Blockchain is impacting virtually every industry:

- **Digitizing warranties** for management and transferability
- Preventing trade of **stolen goods**
- Distributing and trading in **digital assets**
- Cryptocurrency **integration to existing gas stations**
- Enabling **oil commodities investment** trading in carbon emissions
- Seamless **cross currency settlement**
- Replacing legacy FSI networks with **blockchain infrastructure**
- Direct **peer-to-peer payments**
- Preventing **medical data forgery**
- Tracing and preventing counterfeit **pharmaceuticals**
- Creating an exact representation of a person’s **genetic map on blockchain**
- Managing very large volume arrays of devices such as **manufacturing sensors**
- Full supply chain transparency enabling **secure traceability for materials**

- Verification of **videos and photos authenticity**
- Decentralized sharing of goods and services as part of the **shared economy**
- Transforming mobile phones to **portable blockchain wallets**

- Setting **industry standards** for migrating real estate management onto blockchain
- **Transferring existing land deeds**
- Migrating the entire land registry of Honduras onto blockchain

- Managing **registered IDs**
- Voting platforms
- Blockchain based **public records keeping**

**Consumer business**

**Energy & resources**

**Financial services**

**Life sciences & healthcare**

**Media**

**Real estate**

**Public sector**

**Manufacturing**
Blockchain provides an opportunity for realizing both agency-specific and whole-of-government benefits that can foster more efficient and effective mission delivery.

**A government perspective on blockchain**

**Government as the Regulator**
- Define new blockchain regulation
- Be able to apply current blockchain regulation to the market

**Government as the Regulated**
- Need to accept and abide by the participating permissioned (consortium) blockchain’s regulation

**Government as the Participant**
- Become a peer within the participating permissioned (consortium) blockchain

**Actively explore blockchain’s potential**
- Evaluate use cases and understand where the value can be derived

Blockchain is currently on the agenda of hundreds of companies

**IS BLOCKCHAIN ON YOUR AGENDA?**

The EEA provides resources for businesses to learn about Ethereum and leverage this groundbreaking technology to address specific industry use cases

**400+** Member Companies

Hyperledger incubates nine business blockchain and distributed ledger technologies

**200+** Member Companies

MANY STATES ARE LOOKING TOWARDS BLOCKCHAIN

Arizona passed a bill that explicitly defines and supports blockchain technology for public use, while declaring that all data tied to a blockchain is an electronic record, which is acceptable for use by the state.

North Dakota called for a specific study to consider “the feasibility and desirability of regulating virtual currency, such as bitcoin.”

Maine instigated a 90-day field study to learn the effects of, “Using Blockchain Technology in Conjunction with Paper Ballots in Maine Elections.” Results from the study were presented to the Senate in December.

Delaware launched a blockchain initiative, which encourages the state and businesses within the state to explore and utilize blockchain technology. In particular, Delaware made it possible for companies to put their shareholders on a blockchain. Several retailers (such as Overstock) are utilizing the technology to do this.

California forbids organizations to sell raffle tickets for cryptocurrency, the first time a State has outlawed a cryptocurrency from being used in a specific way.

Nevada passed a bill that recognizes and authorizes “the use of blockchain technology” and smart contracts by Nevada residents, allowing residents to explore and utilize the technology.

Illinois also launched a blockchain initiative, which will be used to determine if blockchain can be leveraged to create more efficient, integrated and trusted state services.

The Illinois Blockchain Initiative also published a Request for Information (RFI) to invite participants to submit non-price information about Blockchain and distributed ledger technology.
Problem / Opportunity Statement

For Affordable Housing Owners/Operators, it is expensive and time-consuming to comply with multiple subsidy program requirements, which often come with duplicative requirements for each subsidy program. However, subsidy layering is often needed to build and support affordable units. In the current state, the Owners/Operators must communicate information and submit to inspections / oversight for each program, draining resources that could be better used supporting affordable housing units. Additionally, State and Federal entities do not have access to the same information regarding the Owners/Operators or the Properties, which hampers coordinating efforts, reduces the ability to evaluate program effectiveness, and increases administrative costs.

