the network will improve.

## Pilot Implementations

The system will be rolled out sequentially at first to identify and resolve any issues and bugs. Once the system has demonstrated stability, capacity and integrity, it will be made available as a public platform.

## National Conference

The PPP will host a global conference to roll out the system. All new members of the eco system will pay to initially participate in the system. Those funds will go into a pool to incentives developers through the payment of bounties to continue to improve the open source standards and core software.

## Commercialization

PPP private companies will be able to earn profits from the customization of the core software to meet the specific needs of states and other government entities that wish to implement the blockchain system.

# Program Administration

The Government Blockchain Association will administer the program until it becomes self-sustaining in much the same way that the Bitcoin network is self-sustaining. There is no single company or entity that manages the bitcoin network and to date, it has never had one nanosecond of down-time or outage.

**Appendix A: Acknowledgements**

Special thanks to the following GBA members for their contribution towards this whitepaper.

[David Anderson](https://www.gbaglobal.org/members/prestructure/profile/)

[Gerard Dache](http://www.GBAglobal.org/members/gdache/profile)

[Mark Wasser](https://www.gbaglobal.org/members/mark-wasergmail-com/profile/)

[Paul Chalekian](https://www.gbaglobal.org/members/schurinfo/)

[Robert Perry](https://www.gbaglobal.org/members/robert-perry/profile/)

[Steven Olson](https://www.gbaglobal.org/members/solson/profile/)

1. www.usgovernmentrevenue.com/current\_revenue [↑](#footnote-ref-1)
2. https://en.wikipedia.org/wiki/History\_of\_bitcoin [↑](#footnote-ref-2)
3. www.pogo.org/analysis/2018/09/pentagons-contract-managers-have-room-for-improvement [↑](#footnote-ref-3)
4. [www.cio.com.au/article/640935/budget-2018-dta-explore-blockchain-government-payments](http://www.cio.com.au/article/640935/budget-2018-dta-explore-blockchain-government-payments) [↑](#footnote-ref-4)