CONSTRUCTION
INNOVATION CENTRE
Research Driving Change

2026

Research Roadmap & Implementation Plan

Executive Summary

The Construction Innovation Centre (CIC) was established in 2019 to bring together academia, industry, and government to provide new opportunities for collaboration in Alberta's construction industry. To ensure CIC projects remain at the leading edge of construction research and innovation, the CIC has developed a new research roadmap and implementation plan.

Roadmap

The CIC conducted more than seventy in-depth interviews with stakeholders representing academia, industry leaders, policymakers, and community partners to determine the most important areas of research.

The results of these surveys indicate that the fifteen most relevant areas of research for the construction industry are (1) workforce development and management, (2) advanced materials and applications, (3) health, safety, and risk management, (4) energy-efficient systems and practices, (5) supply chain optimisation, (6) lean construction and manufacturing, (7) automated and generative design, and (8) smart procurement and contract management. Mid-term priorities include (9) sustainable and net-zero construction management, (10) digitization, (11) performance monitoring and data-driven decision making, and (12) climate adaptation and disaster resilient construction. Long-term priorities include (13) advanced construction technologies, (14) policy and regulation changes, and (15) decarbonization of construction processes.

Implementation Plan

Under the new implementation strategy, the CIC will offer partners end-to-end support through the research and innovation process. These services include assistance with scope and proposal writing, innovation matchmaking to connect industry and academia, high-level project management and advisory services, rigorous analysis and reporting tools, knowledge sharing facilitation, pathways for commercialization, and intellectual property services.

To ensure research activities generate meaningful and measurable benefits to Alberta's construction ecosystem, all project proposals will be evaluated against six industry impact criteria: (1) improved productivity (2) improved cost efficiency (3) reduced waste and required resources, (4) increased workforce capacity and skills development, (5) improved safety and well-being, and (6) scalability and replicability.

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Acknowledgments

This roadmap was prepared by the Construction Innovation Centre (CIC) in collaboration with industry, academia, government, associations, and other stakeholders.

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1 Introduction

1.1 Background and Context

The Construction Innovation Centre (CIC) was established in 2019 with a clear mission: "to provide breakthrough research, education and training that directly benefit Canada's construction industry and lead to the sustainable and economic development of our built environment and a competitive advantage for the Canadian construction industry."[1] To this end, the CIC has brought together more than 30 established faculty members in construction engineering, building science, masonry, steel, and other disciplines outside civil engineering, with more than 50 industry partners, professional associations, and funding bodies, to create opportunities for collaboration between various research and industry areas.

The goals of the CIC include the following:

- Accelerating and supporting innovation, productivity, and competitiveness in Alberta's and Canada's construction industries through high-impact research projects;
- Identifying industry needs and aligning CIC research programs to meet these needs;
- Providing a unified platform for solutions to construction industry problems through multi-disciplinary research;
- Training the next generation of construction engineers and workforce with leading-edge knowledge and skills; and
- Enhancing engagement with all levels of government to grow and sustain investment in Canada's construction industry.

One of the CIC's ongoing challenges is identifying areas of research that are collaborative in nature, have significant potential for academic breakthroughs, and will lead to the greatest positive impact on the construction industry. This requires a detailed research roadmap based on both industry need and academic capacity, that not only determines the most relevant and urgent research avenues, but also provides a strategic plan for implementing and sustaining high-impact contributions for the construction sector.

To meet the rapidly evolving needs of the industry, the CIC has developed a refreshed research roadmap and implementation plan. In addition to providing direction for research areas, the following roadmap integrates proposal support, evaluative tools, and operationalization pathways directly into the research lifecycle, improving the CIC's infrastructure for experimentation, piloting, and adoption of new technology and methods into the construction industry.

[1] Construction Innovation Centre (5 September, 2021). *About the CIC*. https://constructioncic.ca/about-the-cic.

1.2 Objectives of the Study

The primary objective of this study is to provide the CIC with a research roadmap that responds to the shifting needs of Alberta's construction sector and aligns with global best practices. To achieve this objective, the study aims to

1. **Identify priority research themes.** Develop a concise set of research priorities that reflect the short- medium- and long-term needs of Alberta's construction industry.

2. **Define pathways for adoption.** Develop an end-to-end service model that connects proposal development, innovation matchmaking, training, evaluation and reporting, and operationalization.

3. **Establish mechanisms for measuring impact.** Develop an evaluation framework for proposals that assesses projects' alignment with priority research areas, feasibility, and potential impact on the industry.

2 Methodology

2.1 Approach

The roadmap 1) to capture and synthesize stakeholder perspectives from across the construction ecosystem, 2) to benchmark Alberta's innovation capacity against leading international centres, and 3) to design actionable framework that links research directly to practice, ensuring measurable outcomes in productivity, sustainability, and workforce development.

To ensure stakeholder engagement remained central to the process, more than 70 representatives from industry, academia, and government participated in surveys that collected both quantitative and qualitative data. This ensures that the roadmap is firmly grounded in Alberta's realities while aligned with global best practices. The roadmap development process was accomplished in five phases:

1. **Analysis Phase:** Establishing a strategic vision and long-term objectives, with adaptability as a guiding principle. This phase identified emerging technologies, risks, and opportunities, alongside a contextual analysis of Alberta's construction ecosystem.

2. **Methodology Development Phase**: Translating broad objectives into research priorities. This included establishing criteria for evaluating relevance, feasibility, and impact, as well as mechanisms to capture synergies across stakeholder interests. Efforts were guided by a

long-term vision of a sustainable, digitally enabled, collaborative, and globally competitive construction sector.

3. **Drafting Phase**: Determining preliminary research pathways by synthesizing stakeholder insights, benchmarking data, and foresight outputs. This phase emphasized co-creation, incorporating continuous feedback loops and building mechanisms for technology transfer so innovations could move more easily from research to real-world applications. Draft priorities were iterated several times to ensure alignment with both immediate challenges and long-term opportunities.

4. **Validation and Refinement Phase**: Draft outputs were tested and validated with stakeholders and global comparisons. This stage introduced an agile structure, breaking the roadmap into smaller six-to-twelve-month cycles with clear deliverables and measurable indicators.

5. **Finalization Phase**: The final stage consolidated the roadmap into a coherent, implementable framework, supported by real-time monitoring and evaluation systems. Analytics from projects, pilots, and global trends feed back into the process, allowing CIC to track outcomes and adjust as needed. In this way, the roadmap becomes a living framework, capable of continuous evolution while maintaining a clear strategic direction.

This approach, in which each phase narrows the focus from a wide field of possibilities to a set of clear, evidence-based priorities while keeping space for iteration, ensures that CIC's Research Roadmap is both grounded in Alberta's specific context and resilient enough to evolve as the construction sector undergoes rapid global transformation.

2.2 Data Sources

To ground the roadmap in real-world needs, the CIC engaged with the full range of stakeholders in the industry: industry leaders, SMEs and trade contractors, academic researchers, government representatives, and non-profit associations. Through workshops and a questionnaire, their contributions were both qualitative and quantitative, and addressed both opportunities for innovation and barriers to progress. Other data sources include a comparative analysis of world-renowned innovation centres, and a literature review.

2.2.1 Stakeholder Distribution and Segmentation

The CIC consulted 72 organizations and individuals spanning industry, academia, government, and community actors. Specifically, it included 33 industry partners, 21 academic collaborators, and 18 organizations from government agencies, regulators, trade unions, and community groups, ensuring both technical and policy priorities were represented alongside grassroots perspectives, including Indigenous organizations.

Within industry, general contractors accounted for 46% of respondents (Figure 1), but the sample also included trade contractors, consultants, suppliers, and technology providers. SMEs, often overlooked in innovation dialogues, were deliberately targeted due to their importance as key drivers of innovation adoption.

