EY’s public finance management chain
A foundational blockchain solution for government and the public sector

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Dr. Mark MacDonald | Partner & Global PFM Leader
Why blockchain?
The significant promise of blockchain for government

If you know how money is spent, imagine how far it could go?
How do I know if blockchain will help with my challenge?

<table>
<thead>
<tr>
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<th>Question</th>
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<tbody>
<tr>
<td>1</td>
<td>Are you trying to get multiple parties to work together?</td>
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<tr>
<td>2</td>
<td>Do you have trust issues between the parties?</td>
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<td>3</td>
<td>Is it important to get a tamper proof record of transactions between the parties?</td>
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<td>4</td>
<td>Are we moving something of finite value* around?</td>
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<tr>
<td>5</td>
<td>Does the group benefit from increased transparency &amp; lower cost of information exchange?</td>
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* Could be currency, assets, data.
The significant promise of blockchain for government

Blockchain is best suited to situations where we have to deal with interfaces in the exchange of resources and information across organizational boundaries

1. In situations where the exchange of information is important for the discharge of individual and collective responsibility across interfaces between two or more entities
2. When the interface boundaries bridge different financial and operational systems under different control
3. When attaching non-financial objectives and conditions to revenue/expenditure/fixed assets would enhance results
4. To enable integrated reporting to the n\textsuperscript{th} level of use in any supply chain or user/delivery chain
5. To eliminate or greatly reduce audit-based compliance frameworks
6. Secure benefits without having to make costly, risky, major IM/IT system replacements or upgrades

*Blockchain won’t magically fix a broken business issue, but if your desire is to fix the broken business issue, blockchain can help enable a solution like no other technology that has come before it*
A wide range of applications covering all major approaches to public management & administration

Blockchain is applicable to most if not all of the internal and external relationships of government and the public sector

**Government to individuals**
- Identity management, benefits delivery, regulation, taxation, fees, voting

**Government to business/NGO**
- Procurement and supply chain; public-private partnerships, grants and contributions, transfer payments, regulation, taxation, fees

**Government to Government**
- Intergovernmental transfers, regulation, indirect taxation (payments in lieu), fees

**Public Finance Management**
- Core foundations of public budgeting and financial accountability underpinning all government action
Better PFM, better services, better government
Foundations of better government

Enhancing public finance management (PFM) is focused on three foundational issues that very few jurisdictions have been able to address fully, presenting an opportunity for innovation and the delivery of better government and public sector outcomes.

1. Transparent, accurate, continual information for financial reporting and accountability along the entire PFM chain: central budget authority, program authority, delivery agent

2. Administrative efficiency and capacity in core financial management business processes such as budgeting, expenditure management and performance management, without significant FMIS investment and risk

3. A single source of integrated financial and nonfinancial performance information provided continually to support managerial and strategic decision-making and help promote allocative efficiency and effectiveness for public outcomes
Significant opportunity for applying blockchain technology

Provide a single source of truth along the blockchain to support timely decision-making, based on integrated financial and nonfinancial data, leading to better outcomes for citizens and government.

Flexibility to pull the right data at the right time allows program authorities to manage programs more effectively and budget authorities to prioritize, course-correct and calibrate overall fiscal strategies in near to real-time.

All users secure significant benefits:

- Simplified and integrated business processes at lower cost
- Enhanced visibility into data
- Improved analytical ability
- Minimal human errors
- Near-real-time auditable process
- More transparency
- Multi-stream reporting (e.g., public and management accounts)

High degree of confidentiality and security through use of sophisticated cryptographic protocols inherent to the power of blockchain methods.

Opportunity to code more controls in place through use of “smart contracts” at any point along the chain, including for external delivery agents and suppliers, and in situations of statutory payment obligations (e.g., individual benefit programs, demand-driven).

Define user accessibility to confirm the right level of visibility into decision-making data is provided, respecting formal authority and accountability.
EY’s PFM chain: use case
EY’s PFM chain supports effective decision-making, reduces costs, and improves transparency and accountability ...

