Roadmap to Transform the Canadian Construction Industry

through Industrialized Construction, Research and Innovation




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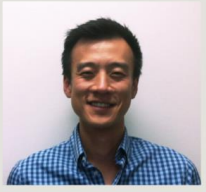
Project team



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WHAT NRC DOES

14 Research Centres

DIGITAL TECHNOLOGIES	• Digital Technologies
EMERGING TECHNOLOGIES	• Advanced Electronics and Photonics • Herzberg Astronomy and Astrophysics • Metrology • Nanotechnology • Security and Disruptive Technologies
ENGINEERING	• **Construction** • Energy, Mining and Environment • Ocean, Coastal and River Engineering
LIFE SCIENCES	• Aquatic and Crop Resource Development • Human Health Therapeutics • Medical Devices
TRANSPORTATION AND MANUFACTURING	• Aerospace • Automotive and Surface Transportation

NRC Platform to Decarbonize the Construction Sector at Scale

NRC Platform's 3 Research Programs

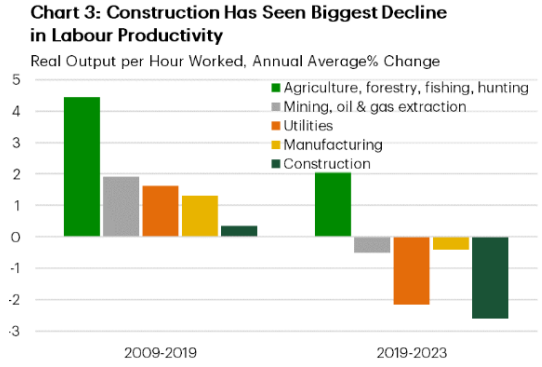
1. Low Carbon Regulatory Framework
2. Low Carbon Built Environment
3. ***Construction Sector Digitalization and Productivity (CSDP)***
   - ***3 Main Themes***

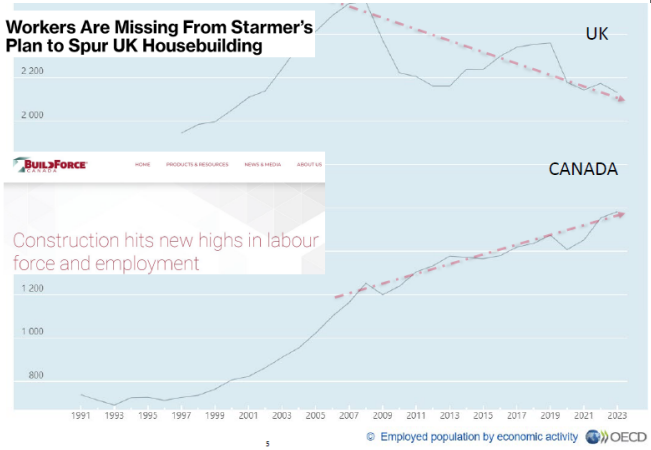
Performance-based regulation R&D

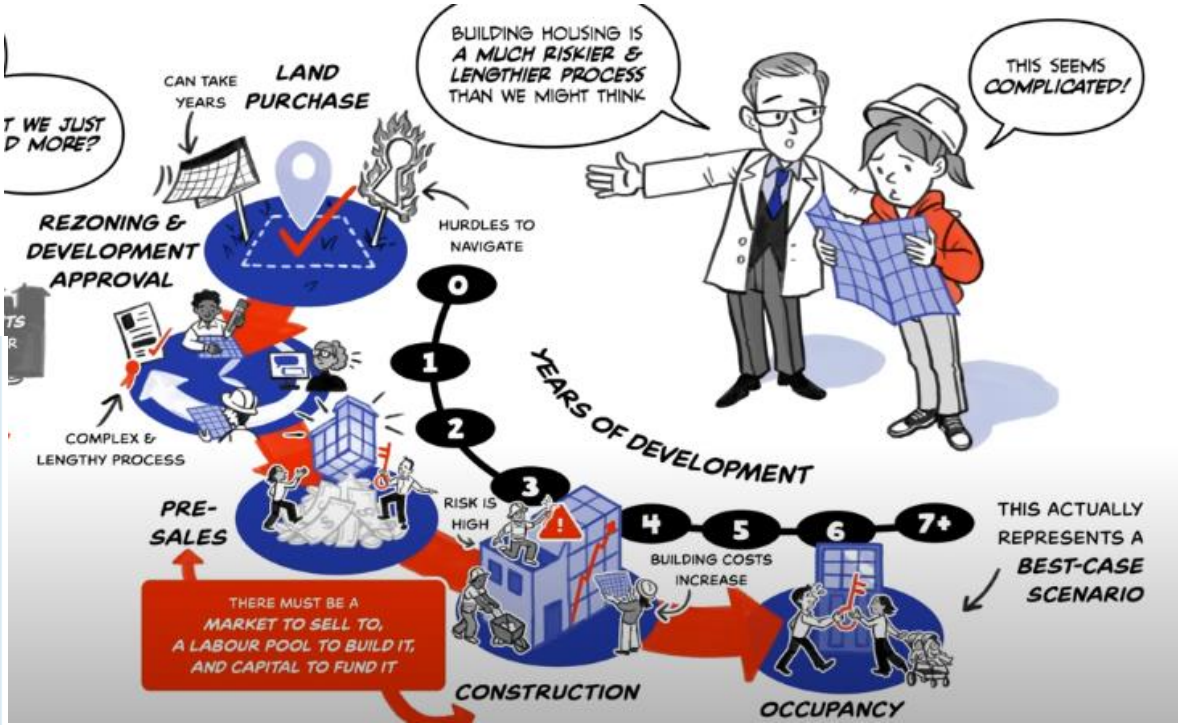
Digitalization of the construction value chain (BIM, ISO 19650)

Advanced Construction Practices (Industrialized construction, robotics, AI, 3DPC)

CSDP Program Rationale







Program Rationale

Canadian Occupational Projection System (COPS)