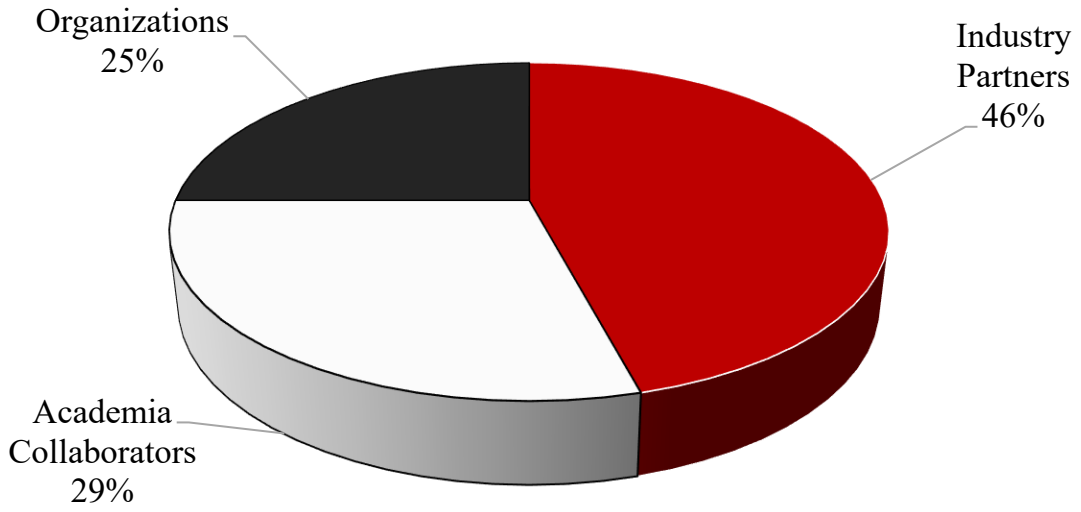


Figure 1. Stakeholder Engagement Breakdown

As shown in Figure 2, general contractors accounted for 46% of respondents, reflecting their dominant role in project delivery and innovation adoption. Specialty contractors, consultants, suppliers, and owners made up the remainder of respondents.

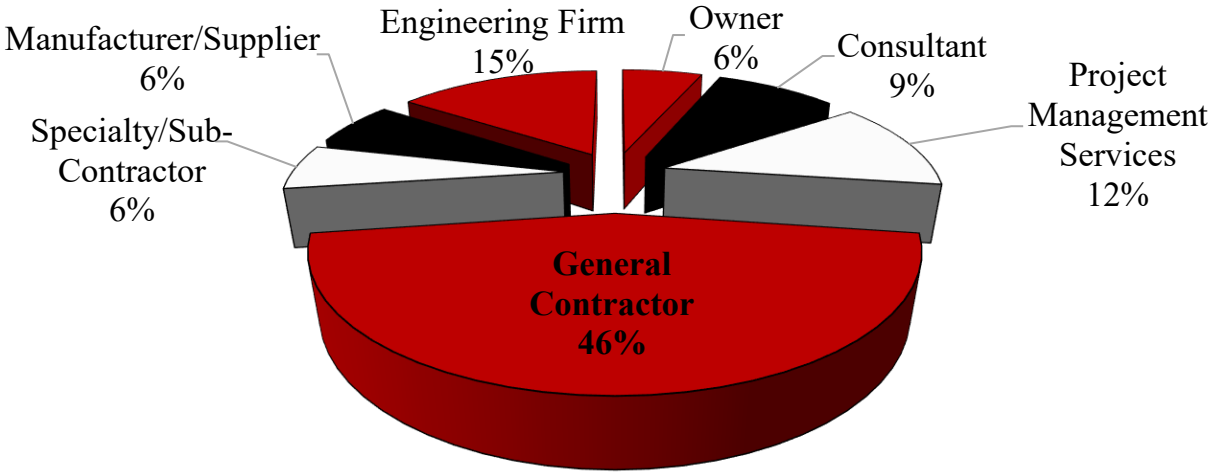


Figure 2. Stakeholder Segmentation by Category

Table 1 provides a structured overview of the stakeholder groups engaged in roadmap development. It categorizes participants into six main groups: Government Agencies (3), Industry

Partners (33), Academic Collaborators (21), Regulatory Bodies (3), Industry Associations (4), Community Organizations (5), and Trade Unions (3).

Table 1. Stakeholder Participation Table

	Government Agencies (3)
1	Alberta Infrastructure
2	Alberta Municipal Affairs
3	City of Edmonton, Building and Development Services
	Regulatory Bodies (3)
4	Association of Professional Engineers and Geoscientists of Alberta (APEGA)
5	Association of Science and Engineering Technology Professionals of Alberta (ASET)
6	Safety Codes Council
	Industry Associations (4)
7	Canada Mortgage and Housing Corporation (CMHC)
8	Construction Owners Association of Alberta (COAA)
9	Alberta Construction Association (ACA)
10	Edmonton Construction Association (ECA)
	Community Organizations (5)
11	Calgary Tool Library
12	Habitat for Humanity Southern Alberta
13	Edmonton Federation of Community Leagues (EFCL)
14	Alberta Indigenous Construction Career Centre (AICCC)
15	First Nations Major Projects Coalition (FNMPC)
	Trade Unions (3)
16	Christian Labour Association of Canada (CLAC)
17	Building Trades of Alberta (BTA)
18	Laborers' International Union of North America (LIUNA) Local 92
	Industry Partners (33)
19	3i Precast Concrete Ltd.
20	Active Homes
21	AECOM
22	ATCO Electric
23	ATCO Structures
24	All Weather Windows
25	Arcadis

26 Bird Construction
27 Canadian Natural Resources Ltd. (CNRL)
28 Carlson Construction
29 Carry Steel
30 Chandos Construction
31 Collins Steel
32 Cormode & Dickson Ltd.
33 Daytona Homes
34 Dub Architects
35 Eagle Precast
36 EPCOR
37 Graham
38 Kent Homes
39 Landmark Group
40 Ledcor
41 NCSG Crane & Heavy Haul
42 NRB Modular Solutions
43 PCL Construction
44 Procore
45 Promise Robotics
46 Qualico
47 Rohit Homes
48 Shell
49 Steadfast Engineering
50 Superior Precast
51 Supreme Steel

Academic Institutions (18) *21 collaborators across 18 institutions

52 Canadian Forces School of Military Engineering
53 Centrale Lille
54 Concordia University
55 ETH Zürich
56 Royal Military College of Canada
National Taiwan University
57 Northumbria University
58 University of Alberta (10)
59 University of British Columbia
60 University of California, Berkley
61 University of Cambridge
62 University of Calgary
63 University of Florida
64 University of Michigan

65 University of New Brunswick
66 University of Sherbrooke
67 University of Toronto
68 University of Waterloo

2.2.2 Workshops and Questionnaire

Workshops and the stakeholder questionnaire are the link between consultation and implementation, and central to the process of continuous engagement illustrated in Figure 3.

The governance bodies for the CIC, the Scientific Advisory Committee (SAC) and the Executive Management Committee (EMC), which are composed largely of industry leaders, provided feedback and insights into adoption and operational feasibility.

In addition to the workshops, stakeholders were also presented with a questionnaire, designed to give them a direct voice in shaping priorities, and to validate that the roadmap aligned with the realities of those responsible for adoption and delivery.

