

# Blockchain Innovation Journey

Transforming the Canadian  
housing finance ecosystem  
with emerging technology





# Executive Summary

Canada Mortgage and Housing Corporation (CMHC) is paving the way for a housing finance ecosystem transformation that will unlock value for people living in Canada, financial institutions and other industry participants. We have embarked on a journey to radically improve the end-to-end housing finance experience and create a more stable, efficient market. The housing finance industry is invited to join CMHC on this exciting journey by collaborating to build a blockchain platform that can streamline the end-to-end housing, mortgage, and securitization process.

It is widely known that Canada is experiencing a housing affordability crisis. CMHC has set an audacious strategic goal – by 2030 everyone in Canada will have a home that they can afford and that meets their needs. In order to achieve this goal, we must think big, push the boundaries and embrace innovation through the exploration and investment in new technologies to accelerate our effectiveness.

CMHC imagined a world where the housing, mortgage and securitization processes are streamlined, where there is a single source of truth for all property and finance data, and where there is full traceability of funds throughout the process. Blockchain technology was identified as a key enabler to achieve this. In partnership with Accenture, we began on our innovation journey to explore its value and potential.

As a starting point, we examined the many complexities and inefficiencies that exist across the end-to-end value chain. These stem from an ecosystem that has no trusted source of shared data, with multiple parties using disparate data sources and systems that require complicated integrations and reconciliation processes. Within this value chain, the Mortgage Securitization process was chosen as an initial use case of focus due to CMHC's management of the *National Housing Act – Mortgage Backed Securities Program* (NHA MBS program) and the significant impact for stakeholders across the housing finance ecosystem.

The NHA MBS use case illustrates concrete examples of the key problems that were identified across the entire process, with many stakeholders collecting and verifying the same information and heavy reconciliation requirements. This use case in particular has a lot to gain from a technology that enables increased speed and efficiency and increased transparency through a distributed and holistic view of data and transactions. This use case would also allow for the extension of such technology beyond the securitization process to upstream and downstream use cases where impact and value can be maximized for all ecosystem players.

A proof-of-concept (POC) was developed to prove the value and viability of leveraging this emerging technology for five distinct steps in the creation of an NHA MBS Pool by financial institutions, mortgage insurers and CMHC. The POC was successful in demonstrating the unique value of blockchain, sparking ecosystem collaboration, and developing related knowledge and assets. One of the key learnings from the POC was the importance of building partnerships with strong governance for collaboration across the ecosystem. "If 'a financial system is only as strong as the governing practices and institutions of its participants,' transparent policies and rules, along with accountable and responsible governance are a prerequisite."<sup>1</sup>

In order to tackle the challenges within the housing finance ecosystem, organizations across this complex ecosystem must align behind shared economic incentives and robust governance structures. CMHC, the financial institutions, mortgage insurers, and many other participants have the opportunity to create a peer network through a Consortium, to implement a solution that will address the inefficiencies facing the ecosystem.

Participation in this consortium would yield significant annual cost savings for each institution, with this first use case driving process efficiencies, improved liquidity and improved loan and security transparency. Expanding this use case to other elements of the value chain would enable new revenue streams and data opportunities, while reducing systematic risk and improving market stability.

The next step in this innovative journey will be to convene interested parties to join the Consortium, to help set the direction, define the governance structure and work towards launching a pilot product to the market.

In addition, while publishing this paper, Canada, along with the rest of the world, has been greatly impacted by the COVID-19 pandemic. The pandemic and related containment measures have deeply affected Canadians and the Canadian economy. As you will observe, the focus of this paper is on the value of a Blockchain Technology Platform in helping Canada to address a housing affordability crisis in the country. However, the pandemic has further highlighted the urgency to address inefficiencies in the housing market as it introduces unprecedented uncertainty to economic and housing outlooks. The pandemic-induced crisis should be a call to action to radically improve the end-to-end housing experience and create a more stable and efficient market.