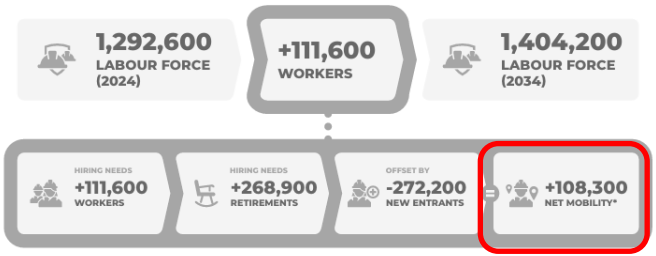
Occupations showing moderate or strong signs of shortage conditions

72100 Machinists and machining and tooling inspectors; 72102 Sheet metal workers; 72104 Structural metal and platework fabricators and fitters; 72106 Welders and related machine operators; 72200 Electricians (except industrial and power system); 72201 Industrial electricians; 72300 Plumbers; 72302 Gas fitters; **72310 Carpenters;** 72311 Cabinetmakers; 72320 Bricklayers; 72400 Construction millwrights and industrial mechanics; **72401 Heavy-duty equipment mechanics; 72402 Heating, refrigeration and air conditioning mechanics;** 72404 Aircraft mechanics and aircraft inspectors; 72410 Automotive service technicians, truck and bus mechanics and mechanical repairers; 72411 Auto body collision, refinishing and glass technicians and damage repair estimators; **72422 Electrical mechanics;** 72600 Air pilots, flight engineers and flying instructors; 72999 Other technical trades and related occupations; 73100 Concrete finishers; 73110 Roofers and shinglers; 73112 Painters and decorators (except interior decorators); 73113 Floor covering installers; 73300 Transport truck drivers; 73301 Bus drivers, subway operators and other transit operators; 75110 Construction trades helpers and labourers

occupations expected to face risks of shortage conditions (2024-2033)

70010 Construction managers; 70011 Home building and renovation managers; 72100 Machinists and machining and tooling inspectors; 72102 Sheet metal workers; 72106 Welders and related machine operators; 72200 Electricians (except industrial and power system); 72201 Industrial electricians; 72300 Plumbers; 72302 Gas fitters; **72310 Carpenters;** 72311 Cabinetmakers; 72320 Bricklayers; 72400 Construction millwrights and industrial mechanics; **72401 Heavy-duty equipment mechanics; 72402 Heating, refrigeration and air conditioning mechanics;** 72404 Aircraft mechanics and aircraft inspectors; 72410 Automotive service technicians, truck and bus mechanics and mechanical repairers; 72422 Electrical mechanics; 72501 Water well drillers; **72600 Air pilots, flight engineers and flying instructors;** 72999 Other technical trades and related occupations; 73100 Concrete finishers; 73110 Roofers and shinglers; 73112 Painters and decorators (except interior decorators); 73113 Floor covering installers; 73300 Transport truck drivers; 74201 Water transport deck and engine room crew; 75110 Construction trades helpers and labourers

FIGURE 4:
CHANGES IN THE CONSTRUCTION LABOUR FORCE, CANADA



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Advanced Construction Practices (ACP) Rationale

- What is the overarching vision or goal of the ACP Theme?

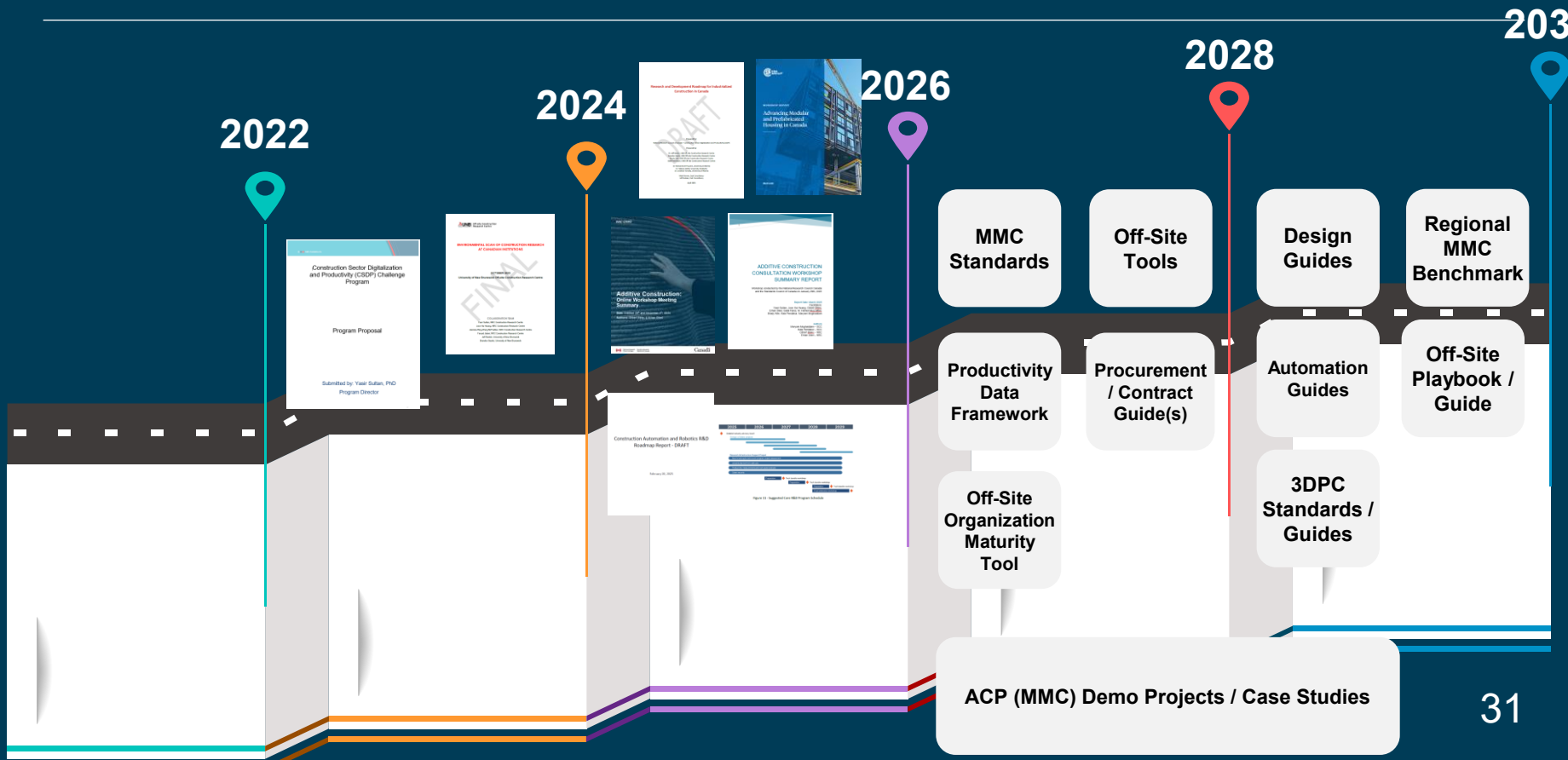
Identify and Reduce barriers to accelerated adoption of ACP (off-site construction, robotics, additive construction)

Opportunity to improve efficiency and productivity while alleviating labour shortages in key construction trades and value chain

How do we start?