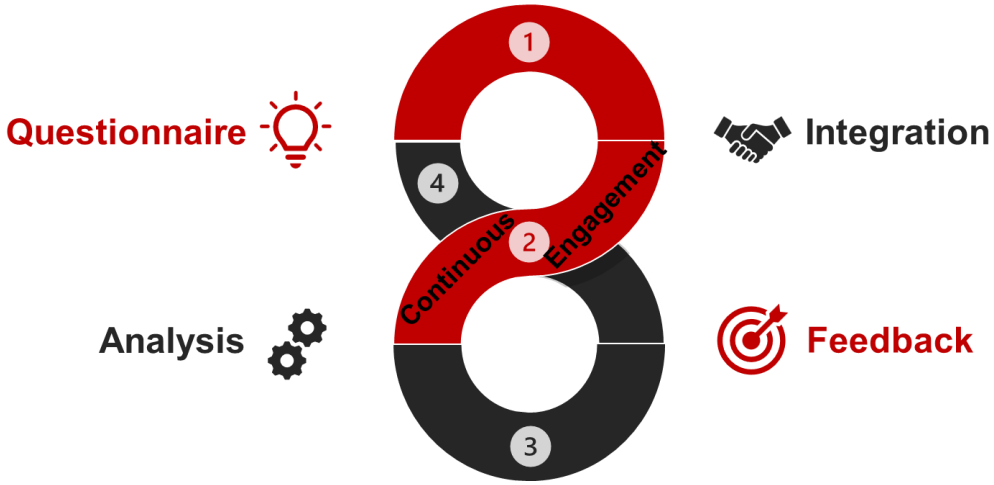


Figure 3. Stakeholder Engagement Loop

The questionnaire was divided into three main parts:

1. **Interviewee Information**: Captured organizational characteristics (e.g., size, sub-sector, ownership structure, turnover) and respondent background (years in role, overall industry experience) to contextualize responses.
2. **General Industry Challenges and Research Engagement**: Explored current barriers facing the sector, previous experiences with research and development (R&D) collaborations, and perceptions of priority areas needing improvement. This section

included both open-ended questions and Likert-scale items ranking engagement methods (e.g., in-house R&D, pilot projects, or digital adoption).

3. **Strategic Inputs for CIC**: Focused on shaping CIC's role by asking participants to evaluate potential services (e.g., technology validation, data analytics, commercialization support), rate collaboration models, and prioritize training and outreach opportunities. It also included exercises categorizing research themes into short-, medium-, and long-term horizons.

The questionnaire combined closed-ended questions for comparability with open-ended prompts for depth (as shown in Table 2), allowing both quantifiable analysis as well as narrative insights. In addition to priorities, participants were asked about barriers and enablers to adoption, in order to assess how research outcomes could be applied in practice.

Quantitative results fed into prioritization matrices, where weighted averages of importance and urgency determined sequencing of initiatives. Qualitative responses were thematically coded while points of divergence were flagged as risk nodes requiring mitigation, and shared priorities were highlighted as core commitments.

Table 2. Sample Questionnaire Structure

Section	Objective	Question Type	Analysis Method
Strategic Priorities	Identify and rank high-level goals across stakeholders	Likert-scale (importance/urgency ranking)	Quantitative aggregation and weighted scoring
Operational Challenges	Understand barriers to execution and resource constraints	Multiple-choice and ranking questions	Statistical summaries and frequency analysis
User Needs & Expectations	Capture qualitative insights on pain points and service gaps	Open-ended questions	Thematic coding and sentiment analysis
Future Opportunities	Explore receptivity to innovation and test responses to potential scenarios	Scenario-based prompts	Scenario comparison, clustering, and trend mapping

To ensure balanced representation, a weighted averaging method was applied to the questionnaire results. Industry perspectives (50%) carried the most weight due to their direct market relevance, while academia (30%) contributed scientific rigor and long-term insights. Other stakeholders, government, regulators, associations, unions, and non-profits (20%), added policy and societal

perspectives critical for adoption and legitimacy. This weighting preserved analytical integrity, ensuring no single group dominated results, while keeping the roadmap both practical and evidence-based.

The applied weighted average formula follows:

Formula

$$\text{Weighted Average} = (I \times 0.5) + (A \times 0.3) + (O \times 0.2)$$

Where:

- I = Industry score
- A = Academia score
- O = Others' score

2.2.3 Comparative Analysis of Global Innovation Centres

To ground CIC's work in a global context, benchmarking was conducted with more than forty innovation centres worldwide. This comparative exercise provided an external reference for what constitutes best practice in governance, service models, and research prioritization.

Ten comparative dimensions were applied to assess international centers against Alberta's priorities and constraints. These included:

1. **Relevance to Alberta's construction industry**: Do the outcomes align with Alberta's sector needs and realities?
2. **Industry collaboration**: Can the center partner effectively with firms across the value chain?
3. **Economic impact**: Does it generate measurable value in cost savings, competitiveness, or growth?
4. **Focus on sustainability**: How strongly are decarbonization and environmental performance integrated?
5. **AI and digital innovation**: To what extent are advanced digital tools embedded in delivery?
6. **Policy and standards**: Does it influence regulatory frameworks or support policy alignment?
7. **Regional collaboration**: Can it connect with Alberta's institutions and respond to local challenges?
8. **Funding and economic models**: Is its business model resilient, diversified, and scalable?
9. **Track record and impact**: What results has it delivered at scale?
10. **Workforce development**: Is it addressing skills gaps and building future capacity?

Each center was assessed against these dimensions through a combination of research, structured scoring (1–10 alignment), and qualitative profiles. The centers were then grouped into regional applied hubs, national drivers, global networks, specialized excellence centers, and corporate or hybrid labs.

Around the world, innovation centers illustrated in Figure 4, are tackling many of the same challenges that Alberta faces: sustainability, digital transformation, workforce shortages, and the pressure to build faster, smarter, and greener. Our review of forty-one leading centers, provides insight into how others are approaching these issues, and where Alberta can learn, adapt, and lead.

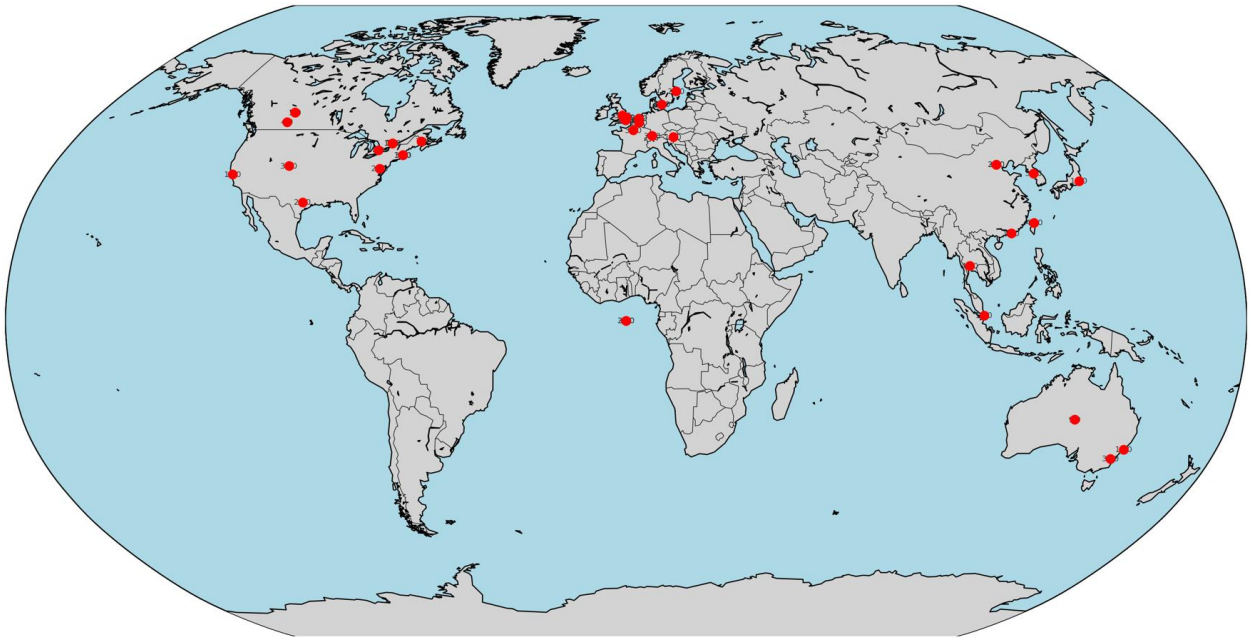


Figure 4. Global Distribution of Leading Construction Innovation and Research Centers