The best path forward is one that can:
► Sustain an effective, efficient, secure, and cost-effective solution without the need for costly transformation of core FMIS
► Provide transparency via a single source of truth across the entire chain for real-time decision-making and effective allocation and prioritization of public resources
► Find a mechanism to synchronize and align disparate systems and business processes in driving transparency and accountability

Suboptimal decision-making
► Currently, there is lack of timely and accurate reporting of outputs and outcomes for effective decision-making
► Aggregated view of outcomes, clients, programs not available to prioritize
► Measure what you can, not what you should

Costly information exchange
► Significant overhead in reconciling and exchanging transactional and reporting information
► Disconnect between public reporting of program performance and management of program performance

Lack of transparency
► Incomplete view of financial and nonfinancial information, of funds allocated against program outputs/outcomes
► Inability to jointly view and reconcile appropriation and management frameworks in near to real-time

Outputs
► Output KPIs
► Management accounts
► Organization
► People
► Technology
► Business processes
► Inputs, outputs, results

Derived outcomes
► Citizen satisfaction
► Government and economy performance
► Government accountability
... creating a single source of truth to support more effective day-to-day decisions and lead to better citizen results

Effective decision-making
- Timely and accurate availability of reporting measures for allocative and administrative decision-making
- Ability to integrate strategic budget-level program performance objectives with consumption-level management objectives

Efficient and near-real-time exchange of information
- Transactional and reporting data is synchronized across participants through the blockchain layer
- Reduces direct administrative costs and re-allocation to high-value-add activities

Integrated view of performance along the chain
- Decision-making authority has aggregated view of funds allocated to outputs and outcomes across programs, departments and ministries in a single place and in near real-time

Derived outcomes
- Citizen satisfaction
- Government and economy performance
- Government accountability

Reconciliation and consolidation at various interface nodes (e.g., between program authorities and delivery agents)
Integration of financial and non-financial reporting information
Improved internal controls including potential use of “smart contracts”
Opportunity to improve PFM architecture and performance without expensive and risky FMIS transformation
Stylized use case to demonstrate allocation, reconciliation and consolidation using blockchain in a transfer payment model

1. Executive government authority approves appropriation structure and Ministry of Education allocates funds to ABC youth services program (controlled by a program office). Data is recorded on internal ERP systems.

2. Treasury Board allocates funds by creating a vote. Ownership of vote is transferred to Ministry and recorded on blockchain. Vote information is pulled from ERP.

3. Ministry of Education splits vote amount and transfers ownership to delivery agents (e.g., school boards, community hubs).

4. Delivery agents internally allocate funds using their current management accounts.

5. School boards and community hubs record spending (on operations and capital) and report outputs (KPIs) that are captured in the smart contract and assigned to the current vote.

Outputs are measured on an ongoing basis. These KPIs are used to inform management and strategic decisions to improve outcomes over time.

Spending and output KPIs are now mapped to the allocated funds. Treasury board and Ministry have full view of flow of funds, spending and outputs achieved for the funds.

Additional analytics helps decision-making by showing high-performing delivery agents, laggards, program effectiveness etc. and calibrate fund allocation.
EY’s PFM chain: technical architecture
Blockchain provides an efficient and effective approach to dealing with the interface between CBA, program managers and delivery agents.

The PFM solution helps Government entities answer three key questions reliably:

► What is money spent on?
► How is money being spent?
► What outputs are delivered and outcomes achieved?
Scope of current EY proof-of-concept investment focuses on utilizing a private blockchain to produce a new information service layer for various decision-makers.

- **Executive Government (Fund administrator)**
- **Ministry/department (Program administrator)**
- **Delivery agent (Program delivery agent)**

**Azure Key Vault** ↔ **Azure AD** ↔ **PFM REST API Gateway**

**Service layer (Azure web app)**
- Allocation, disbursement and target KPI definition
- Active directory integration
- Near real time reconciliation
- Document management
- KPI reporting
- Dashboard analytics
- Reprioritize allocation and disbursement
- Advanced analytics
- Key management
- Identity management

**Enterprise data integration**
- ERP connectors
- Proxy ERP connectors
- CBA ERP
- Ministry ERP
- Delivery agent

**Off-chain storage**
- Mongo DB
- Swarm

**Ethereum consortium on Azure**
- Smart contracts (Vote, Asset, Location, Authorization)
- Proof of authority consensus

**Legend:** Future enhancement
The proof-of-concept consists of various one-to-one, one-to-many and many-to-one resource relationships.
Questions about the future
The significant promise of blockchain for government

The world will move exceptionally quickly from concept, through proofs, to pilots, to full industrialization of blockchain; some interesting questions remain to be explored

1. How will Supreme Audit Institutions respond to a blockchain world?

2. What will global accounting standards bodies think about the power of blockchain?

3. Will governments embrace a move from private to public chains?

4. How far and how quickly will we introduce digitization of fiat currency into the equation?

5. What is the role of government as we shift from notarization to tokenization on the blockchain?

6. How disruptive will blockchain be as solutions move away from parallel audit-based systems, to ones integrated with laws and regulations?
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