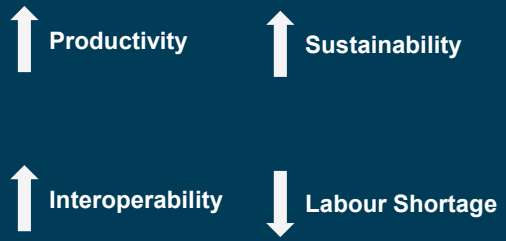
Advanced Construction Practices (Industrialized construction, robotics, AI, 3DPC)

Where We Are and What's Next



How to Get Involved

What do we look for?



MP-7	Establishing foundation for ACP adoption
MP-8	Construction digitalization and productivity framework and benchmark
MP-9	Optimizing the factory-built value chain

For more information, please contact:

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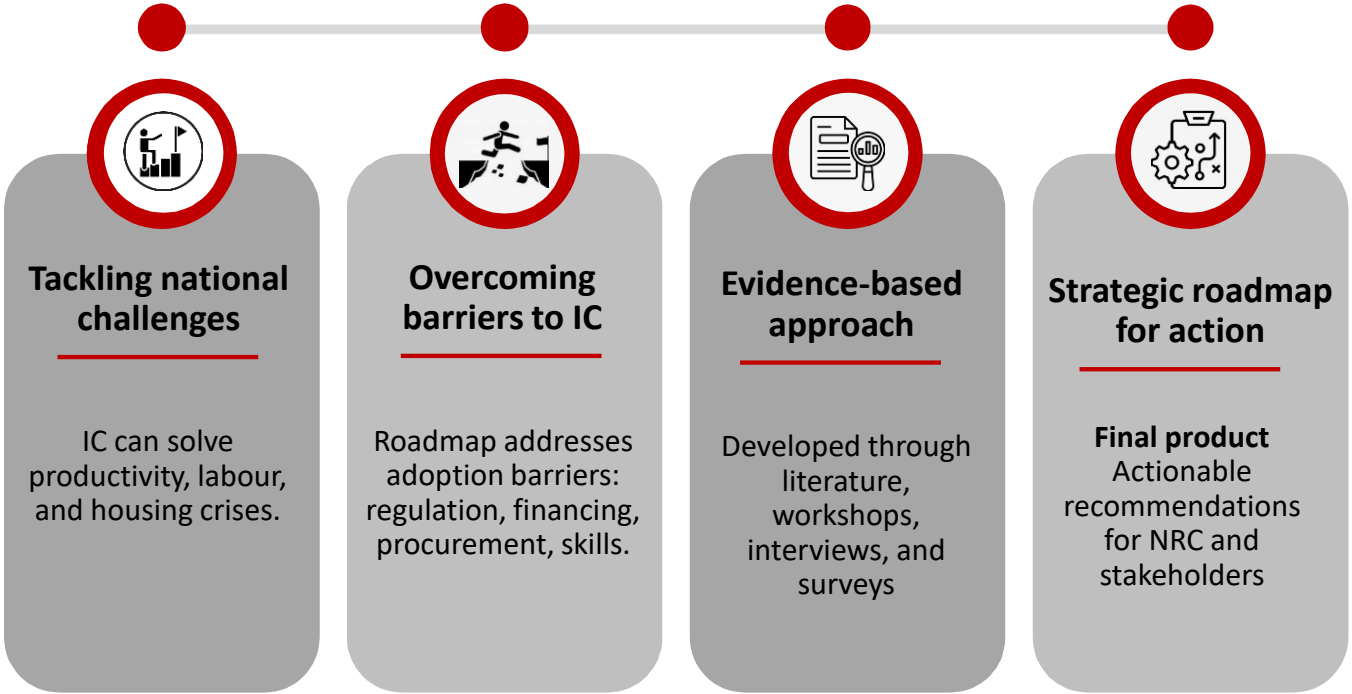
We welcome questions or feedback in any format or forum

Unlocking Canada’s construction potential with Industrialized Construction (IC)



Objectives and scope

Project goals and strategic scope

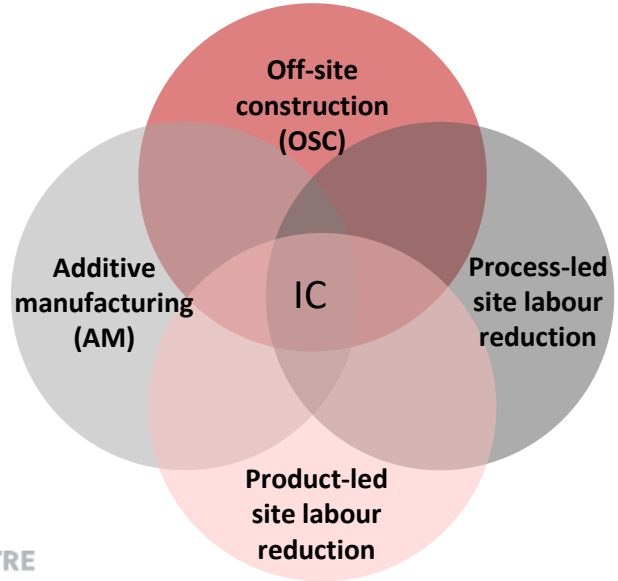
1. Understand IC barriers and develop a national strategy
2. Engage stakeholders from public and private sectors
3. Deliver an industry-informed roadmap for adoption and R&D priorities

What is Industrialized Construction (IC)?

A transformative shift in the construction industry, aiming to significantly increase productivity.