2.2.4 Literature and Evidence Review

Canada's national direction provides the backdrop for CIC's roadmap. The NRC 2024–2029 Strategic Plan positions public research as a driver of productivity, decarbonization, and commercialization, with measurable outcomes and industry pull. The NRC Digitalization and Productivity R&D Roadmap (2024) makes clear that productivity gains will come from interoperable data, model-based delivery, and repeatable digital workflows. The companion openBIM roadmap (NRC 2024) translates this into standards, common data environments, and exchange rules that allow seamless information flow across the sector. Together, these national signals justify CIC's choices: embedding AI and data interoperability as core infrastructure, linking funding to measurable productivity gains, and making openBIM the "default" in pilots to ensure scalability. Moreover, the NRC openBIM and digitalization roadmaps align with

international practices on open standards and lifecycle analytics. They argue for neutral formats, exchange requirements, and data governance, enabling portability across owners and municipalities. For CIC, adopting openBIM in pilots ensures results scale province-wide and simplifies training through shared workflows.

University of Alberta scholarship connects this national vision to CIC's operating model. Golabchi, Mohamed, Robinson Fayek & AbouRizk (CRC 2024) show how academia–industry collaboration achieves impact through co-defining problems, applied prototypes, and clear lab-to-site pathways. Fayek & Golabchi (2022) provide the metrics framework, alignment, feasibility, partner demand, knowledge transfer, and scale-up potential, that underpins CIC's evaluation system. These works support CIC's proposal co-development, advisory services, and built-in reporting, ensuring impact is designed from the start rather than assessed after the fact.

The international literature on roadmapping under uncertainty reinforces CIC's adaptive structure. Siebelink, Halman & Hofman (2016) show that scenario-driven roadmaps hedge against uncertainty by stress-testing priorities against divergent futures, justifying CIC's annual refresh and rolling activation windows. Simonse, Hultink & Buijs (2015) emphasize co-creation and translation into tools and governance rhythms, while Burian, Rogerson & Maffei (2010) stress early stakeholder engagement, milestone-linked decisions, and visible progress reporting. These studies validate CIC's phased implementation, use of decision checkpoints and KPIs, and commitment to public dashboards.

Digitalization research underscores that transformation requires systems thinking, not isolated tools. Kazi, Aouad & Baldwin (2009) and Kazi et al. (2007) argue foresight and ICT roadmaps deliver value only when paired with interoperability and process change. Kim et al. (2009) extend this with an interdisciplinary R&D roadmap linking IT with contracts, training, and organizational practices. These sources support CIC's choice to treat AI/digital as a cross-cutting enabler, integrated into safety, procurement, workforce, and supply chains, while pairing pilots with procurement guidance, contract language, and training modules to drive adoption.

The CIB corpus provides domain-specific scaffolding. *Information Integration in Construction (Publication 417, 2019)* anchors CIC's push for data standards and CDEs; *Integrated Design and Delivery Solutions (Publication 370, 2013)* validates early contractor involvement and collaborative contracts; *Intelligent and Responsive Buildings (Publication 415, 2018)* supports digital twins and performance monitoring; *Offsite Production and Manufacturing (Publication 372, 2013)* and the CIB Global Report (2023) inform modular delivery and logistics; *Safety and Health in Construction (Publication 376, 2020)* underpins safety-by-design and analytics for proactive risk management. Collectively, these works justify CIC's thematic priorities and the use of pilots and living labs for demonstration.

Climate research strengthens CIC's sustainability logic. Sim et al. (2023) highlights shifting environmental baselines, flood, fire, cold climate, and permafrost risks, making adaptation an

engineering requirement. This informs CIC's choice to couple decarbonization with resilience in long-horizon themes and to frame sustainability as risk and cost mitigation, not just compliance.

In sum, the literature base supplies CIC with operating principles. National strategies demand measurable productivity and decarbonization; U of A scholarship provides the collaboration and metrics architecture; roadmapping research guides adaptability; digitalization studies stress interoperability; CIB publications define the capability stack; and climate science embeds resilience. The roadmap translates these threads into five commitments: treat AI/data as shared infrastructure; make sustainability a mandate; design projects with adoption in mind; diversify funding for shared ownership; and publish transparent evidence so success compounds.

3 Results and Discussion

3.1 Stakeholder Priorities

The stakeholder engagement process produced recurring themes that guided the roadmap design.

Table 3 presents a result-based matrix where stakeholders ranked each theme's importance across short (S), medium (M), and long (L) time horizons, along with a "Not Applicable" (NA) option. This dataset reveals how stakeholders perceive relative urgency and impact:

- **Short-term**: Health, Safety, and Risk Management (32 votes) and Advanced Construction Materials (27 votes) are clear immediate priorities. Workforce Development (22) and Energy-Efficient Systems (22) also score strongly, underlining urgent workforce, safety, and sustainability challenges.
- **Medium-term**: Sustainable and Net-Zero Construction (28 votes) and Digital Transformation (26) dominate this area, reflecting the sector's recognition that decarbonization and digital tools are essential but require careful scaling. Performance Monitoring (23) and Climate Adaptation (21) also cluster here, signaling mid-range readiness.
- **Long-term**: Advanced Construction Technologies (23), Policy and Regulation (21), and Decarbonization (22) all scored strongly in long term, due to their structural complexity and regulatory dependencies.
- **Ambiguous/NA responses**: Human-Centric Design had the highest NA rating (22), suggesting uncertainty among stakeholders about how to operationalize this theme relative to other priorities.

Table 3. Sequencing Research Priorities Across Horizons

Importance	Priority Research Themes	S	M	L	NA
M	Sustainable and Net-Zero Construction Management	11	28	18	15
M	Digital Transformation in Construction	17	26	17	12
L	Advanced Construction Technologies	15	20	23	14
S	Workforce Development and Management	22	18	15	17
S	Advanced Construction Materials and Applications	27	10	20	15
L	Policy and Regulation in Construction	15	17	21	19
S	Health, Safety, and Risk Management	32	19	15	6
S	Energy-Efficient Systems and Construction Practices	22	15	20	15
L	Decarbonization of Construction Processes	17	20	22	13
S	Construction Supply Chain Optimization	21	19	20	12
M	Performance Monitoring and Data-Driven Decision Making	14	23	16	20
M	Climate Adaptation and Disaster-Resilient Construction	14	21	19	18
NA	Human-Centric Design and Well-Being in Built Environments	14	19	17	22
S	Lean Construction and Manufacturing	21	18	17	16
S	Automated and Generative Design in Construction	24	20	14	14
S	Smart Procurement and Contract Management in Construction	23	16	17	16

S: Short, M: Medium, L: Long, NA: Not Applicable

This matrix demonstrates broad alignment on safety, workforce, and materials as immediate concerns, while sustainability, digitalization, and policy reforms require medium- to long-term planning.

3.1.1 Large Industry Firms

Large firms emphasized the urgency of scaling innovation quickly. They view CIC as a platform to de-risk emerging technologies, digital twins, advanced materials, AI-enabled safety, and to

accelerate adoption across the supply chain. They stressed the need for CIC to act not only as a convener but as an implementation partner, ensuring that pilots move beyond proof of concept.