<sup>1</sup> Accenture and DTCC, Governing DLT Networks  
[http://perspectives.dtcc.com/articles/governing-dlt-networks?utm\\_source=website&utm\\_medium=press\\_release&utm\\_campaign=dlt\\_governance\\_august\\_2019](http://perspectives.dtcc.com/articles/governing-dlt-networks?utm_source=website&utm_medium=press_release&utm_campaign=dlt_governance_august_2019)

## VISION 2030:

# A Home for Everyone Living in Canada

It is widely known that Canada is experiencing a housing affordability crisis. CMHC has stated its commitment to an audacious goal – **by 2030, everyone in Canada has a home that they can afford and that meets their needs.**<sup>2</sup> Currently, 13% of households in Canada are in core housing need, meaning their core housing falls below at least one of the adequacy, affordability or suitability standards, and it would have to spend 30% or more of its total before-tax income to pay the median rent of alternative local housing that is acceptable to meet all three housing standards<sup>3,4</sup>. Solving the housing affordability crisis is “key to building a stronger Canada, where the economy thrives and everyone has the dignity of a home where they can work, study, raise their family and participate fully in society”<sup>5</sup>.

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<sup>2</sup> CMHC, 2019-2023 Summary of the Corporate Plan

<sup>3</sup> “A household is said to be in core housing need if its housing falls below at least one of the adequacy, affordability or suitability, standards and it would have to spend 30% or more of its total before-tax income to pay the median rent of alternative local housing that is acceptable (meets all three housing standards)” <https://www.cmhc-schl.gc.ca/en/housing-observer-online/2018-housing-observer/13-point-6-percent-urban-households-were-core-housing-need-2016>

<sup>4</sup> CMHC, Core Housing Need by the Numbers

<sup>5</sup> Jean-Yves Duclos, Former Minister of Families, Children, and Social Development

## OUR ASPIRATION

By 2030, everyone in Canada has a home that they can afford and that meets their needs

### OUR PEOPLE

### OUR FOCUS

Understand needs of Canadians who are vulnerable

Experiment with new ideas

Publicize housing data and insights



### OUTCOMES



People who are **vulnerable** have reliable access to **secure** and **affordable housing**



Canada has the **number** of homes and **mix** of housing options to serve our diverse needs



Canada's **housing system** supports **sustainability** and house price **stability**

## CMHC's Role

As the national housing authority, CMHC's mandate is to make housing affordable and support a stable housing finance ecosystem for a stronger, safer Canada. Specifically, CMHC participates in housing finance to administer mortgage loan insurance, the *National Housing Act Mortgage Backed Securities* (NHA MBS) program, and the Canada Mortgage Bond (CMB) program. This role and vested interest allow CMHC to lead systemic change in the housing finance industry.

## Reimagining the Housing Finance Ecosystem

Currently, homeowners are overstretched, there is a slow pace of regulatory change, and there are inefficiencies and a lack of trust in the housing finance system. CMHC began to imagine a world where everyone has control over his or her digital identity and data. Transforming the home buying

process through building a trusted single source of truth for borrower, properties, mortgages and financial information across the housing ecosystem. This would further facilitate traceability of funding for projects targeting affordability and enhancing the transparency, stability and efficiency of the securities market.

Blockchain, an emerging technology that is pioneering transparent and secure business processes, was identified as a solution that could move both CMHC and the housing finance ecosystem towards these goals.

CMHC set a north star for their innovation journey, to transform the housing finance ecosystem to unlock value for people living in Canada, financial institutions, CMHC, and other participants by building a blockchain platform that streamlines the end-to-end housing, mortgage, and securitization processes from mortgaged origination to services.

## A blockchain enabled ecosystem



Trusted source  
for all property  
information  
in Canada



Digital identity  
for everyone  
in Canada



Single source of truth  
for mortgages &  
Insurance across  
the ecosystem



Traceability  
of funding for  
affordable  
housing



More efficient,  
transparent, & stable  
securities market

## Mortgage Origination

- Digital twin for properties
- Digital identity for borrowers
- Streamline origination

## Securitization

- Streamline mortgage securitization
- Security trading & settlement

## Servicing

- Reconciliation of incoming mortgage payments
- Disbursement of funds to investors

CMHC partnered with Accenture, leveraging the firm's expertise in emerging technology and blockchain specifically, to explore the potential opportunities for value creation, from mortgage origination through to securitization and servicing. Two financial institution partners were also engaged to bring forward an industry perspective, collaborating on the opportunities and potential value to the ecosystem identified.