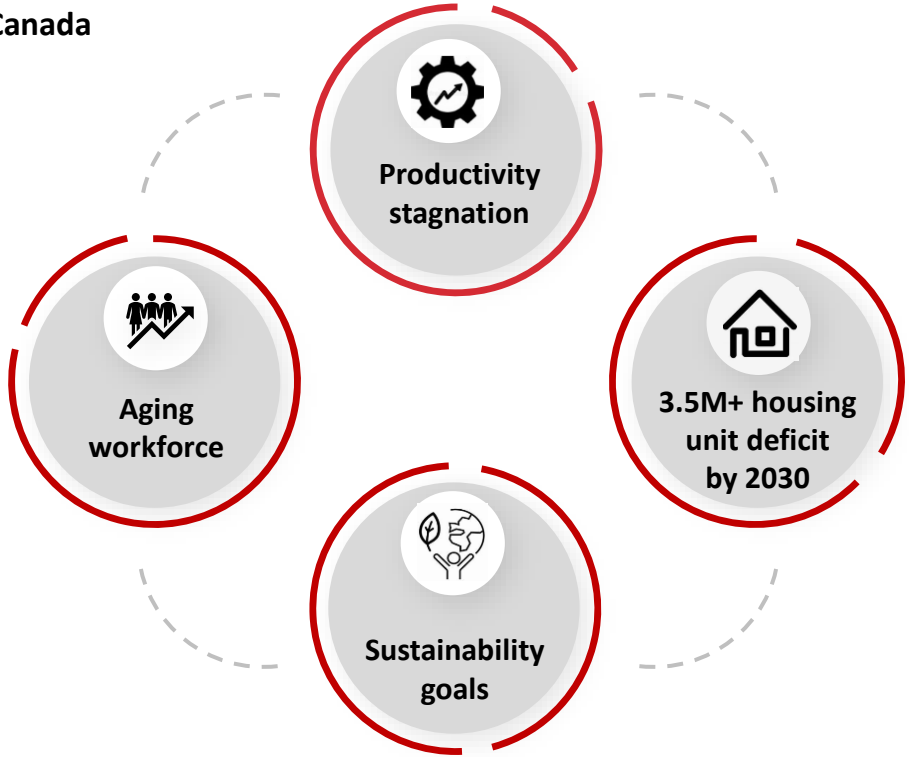
Mechanization + **Automation** + **Advanced manufacturing technologies**

Interrelated domains of IC



Why IC is critical now?

Drivers of IC Adoption in Canada

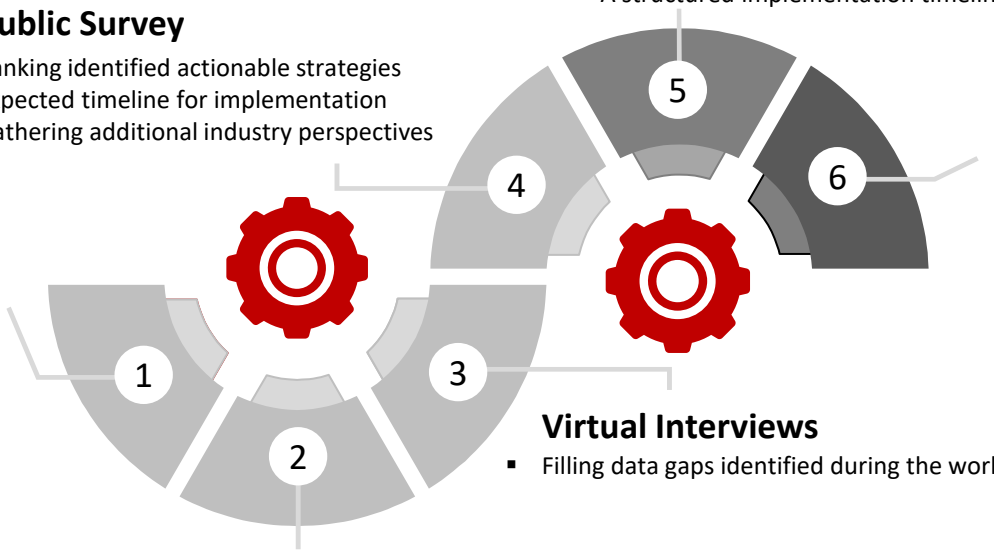


Roadmap development process

Literature review
- Insights from international best practices
- Previous studies on IC in Canada

Public Survey
- Ranking identified actionable strategies
- Expected timeline for implementation
- Gathering additional industry perspectives

Qualitative analysis
- Developing actionable strategies for IC advancement
- Quantified ranking of actionable strategies
- A structured implementation timeline