- "*We don't need more studies, we need support in getting innovations out of the lab and into projects*."
- "*CIC should help us reduce the risk of being first movers; shared pilots can spread costs and build confidence*."
- "*Scaling innovations isn't about a single company, it's about shifting the whole industry together*."

3.1.2 SMEs and Trade Contractors

SMEs repeatedly underlined accessibility. They value CIC's neutrality and resources but worry about being left behind if services primarily target larger players. Practical, low-barrier supports, like access to knowledge databases, training workshops, and grant facilitation, were seen as essential. SMEs also expressed enthusiasm for demonstration projects, provided that participation is affordable and clearly beneficial.

- "*If we can't afford to join pilots or access training, then innovation becomes something for others, not for us*."
- "*Our margins are tight; we need supports that don't add new overhead*."
- "*Give us hands-on demonstrations, seeing a tool in action makes adoption more realistic*."

3.1.3 Academia

Academic stakeholders emphasized the need for stronger industry linkages. They welcome CIC's role in bridging research with practice but noted that alignment on project timelines and intellectual property remains a challenge. Many advocated for co-designed research projects, embedded graduate internships, and reciprocal exchange between laboratories and job sites. Academics also highlighted the need to bridge fundamental research areas with applied, industry-ready solutions, particularly in advanced materials, AI-enabled design, and workforce development.

- "*Research has to be framed around industry timelines, or it risks becoming irrelevant*."
- "*Students in the field learn faster than in the lab, CIC can facilitate that exchange*."
- "*IP concerns are real, but shared frameworks could unlock far more collaboration*."

3.1.4 Government and Public Agencies

Government actors highlighted CIC's role in policy alignment and regulatory foresight. They see CIC as a mechanism to provide evidence-based recommendations on safety codes, digital standards, and decarbonization pathways. Funding agencies also emphasized CIC's potential to coordinate proposals and reduce duplication of effort. These respondents further highlighted the government's dual role as funder and rule-maker. Their priorities included clearer procurement processes, regulatory agility to support innovation adoption, and alignment with public-sector goals such as climate commitments.

- "*We need evidence before we can move policy, CIC can be the trusted source*."
- "*Policy windows are short; industry data through CIC could accelerate change*."
- "*If CIC can coordinate proposals, it will save both time and public dollars*."

3.1.5 Non-Profits and Associations

Non-profits and sector associations placed the strongest emphasis on workforce development and inclusion. They advocated for outreach to underrepresented groups, Indigenous contractors, and rural trades, as well as for programs that combine technical upskilling with broader employability and leadership skills. These groups also called for stronger training pathways, better worker safety, and expanded engagement with underrepresented groups, including Indigenous contractors and rural trades.

- "*If innovation leaves people behind, then it has failed its purpose*."
- "*Rural and small-town contractors need to be part of the conversation, not just big-city firms*."
- "*Inclusion means more than recruitment, it means supporting long-term careers*."

3.2 Strengths and Barriers in Alberta's Innovation Ecosystem

While Alberta possesses strong engineering expertise and industry networks, several systemic gaps emerged:

- **Digital Adoption Lag:** Compared to international peers, Alberta firms adopt digital tools more slowly, particularly among SMEs.

- **Weak Commercialization Pathways:** Promising research often fails to move beyond pilot stages due to lack of funding, regulatory hurdles, or limited scaling support.
- **Fragmented Collaboration:** Research, government, and industry efforts are often siloed, limiting cross-sector synergies.
- **Evaluation Blind Spots:** Traditional academic measures (e.g., publications) are insufficient for capturing adoption impact.
- **Underdeveloped Knowledge Hubs:** Stakeholders cited difficulty accessing centralized, practical research outputs for implementation.

3.2.1 Strengths and Opportunities

At the same time, Alberta has significant assets and opportunities to leverage:

- **Strong Academic Base:** The University of Alberta and partner institutions provide global-caliber expertise in construction materials, digital innovation, and sustainability.
- **Industry Willingness to Partner:** Interviews revealed openness to co-develop solutions, particularly in areas of workforce development and modular construction.
- **Policy Alignment:** Provincial and federal priorities around decarbonization and productivity create fertile ground for applied research funding.
- **Growing Demand for Sustainable Construction:** Both regulatory pressures and market expectations are driving opportunities in net-zero building and resilient infrastructure.
- **Emerging Start-up Ecosystem:** Construction technology start-ups are beginning to flourish, offering new opportunities for venture partnerships.

3.2.2 Barriers to Innovation

Stakeholders consistently identified barriers that impede innovation adoption:

- **High Implementation Costs**: upfront investments deter firms, especially SMEs.
- **Resistance to Change**: entrenched practices and risk aversion slow adoption.
- **Regulatory Rigidity**: codes and standards often lag behind technological advances.
- **Workforce Gaps**: insufficient training and skills to implement new technologies.
- **Funding Constraints**: lack of financial support for scaling innovation.

- **Knowledge Transfer Challenges**: poor communication between academia and industry.

3.3 Benchmarking Against Global Centres

An analysis of more than forty international innovation centers and fifty research publications and roadmaps, reveals distinct regional patterns. For instance, Canadian and American centres that tend towards an industry focus (e.g. the Construction Technology Centre at SAIT, Alberta Innovates, the Centre for Integrated Facility Engineering at Stanford), demonstrate how close collaboration between industry and academia drives productivity gains, digital construction adoption, and training for future professionals. These models show the power of linking applied research directly to construction practice, often through public-private partnerships.

European centres, which tend to prioritize sustainability (e.g. the Graz Centre of Sustainable Construction, TU Delft's Faculty of Architecture and Built Environment) are leaders in integrating circular economy principles and net-zero commitments into construction practice. Similarly, the BRE Innovation Park in the UK acts as a live demonstration hub, where sustainable materials and technologies are showcased in real-world environments. European centers also excel at policy influence: they don't just develop technologies, they shape building codes, procurement practices, and funding models to accelerate adoption.

Many Asian centres (such as the Korea Institute of Civil Engineering and Building Technology, the Institute of Industrial Science at the University of Tokyo) are pioneers in robotics, AI-driven design, and smart infrastructure. Singapore's Future Cities Laboratory illustrates how digital twins, AI, and climate-resilient urban planning can converge to create future-ready cities. These centers provide Alberta with a glimpse of how AI and automation can be integrated across the construction lifecycle, from planning to operations.

Beyond these regional clusters, there are also global networks that connect knowledge and set international agendas. Organizations such as the International Council for Research and Innovation in Building and Construction (CIB), the World Green Building Council (WGBC), and the Global Alliance for Buildings and Construction (Global ABC*)* provide platforms where ideas are exchanged, standards are debated, and global momentum builds around sustainability, safety, and digitalization. For Alberta, participating in these networks offers visibility, credibility, and access to cutting-edge practices.

Despite the diversity of these centres, three common threads are clear. First, the most successful centers create structured partnerships between industry, academia, and government, the so-called "triple helix." Second, AI and digital technologies are no longer outliers; they are becoming core infrastructure for how construction research is conducted and applied. And third, sustainability is shifting from being a competitive advantage to being a baseline expectation.

For the CIC, this global overview highlights both inspiration and opportunity. Alberta is already strong in applied industry collaboration and workforce development, but lags behind global leaders in integrating AI and in making sustainability a mandated, system-wide principle. Learning from peers abroad, the CIC can position itself not only as a local enabler but as a global contributor to the future of construction.

When benchmarked against these international and local centers, six dimensions stand out as critical for Alberta's construction innovation: collaboration, AI adoption, sustainability, funding models, workforce development, and policy influence. Alberta shows clear strength in collaboration and workforce development, with strong industry–academia ties and hands-on training traditions. AI integration and funding diversification remain the biggest gaps, where global leaders are advancing faster. Alberta has promising initiatives in sustainability and policy influence, but lacks a mandate-driven approach that links decarbonization and competitiveness.