Current State Process

**State Housing Finance Agency (HFAs)**
- Allocate low-income housing tax credits (LIHTC) to Developers to subsidize affordable housing development
- May also facilitate bond financing
- Levy reporting and inspection requirements on developers/owners that may be duplicative of Federal Requirements
- May lack data necessary to optimally plan for preservation of affordable units

**U.S. Department of Agriculture (USDA)**
- Rural Development 515 program provides subsidies for rural Multifamily affordable units
- Receives data from recipients for compliance purposes and requires inspections

**Affordable Housing Developers/Owners**
- Apply for and receive subsidies, potentially from numerous programs
- Required to comply with multiple sets of overlapping requirements and inspections, draining resources

**Housing and Urban Development (HUD)**
- HUD runs multiple subsidy/insurance programs, including HOME and FHA Multifamily mortgages
- Receives data from recipients for compliance purposes and requires inspections
AFFORDABLE HOUSING SUBSIDY USE CASE

Potential future-state blockchain solution

Stakeholders

Affordable Housing Developers/Owners
- Commit property level information to blockchain, providing transparency regarding all subsidy and property information

U.S. Department of Agriculture (USDA)
- Add Rural Development 515 program subsidy information
- Receive visibility on property information, inspection information and multiple subsidies as applicable

State Housing Finance Agency (HFAs)
- Add LIHTC and Bond subsidy information to blockchain for property
- Gain visibility on property information, inspection information and multiple subsidies as applicable

Housing and Urban Development (HUD)
- Add subsidy/insurance program data by property including HOME and FHA Multifamily mortgages
- Gain visibility on property information, inspection information and multiple subsidies as applicable

Blockchain Business Impact

A. Transparent and Open Government – An authoritative source of affordable housing data can allow for more transparency regarding which properties are subsidized by the government and how.

B. Support Preservation of Affordable Housing – Creating an authoritative data source by property can help all the players collaborate to better preserve affordable housing. For example, there would be an enhanced ability to plan for when subsidies end and how the program performed.

C. Increased Federal/State Operational Efficiency – A blockchain solution could eliminate the need for property owners or program sponsors to access or provide information via manual forms or system interfaces.

D. Alignment of program oversight requirements (e.g., physical property inspections, capital needs assessments) – Results of program oversight checks such as property inspections could be shared with all parties with a material interest via the blockchain, significantly reducing thousands of redundant inspections.

E. Increased property compliance management efficiency – A blockchain could reduce the burden on landlords and taxpayers to support multiple redundant program compliance requirements.

F. Create more precisely targeted delivery of affordable housing by having a better idea of where the affordable units are, how long they may remain affordable, versus where new units are needed (i.e., create/use geocoding in blockchain to better analyze data).

G. Create a common data definition standard for subsidized housing via the blockchain - There’s intrinsic value in creating a standard that can be used to share and exchange data. Creating a common language that is not program unique would allow all stakeholders to have a common understanding of the current property and status of subsidy.
The below boxes list the potential benefits for the main involved parties.

<table>
<thead>
<tr>
<th>Affordable Housing Investors</th>
<th>States HFAs</th>
<th>IRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boost investor confidence in the low income housing tax credit (LIHTC) program. More transparency on subsidy information leads to better oversight, planning and allocation by States, and overall better management.</td>
<td>Many HFAs have difficulty fully understanding and analyzing their portfolios due to imperfect information. Blockchain information would enhance their ability to understand property subsidies. Additionally, using a blockchain could help remove redundancy between duplicative program requirements from multiple program sponsors (e.g. physical property inspection requirements).</td>
<td>For LIHTC subsidies, the IRS may be able to use blockchain information for better program compliance information and to be able to better audit tax credit holders.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Taxpayers</th>
<th>USDA</th>
<th>Congress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Better transparency as to how money is being spent and on what properties.</td>
<td>Gain a better understanding of the state of subsidized properties.</td>
<td>Gain a better understanding of how the subsidy programs are operating in tandem to support affordable housing and whether or not it makes sense to continue to maintain each separately administered program based upon this data.</td>
</tr>
</tbody>
</table>
## Improved data integrity

**Current state**
Current cyber security tools and frameworks have limited capability to secure data flow outside the perimeter of organizations.

**Future state**
Blockchain can act as a single source of truth by storing an immutable fingerprint of the original data and maintaining an audit trail as data is shared across organizations *(example: GuardTime)*

## Reduce Distributed Denial of Service Attacks (DDoS)

**Current state**
DDoS attacks drown centralized systems with multiple requests, making rendering the network unavailable.