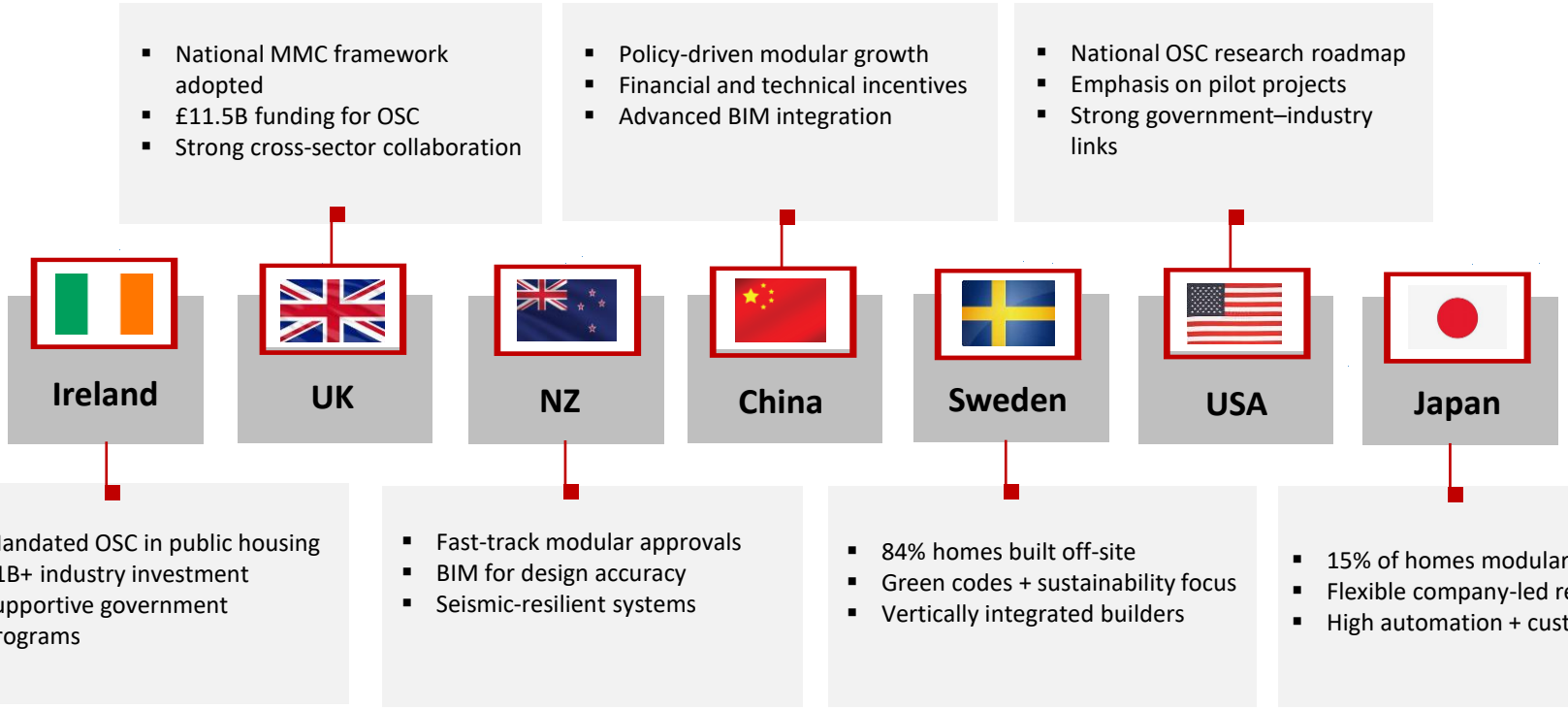
Results

Virtual Interviews
- Filling data gaps identified during the workshops

Regional Workshops (Toronto, Edmonton)
- Explored barriers to adopting IC in Canada
- Began identifying actionable strategies to drive innovation and growth