This analysis suggests that the solution for Alberta is to embed AI as a cross-cutting layer in pilots, elevate sustainability to a mandate posture in select portfolios, and launch tiered membership and matched-funding models to build resilience. By leveraging collaboration and workforce as springboards (while addressing AI, funding, and sustainability gaps) the CIC can sharpen Alberta's position as a global leader in construction innovation.

By representing alignment along with gaps, the heatmap in Figure 5Figure *7* identifies a pragmatic path. Workforce and collaboration can serve as launchpads, while AI adoption and funding endurance call for concerted effort if Alberta is to close the gap with global leaders. Policy and sustainability, however, are transition opportunities, areas where strategic intervention could quickly enhance Alberta's position. Collectively, these findings sharpen the CIC's strategic focus, specifying not only where Alberta is currently strong, but where focused investment will yield maximum international impact.

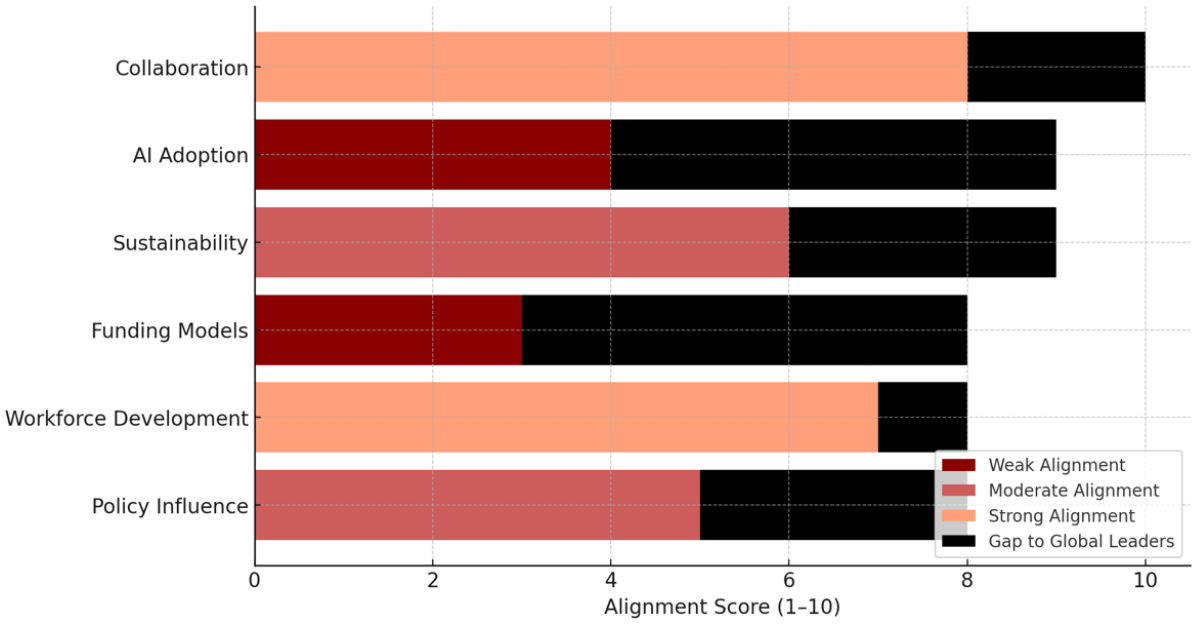


Figure 5. Alberta Relevance Heatmap

3.4 Key Needs, Gaps, and Opportunities

3.4.1 Sector Needs

Although stakeholder groups brought distinct perspectives, five cross-cutting needs consistently emerged across consultations. These needs represent shared challenges that now form the basis for the CIC's service design and research roadmap:

1. **Accessibility for SMEs and trades**: ensuring that CIC's services, training, and pilot projects remain affordable, inclusive, and responsive to the realities of smaller firms and trade contractors.
2. **Scalable pilot projects**: moving beyond isolated demonstrations to develop pilots that can be replicated, adapted, and adopted across the sector as a whole.
3. **Workforce integration**: embedding upskilling, inclusivity, and employability into every innovation initiative to ensure that technological change is matched by human capital development.
4. **Commercialization and international linkages**: strengthening pathways that connect Alberta-based firms to global innovation networks, markets, and partnerships.
5. **Transparent impact reporting**: committing to regular publication of clear data that demonstrates CIC's value, effectiveness, and outcomes to all stakeholders.

These findings were reinforced by Likert-scale feedback data, where *implementation costs, resistance to change,* and *funding gaps* scored consistently as the top three barriers.

3.4.2 Organizational Opportunities for the CIC

The comparative analysis of international centers, reinforced by stakeholder input, also highlights a set of practical, transferable lessons for Alberta's construction innovation ecosystem:

Leverage Existing Strengths: The CIC should leverage existing clusters where collaboration is already strong, such as industrial projects, cold-climate housing, and municipal retrofits.

Embed AI and Data: AI and interoperable data systems must be treated as invisible infrastructure, embedded across the project lifecycle to ensure measurable, comparable outcomes.

Diversity Funding: Resilience requires blending public support, tiered memberships, industry contributions, and commercialization revenues. Effective centers structure collaboration deliberately, integrating regulators and policymakers into pilots to ensure innovations are "regulation-ready."

Publish: Successful centres share results proactively through dashboards, playbooks, and templates, building trust and making adoption easier.

3.4.3 Gaps in Alberta's Construction Innovation Sphere

Through consultations, interviews, and benchmarking, several clear gaps have surfaced:

- **Alberta is rich in technical know-how but fragmented in execution.** Stakeholders are ambitious, but duplication and lack of coordination limit impact.
- **Adoption is uneven.** Large firms often pilot innovations, while SMEs and trades remain cautious or lack capacity to participate.
- **Regulatory and commercialization bottlenecks persist.** Promising pilots fail to scale without clear approval pathways or financing mechanisms.
- **Neutral facilitation is in high demand.** Stakeholders consistently endorsed CIC's role as an impartial convenor and platform builder.
- **Practicality beats aspiration.** Alberta's industry partners want immediate value, applied demonstrations, shared data, and streamlined processes, over abstract research.

4 Research Roadmap

The CIC's refreshed research roadmap is composed of five dimensions:

- **Core Priorities ("WHAT"):** These 15 research themes describe *what* CIC and partners should work on—everything from sustainability to digital transformation and workforce management.
- **Delivery ("HOW"):** The 10 enablers define *how* the research and innovation will be delivered, scaled, and embedded. They capture everything from funding to partnerships and knowledge transfer.
- **Evaluation:** The 9 evaluation criteria ensure that initiatives are not just funded but assessed against practical adoption, scalability, innovation, and value. This is where metrics and dashboards link directly to project performance.
- **Collaboration:** Collaboration defines who works with whom and how across the ecosystem. It emphasizes shared ownership between industry, academia, government, and technology partners, ensuring that innovations are co-developed rather than siloed.
- **Barriers:** Finally, the 6 barriers highlight the *real-world risks* that must be managed to avoid failures in uptake, from cost hurdles to regulatory inertia.

4.0 Roadmap Foundation

The roadmap is shaped by six essential components: Research, Service, Measure, Demonstrate, Collaborate, and Finance.

Research anchors the roadmap, ensuring priorities address the most pressing challenges and opportunities in Alberta's construction ecosystem. **Service** offers tangible support, from proposal development to prototyping facilities and commercialization pathways. **Measure** refers to tracking progress and impact, and provides transparency and accountability. Through robust performance indicators, stakeholder feedback loops, and evaluation frameworks, measurement is integrated as an iterative process, keeping both individual projects and CIC itself aligned with objectives.