Applicable use cases were defined across the process. These use cases included to establish a digital twin for properties, leverage a digital identity for borrowers, streamline mortgage origination streamline mortgage securitization, perform security trading and settlement, reconcile incoming mortgage payments, and disburse funds to investors.

The benefits of these use cases range from:



a trusted, single source of truth for important assets and corresponding transactions;



new product and service opportunities;



and reduced cost and time through process efficiencies.

Ultimately, these use cases have the potential to reduce systemic risk, reduce the cost and time to find and finance a home, increase liquidity in the securities market and investor appeal, and contribute towards greater market stability.

Big thinking is needed to challenge the status quo and solve for obstructive ecosystem challenges. CMHC believes that blockchain is the solution to many of these challenges but requires cross-industry support to transform the current housing finance ecosystem and achieve CMHC's audacious 2030 aspiration.



# Blockchain in the Housing Finance Ecosystem

When considering the current housing finance ecosystem, there are many complexities that exist, all of which exacerbate Canada's housing crisis. In order to identify key challenges to tackle, CMHC highlighted pain points for key stakeholders across the home buying, mortgage origination, securitization and asset servicing value chain. Through this analysis, five key problem areas emerged:

1. Many disparate data sources and systems;
2. Multiple third parties and intermediaries, each with their own systems of record;
3. Complicated integrations and unique reconciliation processes;
4. An ecosystem with no trusted source of shared data;
5. A requirement for extensive governance and regulation due to market complexity.

These challenges result in long, time consuming processes that often include manual reconciliation and validation processes, and duplicated efforts. Ultimately, this results in unnecessary costs to the housing finance ecosystem, and longer wait times for the end beneficiaries of these processes, such as homeowners waiting to receive a mortgage.

There are many inefficiencies and a lack of trust in the system, which can partly be attributed to the lack of transparency and the number of parties involved in any given transaction,

including various financial institutions, government organizations, regulatory bodies, home buyers, investors, and intermediaries. While these challenges exist throughout the entire value chain, from origination to servicing, mortgage securitization was chosen as an initial area to focus on for blockchain development.

In addition, another important area of focus for CMHC is the adoption of mortgage industry data standards. Much like blockchain, they present an opportunity to increase operational efficiencies, help facilitate mortgage securitization and enable increased analytics. Data standards are also important for the wide adoption of blockchain in the mortgage industry by ensuring interoperability in blockchain and eliminating the need to reconcile different partner firms' data structures. Therefore, data standards will greatly support increased blockchain throughout the mortgage lifecycle by reducing creation and adoption challenges.

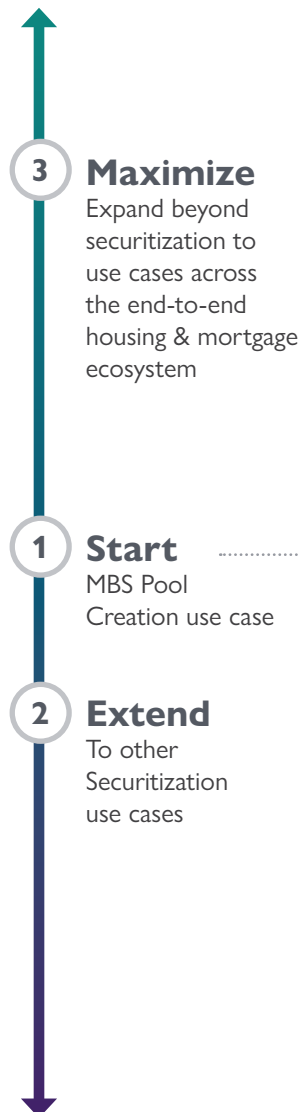
## The Mortgage Securitization Use Case

Within the mortgage securitization process, the NHA MBS Pool Creation use case was selected as a natural starting point to explore the value of reduced reconciliation, self-executing logic, direct peer-to-peer access, and improved security and privacy. This was due to CMHC's management of the NHA MBS program and strong relationships with

industry participants, the benefits that exist for stakeholders across the ecosystem, the potential for upstream and downstream extension, and the ability for the well-established set of ecosystem players involved to collaborate effectively.