**Future state**
Blockchain technology can protect against DDoS attacks by allowing users to pool unused network capabilities in a decentralized manner to absorb DDoS attacks *(example: Gladius)*

## Secure edge devices

**Current state**
Shift to “smart” devices and connectivity opens new opportunities for hackers to exploit IoT devices.

**Future state**
Blockchain allows for secure peer-to-peer self-managed connectivity for a large network of IoT devices. Smart contracts can be set up between devices to enable automated transactions *(example: Xage Security)*

## Secure private messaging

**Current state**
User metadata in private messaging is easily susceptible to security breaches.

**Future state**
Blockchain can secure private information exchanged in chats by randomly distributing metadata throughout the ledger thus preventing information from being gathered from a single point *(example: Obsidian)*

## Online identity verification

**Current state**
There is a lack of convenience and security involved in sharing personal data with third parties performing identity and authentication services.

**Future state**
Blockchain can act as a shared repository of identity information and provide controlled access to other service providers, such as e-commerce websites *(example: SecureKey)*

## Boost public key infrastructure

**Current state**
Increasing man-in-the-middle attacks through hacker developments of fake certifications.

**Future state**
Implementations of blockchain-based PKI to give devices specific SSL certificates to prevent intruders from faking credentials *(example: REMME)*
<table>
<thead>
<tr>
<th>Use Case</th>
<th>Current State</th>
<th>Future State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enforce regulations effectively</td>
<td>Slow enforcement process as new regulations cross multiple departments and national borders</td>
<td>Disputes resolved faster with fully transparent audit trail as all regulations will be approved through consensus <em>(example: Estonia’s legislative branch)</em></td>
</tr>
<tr>
<td>Promote data integrity and record keeping</td>
<td>Data tampering prevalent due to data control and authority issues</td>
<td>Append-only characteristic reduces the threat of transactions or document tampering along the audit trail <em>(example: record keeping)</em></td>
</tr>
<tr>
<td>Improve supply chain management</td>
<td>Difficulty in effectively distributing product information on a near real time basis</td>
<td>End-to-end traceability, shared distribution, and consensus allows related parties access to all necessary information during sensitive good manufacturing and delivery <em>(example: diamond provenance)</em></td>
</tr>
<tr>
<td>Advance know your client procedures</td>
<td>KYC procedures are repetitive in nature as multiple agencies carry out identical KYC checks</td>
<td>A blockchain based registry shared across all government agencies creates a citizen’s digital identity ending the duplication of KYC checks. <em>(example: joint KYC utility development in Singapore)</em></td>
</tr>
<tr>
<td>Benefit welfare distribution system</td>
<td>Unbanked welfare claimants face barriers to enter the benefit system such as credit checks</td>
<td>Establishment of citizen digital identity through a securely encoded device allows welfare claimants to receive benefits at reduced transaction costs to authorities <em>(example: UK Department of Work and Pensions)</em></td>
</tr>
<tr>
<td>Improve land registry process</td>
<td>Vulnerable to human error and forgery as current land registry processes are highly manual and susceptible to manipulation</td>
<td>Higher confidence in land title ownership as properties can be uniquely coded and linked to individual smart keys only held by the owner <em>(example: UK HM land registry department)</em></td>
</tr>
</tbody>
</table>
BLOCKCHAIN SPECIFIC RISK CONSIDERATIONS

**Blockchain design & consensus protocol**
Risks introduced if appropriate controls are not considered during design phase of blockchain solutions, such as choice of consensus protocol

**Cyber security/privacy & confidentiality**
Risks range from lack of confidentiality of data and increased number of entry points due to inherent characteristics of blockchain to vulnerabilities in the application code to compromised oracles feeding data

**Blockchain network legal considerations**
The risks associated with the failure to meet legal obligations from legislative or contractual perspectives, or resolving disputes between nodes/members on the blockchain

**Blockchain network regulatory compliance**
Risks, such as uncertainty around evolving regulations for blockchain-based models, non-compliance to current regulations, such as anti-money laundering, and ambiguity around enforcement of smart contracts

**Blockchain network governance**
Risks introduced by distributed governance maintained by a system of nodes instead of traditional models using third parties; risks of 51% attack on the network

**Smart contract definition & execution**
Risks associated with mapping of complex real life contracts and agreements using smart contracts

**Cyber security/privacy & confidentiality**
Risks range from lack of confidentiality of data and increased number of entry points due to inherent characteristics of blockchain to vulnerabilities in the application code to compromised oracles feeding data
## PRIVACY ISSUES AND CONCERNS RELATED TO BLOCKCHAIN