Demonstrate ensures that innovations are tested and showcased in real-world settings, such as pilots, living labs, and demonstration platforms, which help build credibility with partners, policymakers, and the public. **Collaborate** formalizes partnerships between academia, industry, and government to reduce fragmentation and foster co-development of solutions. Lastly, **Finance** underpins the roadmap's sustainability by promoting diversified funding models that combine public support, industry contributions, and commercialization revenues, ensuring that CIC can maintain momentum over the long term.

Together, these six elements (Figure 6) form the foundation of the roadmap, turning research priorities into actionable, measurable, and sustainable outcomes.

Figure 6. Foundational Elements of the Methodology

4.1 The "WHAT": Priority Research Themes

The priority research themes have been shaped through extensive stakeholder consultations, global benchmarking of leading innovation centers, and the specific needs of Alberta's economy, environment, and workforce. They provide the foundation for guiding research investments, industry collaborations, and long-term impact.

The updated themes expand beyond the previous seven-domain model to encompass fifteen interconnected areas:

- **Sustainable and Net-Zero Construction Management** – advancing methods, practices, and business models that drive low-carbon and net-zero outcomes in construction projects.
- **Digital Transformation in Construction** – accelerating adoption of digital tools, data platforms, and integrated systems such as BIM, digital twins, and AI.
- **Advanced Construction Technologies** – enabling automation, robotics, and novel methods that reshape productivity and safety.
- **Workforce Development and Management** – addressing skills gaps, training needs, and talent pipelines across trades, professional roles, and management.
- **Advanced Construction Materials and Applications** – fostering research and deployment of high-performance, sustainable, and resilient materials.

- **Policy and Regulation in Construction** – informing codes, standards, and regulatory frameworks that enable innovation while safeguarding public interest.
- **Health, Safety, and Risk Management** – embedding proactive safety culture, risk prediction, and occupational health into every stage of the construction lifecycle.
- **Energy-Efficient Systems and Construction Practices** – improving building and infrastructure performance while lowering lifecycle energy demand.
- **Decarbonization of Construction Processes** – reducing embodied carbon through cleaner processes, supply chains, and design choices.
- **Construction Supply Chain Optimization** – streamlining logistics, procurement, and material flows for efficiency, resilience, and sustainability.
- **Performance Monitoring and Data-Driven Decision Making** – embedding metrics, sensors, and analytics to guide continuous improvement.
- **Climate Adaptation and Disaster-Resilient Construction** – designing and building infrastructure that withstands climate extremes and natural hazards.
- **Lean Construction and Manufacturing** – adopting lean principles and modular/off-site practices to increase productivity and reduce waste.
- **Automated and Generative Design in Construction** – leveraging AI and algorithmic approaches to optimize design and resource use.
- **Smart Procurement and Contract Management in Construction** – modernizing procurement and contracts to support collaboration, innovation, and transparency.

These sixteen priority themes balance immediate practical needs with future-oriented challenges, ensuring the roadmap supports both Alberta's near-term competitiveness and its long-term leadership in sustainable, resilient, and human-centered construction.

These priority themes may also be divided into short-, medium-, and long-term objectives:

- **Short-term priorities** are those that can deliver immediate benefits to Alberta's construction sector. These include Workforce Development and Management, Advanced Construction Materials, Health and Safety, Energy-Efficient Systems, Supply Chain Optimization, Lean Construction, Automated and Generative Design, and Smart Procurement. Together, these eight themes represent areas where the sector is already mobilized and where interventions can yield quick productivity and safety gains.
- **Mid-term priorities** shift attention toward systemic improvements and resilience. Sustainable and Net-Zero Construction, Digital Transformation, Performance Monitoring and Data-Driven Decision Making, and Climate Adaptation emerge here, requiring

sustained investment and coordinated approaches. These themes balance implementation feasibility with broader sector-wide transformation.

- **Long-term priorities** address structural shifts and regulatory alignment. Advanced Construction Technologies, Policy and Regulation, and Decarbonization of Construction Processes will demand new capacities, international alignment, and structural policy frameworks. Their inclusion reflects recognition that transformational impact requires long-term horizon planning.

This sequencing illustrates CIC's balanced strategy: quick wins that build momentum, medium-term transformations that embed resilience, and long-term shifts that secure Alberta's leadership position.

Figure 7. Sequencing of Research Priorities Across Horizons

4.2 The "HOW": Delivery Enablers

If the "WHAT" defines the priority research themes, the "HOW" provides the mechanisms that enable these themes to move from concept to real-world impact. These delivery enablers represent the practical pathways through which ideas are tested, validated, and scaled within Alberta's construction innovation ecosystem. The updated framework identifies ten complementary enablers:

1. **Government-Funded Research:** Public investment remains the cornerstone for early-stage, high-risk research. Targeted government funding de-risks innovation, supports pilot initiatives, and signals policy alignment with long-term provincial and national objectives.

2. **Academic Collaboration:** Partnerships with universities and research institutes ensure that cutting-edge science and engineering are translated into applied solutions. Academic collaborations bring rigor, access to laboratories, and opportunities for training the next generation of talent.

3. **Industry Partnerships:** Direct involvement of contractors, suppliers, and owners ensures that innovations address genuine market needs. Industry partners provide test beds, practical feedback loops, and co-investment that accelerates adoption and scalability.

4. **In-House R&D**: Many firms rely on internal research and development to maintain competitiveness. Supporting and aligning these in-house efforts with broader CIC priorities creates synergies and avoids duplication, while fostering innovation tailored to organizational needs.

5. **Pilot Projects & Prototyping**: Demonstrating feasibility in real-world conditions is a critical step toward adoption. Pilot projects and prototypes serve as proof-of-concept platforms, building confidence in new approaches while generating measurable performance data.

6. **Knowledge Dissemination & Internal Workshops**: Workshops, seminars, and technical briefs ensure that findings are communicated effectively across organizations. Knowledge dissemination helps overcome the "last mile" problem where innovations fail to spread beyond initial project sites.

7. **Commercialization and Technology Transfer**: Scaling research outputs into market-ready products and services requires structured commercialization pathways. Technology transfer offices, intellectual property strategies, and startup incubation are essential for bridging the gap between lab and market.

8. **Collaborative Platforms and Knowledge Hubs**: Shared platforms allow multiple stakeholders to co-develop solutions, exchange lessons, and pool resources. Digital hubs and living labs serve as convening spaces where ideas are refined collectively and aligned with broader system-level change.

9. **Training and Capacity Building**: Workforce readiness is a decisive factor in adoption. Training programs, apprenticeships, and micro-credentials build the skills necessary to operate and maintain new technologies, ensuring long-term sustainability of innovation investments.

10. **Policy and Regulatory Engagement**: Regulatory frameworks can accelerate—or hinder—innovation. Structured engagement with policymakers ensures that codes,

standards, and permitting processes evolve alongside technological advances, reducing uncertainty for innovators and adopters alike.

Figure 8 presents a heatmap illustrating the relationship between the construction sector's priority research themes ("WHAT") and the delivery enablers ("HOW"). Each cell contains a priority score on a 1–5 scale, representing the combined strength of (1) the importance of the research theme and (2) the applicability and feasibility of a specific delivery mechanism. Darker shades indicate higher strategic priority, highlighting areas where strong alignment creates immediate opportunity for impact, investment, or collaboration. Lighter shades represent lower current emphasis, often where feasibility is constrained or stakeholder pull is still emerging.

The scoring model integrates multiple stakeholder inputs:

- theme importance was derived using weighted S–M–L–NA ratings collected in the survey,
- delivery enabler weights were developed through workshops and engagement data, and
- final scores were calibrated through an applicability–feasibility lens to ensure realistic differentiation across the matrix.