Once the infrastructure is in place, it will enable the extension to other securitization use cases, and for the benefits to be maximized beyond securitization to the end-to-end housing finance ecosys

Many stakeholders participate in this process, collecting and verifying the same information to reconcile siloed systems, including the lender or issuer, CMHC, a document custodian, the Central Payor and Transfer Agent (CPTA), and the mortgage insurers. The various stakeholders have no ability to share consistent and up-to-date views of the loans or pools between each other. This complex process alongside lack of integration and data standardization, and subsequently lack of trust in the data, directly translates into slower and inefficient processes, and inhibits the ability to innovate and apply business driven changes at an agile pace. In short, this use case illustrates concrete examples of the key problems that were identified across the entire process.



**Rationale for starting with securitization**

**CMHC's ownership of the NHA MBS program and strong influence** over participants will help to drive stakeholder consensus to systematically transform the ecosystem

Streamlining securitization **benefits stakeholders across the housing and mortgage ecosystem**

Extensible to valuable **upstream and downstream use cases and objects** across Securitization and beyond

Involves a **broad, well-established set of ecosystem players** with experience collaborating together



# The Value of Blockchain

At its most basic level, blockchain is a new type of database system that maintains and records data in a way that allows multiple stakeholders to confidently and securely share access to the same data and information. Transactions or data are stored in a ledger that is distributed among interested parties that are participating in an established network of computers. A record of consensus is provided, using a cryptographic audit trail, which is maintained and validated by several individual users, called nodes, that independently check the data blocks. Only stakeholders that need to see the data will have access. And, if anyone tries to tamper with, duplicate or alter any part of the record, all stakeholders will know.

There are five key value tracers that indicate blockchain would be a valuable technology to use to improve an existing process:

1. *Reconciliation of data:* Within the current MBS pool creation process, there are many points of reconciliation between two or more parties regarding loan eligibility, insurance, and required forms.
2. *Collaboration between multiple parties:* There are five key parties involved in the MBS pool creation use case, beginning with lenders and issuers, and involving document custodians, mortgage insurers, and central payor and transfer agent (CPTA), with CMHC at the centre.

3. *Data or transaction validation maintained by multiple parties:* As there is no single source of truth for all stakeholders in the current process, validation of the MBS pools and required forms happens across multiple parties through out the process.
4. *Reliance on intermediaries:* The MBS pool creation process relies on document custodians as intermediaries, to hold documents and data relating to the pooled mortgages and issuers, and ensure all data is kept current in electronic form.
5. *A verified record or audit trail is needed:* Information updates and changes in the process, for example pool validation or changes to the loans, must be tracked and multiple parties made aware.

By enabling the mortgage securitization process with blockchain, value can be delivered across the ecosystem through process efficiencies, improved data quality and transparency to loans and securities, faster closing of NHA MBS Pools to improve liquidity, and encouragement of the extension of distributed ledger technology (DLT) applications to transform the housing finance ecosystem.

## Characteristics



### Distributed

Multiple partners share the same synchronized data across a network



### Consensus

Agreed upon level of access and ability to make changes to data for each member



### Provenance

Audit trail shows where the data came from and how its ownership has changed over time



### Tamper-Evident

Transactions cannot be changed once recorded through the consensus mechanism



### Smart Contracts

Ability to facilitate, verify, or enforce contract terms without thirds parties

## Benefits



### Holistic View

A universal view of information from a single source



### Transparency

Providence and greater transparency for regulatory reporting



### Simplified

Decreased operational costs and complexity



### Speed

Can enable faster data transfer times



### Security

Data is tamper evident; logged transactions cannot be altered



# The Proof of Concept

A proof of concept (POC) was developed to prove the value and viability of leveraging blockchain for the NHA MBS Pool Creation use case and for mortgage securitization more broadly.