<table>
<thead>
<tr>
<th>Privacy Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect incoming data</td>
<td>Lack of control over the authenticity and accuracy of the incoming data may lead to unintended outcomes</td>
</tr>
<tr>
<td>Right to be forgotten</td>
<td>Disability to comply with right to forget regulations given blockchain’s immutable nature</td>
</tr>
<tr>
<td>Application code vulnerability</td>
<td>Vulnerability due to error in the application code, especially in complex components such as smart contracts</td>
</tr>
<tr>
<td>Key theft</td>
<td>Every address on a blockchain is mapped to a private key. Mismanagement of private keys across their lifecycle can result compromise of the accounts</td>
</tr>
<tr>
<td>End point security risk</td>
<td>Lack of adherence to security standards in end points across members of the blockchain network may introduce security threats.</td>
</tr>
<tr>
<td>Denial-of-service attacks</td>
<td>An attack when too many transactions are sent to flood the bandwidth of the service to disrupt its availability</td>
</tr>
<tr>
<td>Cookies stealing information</td>
<td>External websites storing cookies could potentially reveal information about the customer’s usage of application</td>
</tr>
<tr>
<td>Data breach</td>
<td>Single points of failure for the entire system in the form of third parties processing data may be a major component in a blockchain solution</td>
</tr>
<tr>
<td>Corrupt oracle</td>
<td>Smart contracts consume data from sources outside the blockchain. Hence, a compromised oracle can compromise the entire program</td>
</tr>
<tr>
<td>Sybil attack</td>
<td>An attacker can take control of the miner network with the creation of many mostly pseudo-anonymous (forged) nodes, compromising both the availability and the integrity of the system</td>
</tr>
</tbody>
</table>
The onboarding process for many positions, especially for high volume, high turnover positions, can be repetitive and expensive depending on the task. Education and work history verification can be streamlined with blockchain. On top of this, onboarding records can be tracked and recorded, allowing employers to see the progress of new hires, and watch their skill set grow.

Studies show that multiple employers have caught a lie on a resume, and that screening has uncovered lies or misrepresentations on a resume for employers. Blockchain can increase transparency and address fraud in employee credentials. More entrepreneurs are working with blockchain to offer a future fraud proof solution regarding employee certifications.

Sending out payroll data electronically overseas is expensive for businesses and can take a long time to process due to multiple intermediary banks and third parties. Using blockchain and cryptocurrency, international payments can be made simple. If a cryptocurrency (such as bitcoin) is used as a payments rail; employees ultimately get paid out in their local currency significantly faster.

Human Resources (HR) constantly need to validate documents such as qualifications, but also verify other documentation such as address changes, tax file data, medical documentation, etc. Blockchain can keep track of these records and any edits to them on a blockchain through smart contracts and transactions. Each block will then be a validated record.

Blockchain can **help** enhance and grow the workforce if utilized in the below ways:

**Hiring and Training**

The onboarding process for many positions, especially for high volume, high turnover positions, can be repetitive and expensive depending on the task.

**Payroll**

Sending out payroll data electronically overseas is expensive for businesses and can take a long time to process due to multiple intermediary banks and third parties.

**Certification**

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**Document Validation**

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DELOITTE BLOCKCHAIN OFFERING

1. **Innovation and Ideation**
   - We identify relevant use cases to harvest the benefits of blockchain technologies.
   - Our thought leadership, developed in conjunction with our ecosystem of innovation and blockchain companies, enables you to make sense of the broad innovation landscape.
   - We track over 200 blockchain companies.

2. **Strategy Development**
   - We help you to define the “where to play and how to win.”
   - We drive business, technology, integration, and talent strategy.
   - We develop strategies to pilot and implement blockchain based solutions.
   - We define an iterative and flexible approach to match the rapid changes in the ecosystem.

3. **Prototyping**
   - We accelerate prototyping by using our existing technology capabilities and industry experience.
   - We have several prototypes up and running: Digital Bank, Loyalty, KYC, Trade Finance, Smart Identity, etc.
   - We have 30+ prototypes in our library of proofs of concept.

4. **Product Development**
   - We mobilize our global practitioners to your organization to re-engineer business processes or design new ones.
   - We bring our broad set of services, across compliance, technology, talent, operations and tax, to effectively integrate your blockchain solution.
   - We deliver as one team in collaboration with external companies.

**Key Figures**

- **23** Industries where we have deep business process knowledge.
- **30+** Prototypes developed globally on various platforms.
- **>800** Practitioners in our blockchain community from 40 countries.

**A diverse ecosystem of technology and innovation companies.**
Think big... really **BIG**

Start small... very small

Work on the edges first

Iterate *often*