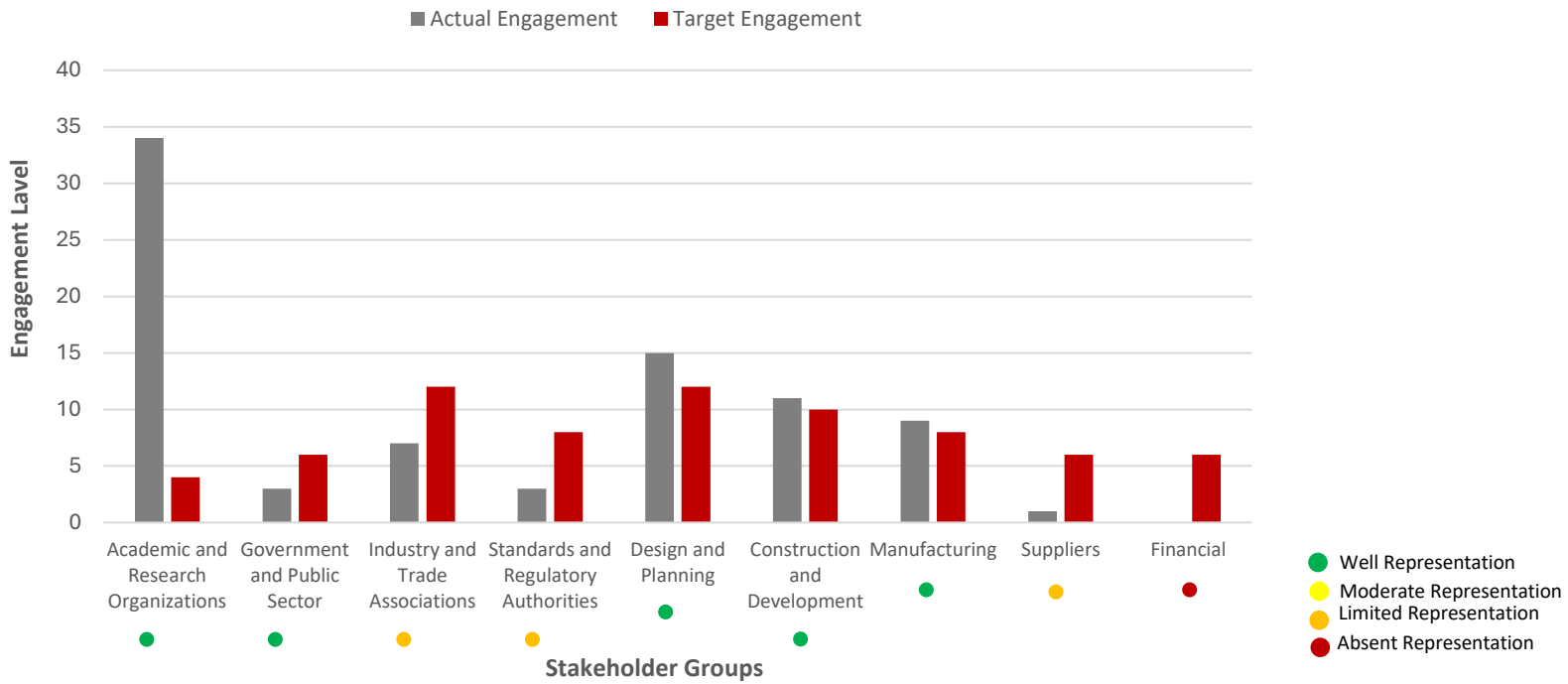
Global best practices

Global Lessons in IC



Stakeholder engagement

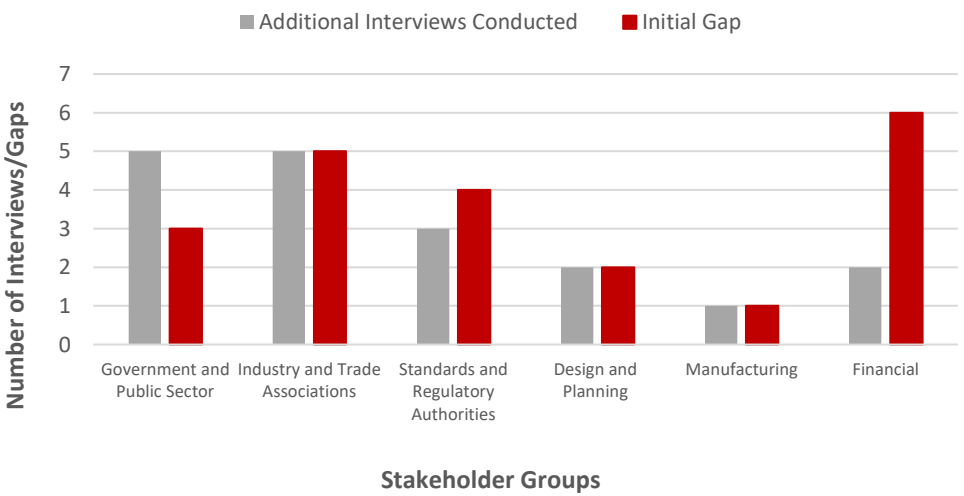
Industry participation and inclusiveness **workshop participants**



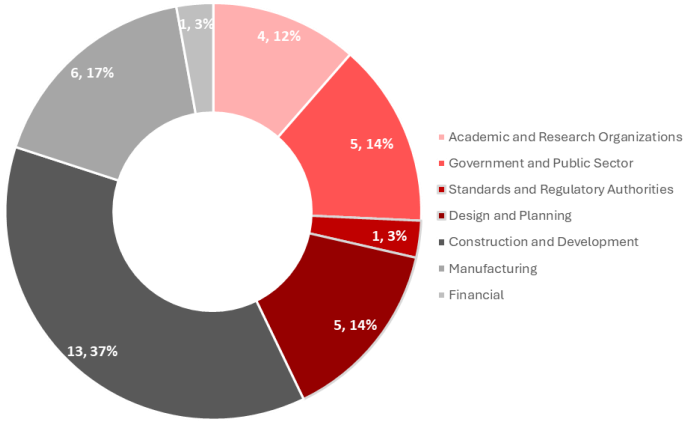
Stakeholder engagement

Industry participation and inclusiveness

Virtual interview participants

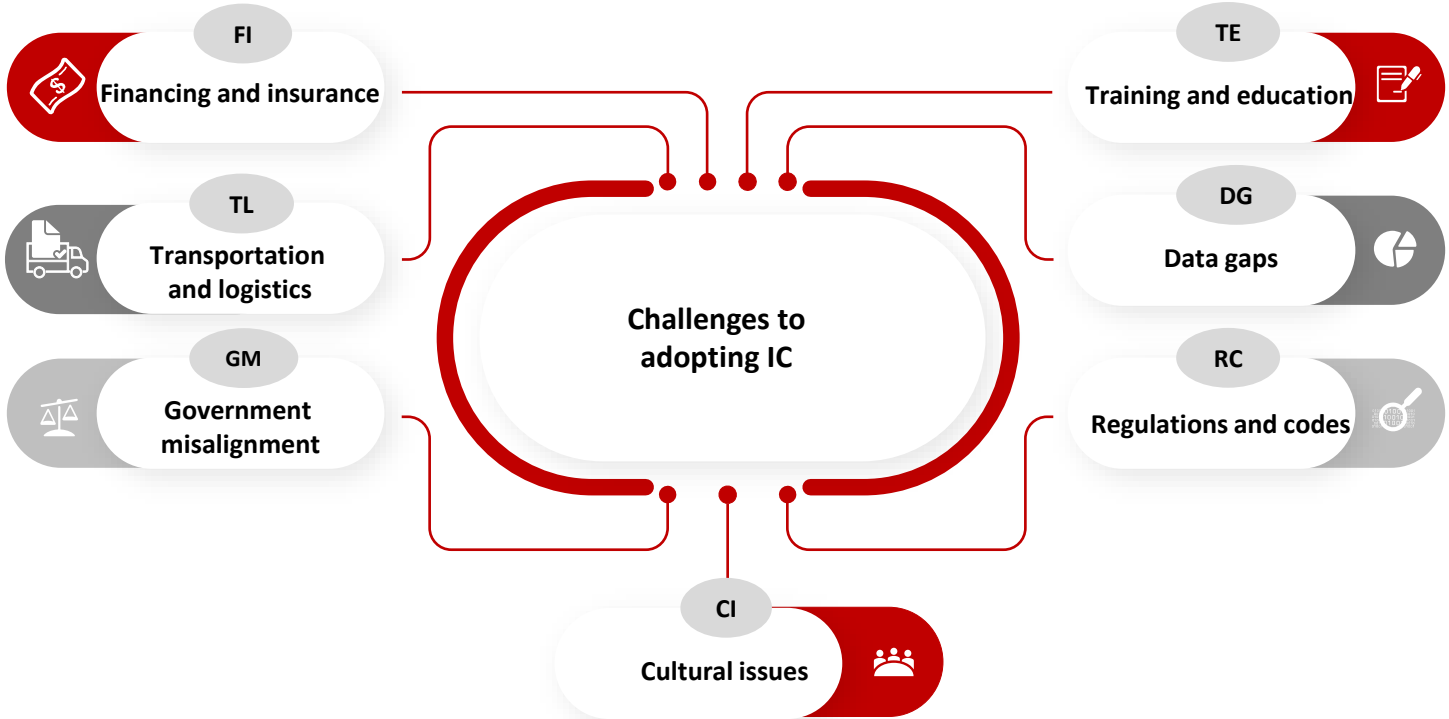


Public survey respondents



Canada’s IC barriers

Challenges Facing IC Adoption (Insights from stakeholder engagements)



Focus areas for action

Strategic focus areas in the roadmap

1. **Policy and regulatory frameworks**

2. **Procurement models and performance systems**

3. **Financial and insurance services**

4. **Awareness, competency, and collaboration**

5. **Quantifying capacity and capability for IC**

6. **Research and data sharing**

Initiatives for advancing IC

1

Policy and regulatory frameworks

PR

- **PR1** Simplify, improve, and harmonize the approval process
- **PR2** Undertake a policy review and harmonize project funding through collaborative procurement tied to incentives
- **PR3** Identify inefficiencies in codes and policies (flexible codes)
- **PR4** Alignment of municipalities and the three tiers of governments
- **PR5** Continuity in government policy