The POC demonstrated how CMHC, Issuers (i.e. mortgage lenders), and Mortgage Insurers can participate on-ledger to validate loans and create an NHA MBS Pool. Key aspects of the NHA MBS pooling process were designed and tested to validate the use of blockchain technology:

## 1. Loan Creation and Validation

**Blockchain-enabled process:** The Issuer creates loan objects on-ledger and the Mortgage Insurer validates that the loans are insured, as this is required for a loan to be included in the security.

**Benefits:** Streamlined integration amongst parties with the ability to communicate and to share assets that take part in multiple business processes.

## 2. Creation of NHA MBS Pool Request

**Blockchain-enabled process:** The Issuer submits a request on-ledger to create an NHA MBS Pool, which is a collection of loans with similar properties that will form the security. The pool request is automatically validated and approved if it is within the Issuer's allowance given by CMHC.

**Benefits:** Reduced manual processing and immediate NHA MBS Pool approval or rejection. The network guarantees that the required validation rules are applied and therefore the shared object is trusted and accepted by CMHC.

## 3. Assigning Loans to NHA MBS Pool

**Blockchain-enabled process:** The Issuer assigns multiple loans to the NHA MBS Pool. Only loans that are 'insured' can be tagged to the pool object. Once assigned to the NHA MBS Pool, those loans will also become visible to CMHC.

**Benefits:** Simplified process and trust through dynamic visibility of assets on a need to know basis. CMHC can only see the loans that are selected for their program when the selection has been made. The ability for the NHA MBS Pool object to contain references to multiple loan objects within the pool is also demonstrated.

## 4. Update NHA MBS Pool

**Blockchain-enabled process:** The Issuer is notified of any changes necessary for an eligible pool and updates fields as needed in order to finalize the NHA MBS Pool for submission to CMHC.

**Benefits:** Reduced reconciliation and manual intervention through immediate validation of pool eligibility. All updates made to the pool or loans by the Issuer are automatically checked against programmed rules on-ledger.

## 5. Lock and Settle MBS Pool

**Blockchain-enabled process:** The Issuer locks and submits the pool to CMHC for settlement. CMHC settles the NHA MBS Pool. The CPTA would receive an automated notification indicating the pool has been locked and settled so a security certificate can be issued to investors.

**Benefits:** Automated pool settlement to reduce manual processing with immediate validation against CMHC's NHA MBS program requirements, including verification of premiums paid, and notification of the CPTA.

# The Success of the POC

## Demonstrated the Unique Value of Blockchain

- Demonstrated trust between the multiple parties through direct exchange of data, and improved access and visibility of data (i.e. the “right parties can see the right data”)
- Managed loan and security object data and lifecycle – including creation, enhancement, and validation of pool objects which consist of multiple loan objects
- Simplified the process and created efficiencies for all participants through demonstrating the potential to reduce reconciliation time, the service level agreement (SLA) required to close the pool, and errors or required updates.

## Sparked Ecosystem Collaboration

- Engaged two financial institution partners to ensure the POC demonstrated value to all parties involved
- Laid the foundation for partnership in future development and exploration of blockchain in the housing finance ecosystem

## Developed Knowledge and Assets

- Established collective knowledge assets on blockchain to enable CMHC and partners to progress towards a blockchain-enabled shared multi-party housing finance ecosystem