Addressed IC Challenges

- Government misalignment
- Regulations and codes

Initiatives for advancing IC

2

Procurement models and performance systems

PM

- **PM1** Develop collaborative procurement models and methods to quantify value of IC (e.g., quantifying pre-manufactured value (PMV)) and incorporate in the procurement process.
- **PM2** Improve language in contracts and procurement (RFPs)
- **PM3** Work with the Canadian Construction Documents Committee (CCDC) and key industry experts to develop or modify contracts for IC

Addressed IC Challenges

- Transportation and logistics
- Financing and insurance

Initiatives for advancing IC

3

Financial and insurance services

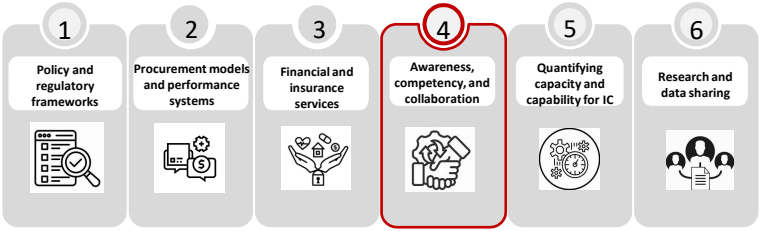
FI

- **FI1** Government underwriting of lending against IC
- **FI2** Deleveraging risk by tax incentives that drive R&D
- **FI3** More flexible R&D funding
- **FI4** Structured financial solutions supported by financial institutions
- **FI5** Create a best practice template proforma document specific to IC for developers
- **FI6** Conduct key case studies to identify drawbacks and understand gaps in the insurance products for IC

Addressed IC Challenges

- Financing and insurance

Initiatives for advancing IC



4

Awareness, competency, and collaboration

AC

- **AC1** Launch an awareness campaign
- **AC2** Address competency gaps and IC opportunities
- **AC3** Standardize DfMA collaboration

Addressed IC Challenges

- Cultural issues
- Training and education

Initiatives for advancing IC

5

Quantifying capacity and capability for IC

CC

- **CC1** Quantify and highlight the labour benefit of IC (specific to Canada's climate and geography)
- **CC2** Clear picture of off-site solutions available and quantify capability
- **CC3** Incentivize and support IC with a focus on driving IC demand that aligns with capacity and capability

Addressed IC Challenges

- Cultural issues
- Training and education
- Data gaps

Initiatives for advancing IC

6

Research and data sharing

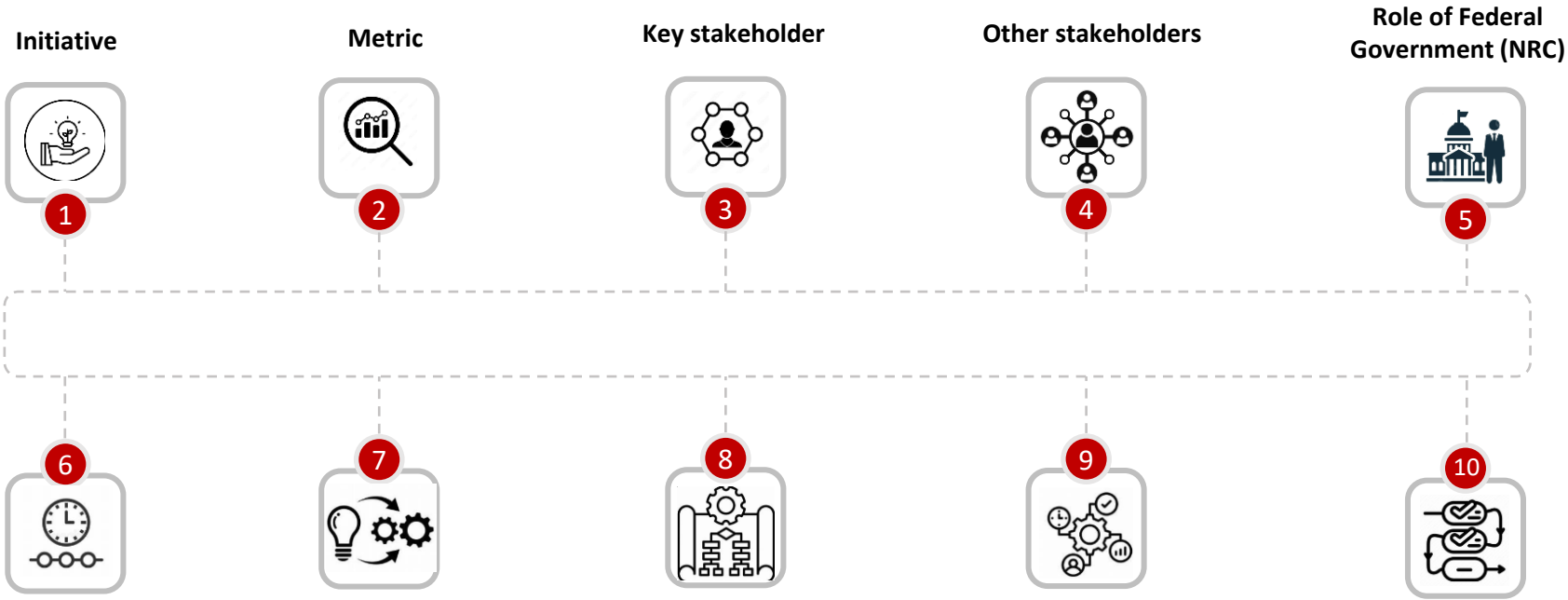
RD

- **RD1** R&D focus on methodologies and tools for industry data capture and sharing
- **RD2** Develop a premanufactured value toolkit for Canada to demonstrate the commercial/financial benefits to owners and lenders

Addressed IC Challenges

- Data gaps
- Regulations and codes

Key actions and implementation strategies



Key actions and implementation strategies

1

Policy and regulatory frameworks

PR

- **PR1** Simplify, improve, and harmonize the approval process
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- **PR3** Identify inefficiencies in codes and policies (flexible codes)
- **PR4** Alignment of municipalities and the three tiers of governments
- **PR5** Continuity in government policy

Addressed IC Challenges

- Government misalignment
- Regulations and codes

Key actions and implementation strategies

Policy and regulatory frameworks

PR1 Initiative

Simplify, Improve, and Harmonize the Approval Process

Timeline and implementation

Expected timeline	Ease of implementation
2028	Difficult

Impact 9/10

Stakeholders

Key Stakeholder(s)

Regulatory and code authorities

Other Stakeholders

Government and public sector
Construction and development sectors
Design and planning departments
Royal Architectural Institute of Canada
Canada Mortgage and Housing Corporation (CMHC)

Metrics

- % Reduction in approval time from permit application to building occupancy
- # No. of jurisdictions adopting streamlined approvals

Scope of implementation

IC Focus Area	Location
All levels of IC	Local & regional

Role of Federal Government **(NRC)**

Work with innovative jurisdictions to create a pilot R&D study and streamline codes.