# Key Findings and Lessons Learned

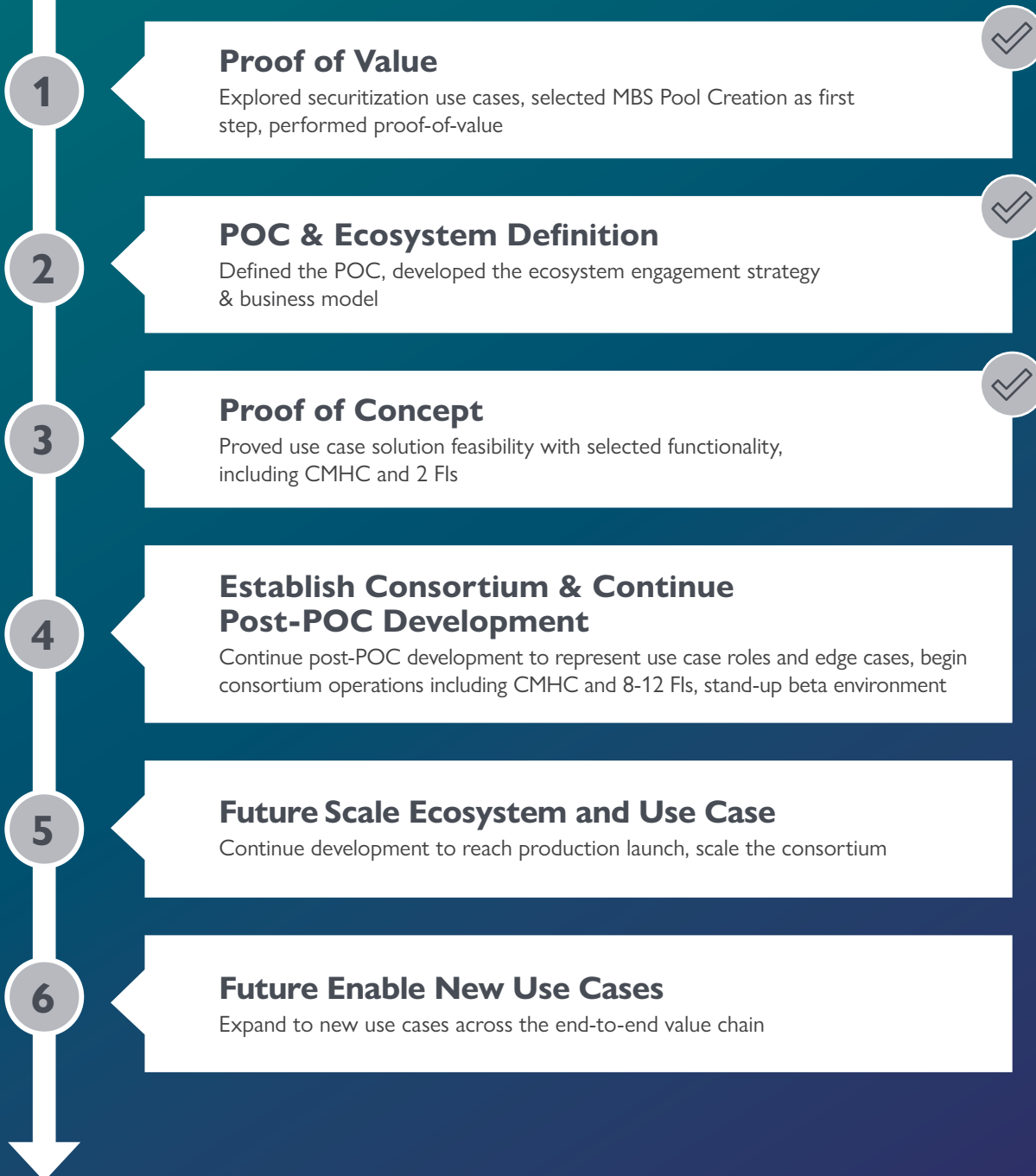
The POC was successful in illustrating the significant operational and business benefits that can be realized by leveraging blockchain technology. Lessons learned from the POC can be built upon in future development and ecosystem collaboration:

- **Blockchain is a platform that can drive change and enable businesses to reimagine existing and future processes:** Blockchain eliminates traditional “data silos” and allows businesses to reimagine workflows built on a platform of shared, but secure and private information. The POC established shared ownership of the NHA MBS Pool asset between CMHC and the Issuer to streamline the process of creation and updates. The POC also began to experiment with a new business concept related to a “Shared Pool”, leveraging the new capabilities provided by the blockchain platform.

- **Trust and trust modeling lie at the center of the design of a blockchain network:** The POC designed the trust model between CMHC, Issuers, and Mortgage Insurers to collectively define who may initiate the creation of pools and loans, who may view these assets, and who may have the ability to change them. Assets were only permitted to be visible by a limited set of relevant participants.
- **Blockchain platforms promote proactive regulatory compliance:** Blockchain enables business logic and regulatory requirements to be encoded directly into integration points and offers real-time access to regulators through their own node. The POC leveraged the use of smart contracts, which represent an agreement between participants on the business logic that is required to validate assets and transactions in an immutable manner, to demonstrate how assets or transactions may consistently be validated and apply immutable regulatory business logic. Additional validation rules were encoded which represent specific business processes and agreements between participants.
- **Consortiums must determine ownership, accountability, governance and maintenance models:** Blockchain requires strong, accountable and transparent governance to implement and manage rules, practices, and processes for a community of competitive parties. The need for governance increases in a post-POC environment, as the number of participants and level of complexity increases, and further exploration would be required.
- **A set of technical standards is required in order to form a collaborative blockchain network:** Building a viable blockchain network for competitive organizations requires a common set of standards and practices to ensure alignment between participants, especially as digital assets are distributed and shared across an ecosystem. Within the scope of the POC, data modeling, validation rules, application programming interface (API), deployment and provisioning method, and monitoring standards were discussed.
- **Blockchain platforms require extensive integration into existing and traditional systems:** Integrations may include digital decoupling work, where the DLT platform may shadow, or coexist with, older systems for an interim period. The POC helped to start mapping such future integrations landscape and initiated the discussion around how such an ecosystem may operate in an initial release.

# Next Steps

CMHC has taken an innovative approach to securitization and has laid the foundation for a consortium of financial institutions to continue post-POC development. This ecosystem of players can leverage blockchain technology to reimagine and transform the housing finance ecosystem.



CMHC and financial institutions have the opportunity to create a peer network to implement blockchain and address the inefficiencies facing the ecosystem. Formed by competitors in a similar industry, this model sees organizations coming together to realize efficiency and value gains at a market-wide level. This consortium model can be flexible enough to accommodate the needs of large and small players alike. The initial emphasis is on creating a step change inefficiency for the entire value chain or market, rather than driving competitive advantage for one participant.

As more parties come on board, the benefits to all will multiply. This fundamental component of the technology is why many organizations are looking externally to partner on the ideation, development, and implementation of blockchain solutions. According to Accenture's Value of Blockchain survey, 84% of organizations surveyed are currently or intend to partner with other organizations on their blockchain initiatives, with 73% partnering with two or more. Within the housing finance ecosystem such a model may eventually encompass financial institutions, solicitors, land registries, and document custodians who collaborate to standardize and share the right information around loans, securities, borrowers, and homes.

By coming together to establish a consortium and a peer network, CMHC and its partners can improve the end-to-end housing finance ecosystem and unlock significant value for stakeholders, including:

- New business model and data opportunities across the end-to-end value chain
- Reduced cost through process efficiencies
- Streamlined and augmented Know Your Client (KYC), Anti-Money Laundering (AML), fraud, and audit
- Increased speed for loan and security issuance
- Decreased financial risk

CMHC is paving the way and setting new standards, bringing transparency and trust to the management of shared data, improving collaboration across participants, and lowering risk for ecosystem stakeholders. This ecosystem transformation has the potential to radically improve the end-to-end home buying experience for people living in Canada and create a more stable, efficient market. CMHC is looking to engage the industry on this exciting journey and collaborate to build a blockchain platform that can streamline the end-to-end housing, mortgage, and securitization process.

If you are interested in learning more about CMHC's work in this space, or want to be involved, please contact Ian Witherspoon at [iwithers@cmhc-schl.gc.ca](mailto:iwithers@cmhc-schl.gc.ca).

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