Steps for implementation

Prerequisite initiative (s)

PR3 – PM3 – RD1

1. Conduct regulatory comparisons through regional pilots.
2. Develop standardized approval process model framework.
3. Pilot testing implementation.
4. Develop IC certification program.

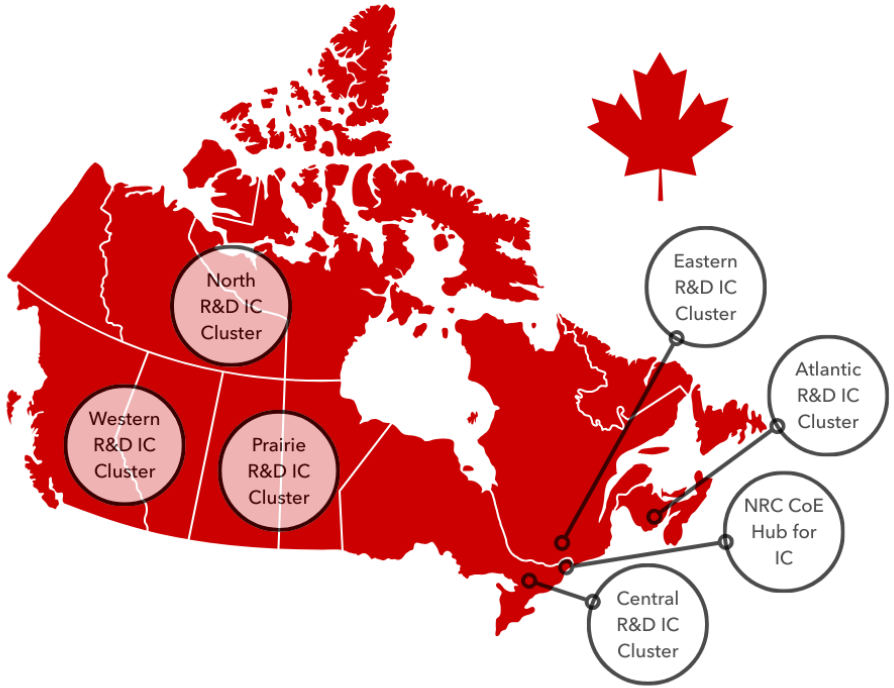
Timeline and impact level of strategic initiatives

Impact level - low to high

Key focus area	Initiative	Short- term		Mid-term		Long-term		
		2025	2026	2027	2028	2029	2030	Beyond 2030
Policy & regulatory frameworks	**PR1.**Simplify & harmonize approvals							
	PR2. Harmonize project funding							
	PR3. Identify inefficiencies in codes							
	PR4. Align municipalities and governments							
	PR5. Ensure policy continuity							
Procurement models & performance systems	**PM1.** Develop collaborative procurement							
	PM2. Improve contract language							
	PM3. Develop or modify IC contracts with CCDC							
Financial and insurance services	**FI1.** Underwrite IC lending							
	FI2. Deleverage risk with R&D tax incentives							
	FI3. Provide flexible R&D funding							
	FI4. Structure financial solution							
	FI5. Create a best practice proforma							
	FI6. Conduct insurance gap studies							
Awareness, competency, and collaboration	**AC1.** Launch an awareness campaign							
	AC2. Address competency gaps and IC opportunities							
	AC3. Standardize DfMA collaboration							
Quantifying capacity and capability for IC	**CC1.**Quantify labour benefits							
	CC2. Map OSC solutions and capabilities							
	CC3. Incentivize and support IC growth							
Research and data sharing	**RD1.** Develop data capture tools							
	RD2. Create PMV toolkits							

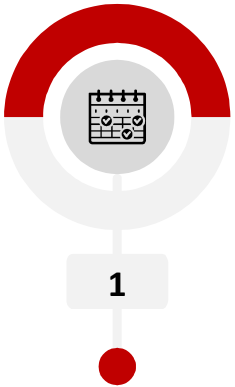
National hub-and-spoke model for IC R&D

To deliver on the IC Roadmap, a hub-and-spoke system is proposed, with the National Research Council as the national hub, supported by regional R&D clusters across Canada.



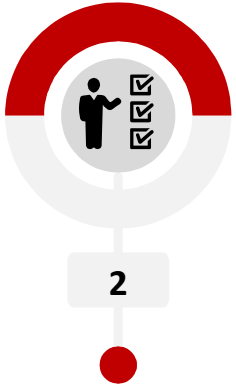
Call to Action

Next steps: Turning strategy into action



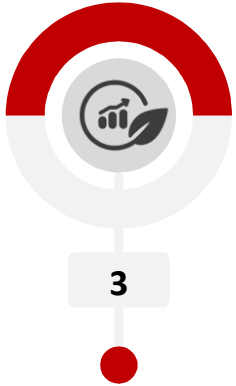
1

Adopt national IC framework



2

Streamline policy to enable IC and OSC

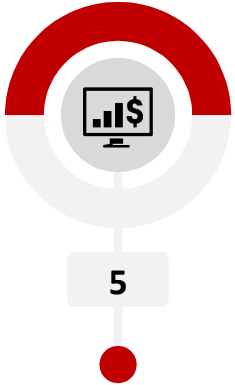


3

Create sustainable demand to de-risk innovation investment

4

Align stakeholders across government, academia, industry



5

Invest in R&D and workforce upskilling

Thank you for your attention!

Q&A?

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