This approach produces a balanced distribution that reveals natural clusters of opportunity rather than uniformly high or artificially inflated scores.

The heatmap helps CIC and partners identify:

- Immediate opportunities where both theme importance and delivery feasibility are high.
- Medium-term pathways where strategic alignment is strong but delivery mechanisms require development.
- Long-term or emerging areas where research interest exists but enabling conditions are not yet mature.

Examples that reflect the current scoring distribution include:

1. **Workforce Development × Industry Partnerships (Score: 3):** This moderate-to-strong score reflects the natural alignment between workforce development and industry involvement, particularly through employer-led training, co-op programs, and apprenticeship collaboration. While highly relevant, feasibility constraints, such as uneven capacity across firms, moderate the overall score.

2. **Lean Construction × In-House R&D (Score: 4):** Lean methods often require internal testing, workflow redesign, and process optimization, making In-House R&D a strong enabler. The darker shade signals strong feasibility for firms to trial lean methods internally before broader sector adoption.

3. **Policy and Regulation × Training & Capacity Building (Score: 2):** This lighter cell indicates that while training is important, it is not the primary mechanism through which regulatory innovation is advanced. Stakeholders see stronger pathways through Policy Engagement or Knowledge Dissemination, which score higher for this theme.

4. **Generative Design × Policy Engagement (Score: 4):** This strong score reflects growing recognition that emerging AI-driven design methods require updated regulatory frameworks, including digital permitting, automated compliance checking, and model-based submissions. The darker shade indicates alignment between innovation readiness and policy evolution needs.

5. **Decarbonization × Delivery Enablers (Mostly Scores of 2–3):** Decarbonization shows a consistent mid-range pattern. Stakeholders view the theme as important, but many delivery mechanisms, particularly Pilots, Commercialization, and Platforms, require substantial development before decarbonization innovations can scale effectively. The resulting lighter-to-moderate shades reflect an area where interest is rising but enabling pathways remain under construction.

6. **Health & Safety (Corrected Distribution: 3–4):** Health & Safety remains one of the highest-priority themes, but the revised distribution avoids artificially high uniformity. Strong scores appear for Gov-Funded Research, Academic Collaboration, Industry Partnerships, and Policy Engagement (each 4), while Pilots, Training, Knowledge, and Platforms appear at moderate levels (3). This produces a realistic pattern that recognizes both the importance of H&S and the varied maturity of delivery mechanisms.

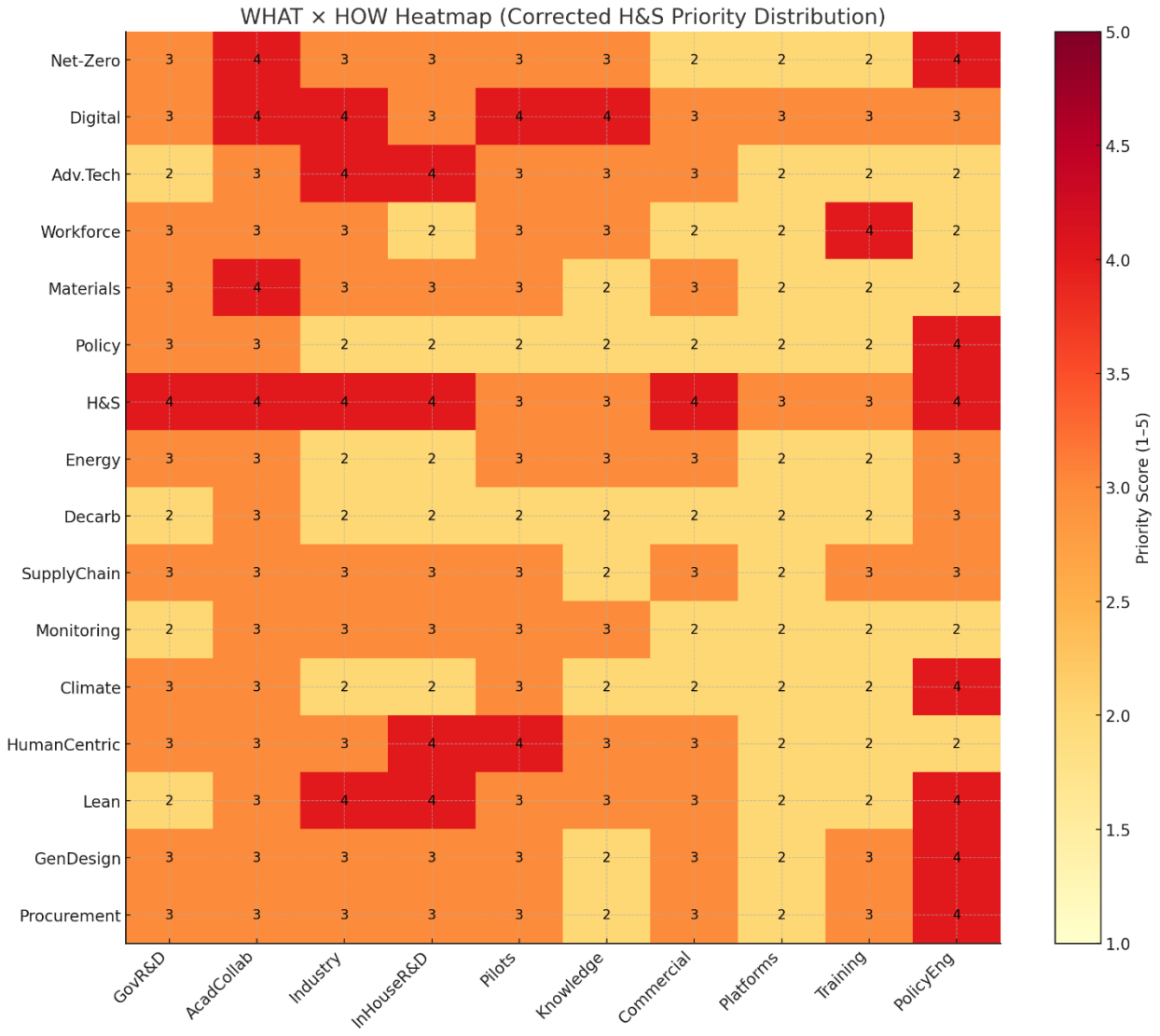


Figure 8. WHAT × HOW Categories Heatmap

Together, these insights demonstrate how the heatmap functions as a **decision-support tool**:

- focusing attention on where the ecosystem is ready to mobilize now,
- clarifying where additional capacity or investment is required, and
- ensuring that research initiatives, pilots, and partnerships are aligned with the sector's real-world conditions.

4.3 Evaluation

To ensure that the roadmap remains both rigorous and actionable, each proposed initiative is assessed using a structured set of evaluation methods. These methods provide a consistent framework for comparing ideas, prioritizing resources, and ensuring alignment with CIC's mandate.

As part of a transparent and defensible process for project selection, providing decision-makers with both quantitative and qualitative insights, each proposed project is subject to the following 9 evaluation criteria:

1. **Practical Implementation**: The technical feasibility, cost efficiency, and regulatory readiness of a project.

2. **Industry Impact**: The extent to which a project addresses pressing sectoral challenges such as productivity, safety, or sustainability

3. **Scalability**: Whether successful pilots can expand to regional or national adoption

4. **Innovation**: The degree of novelty and differentiation compared to existing practices.

5. **Collaboration Potential**: How effectively the project fosters partnerships across academia, industry, and government

6. **Knowledge Transfer**: The project's ability to generate replicable learning

7. **Economic Value**: Which assesses potential returns on investment through cost savings, job creation, or export potential.

8. **Sustainability Alignment**: The extent to which it supports decarbonization and resilience goals

9. **Long-Term Strategic Fit**: whether the project contributes to Alberta's future competitiveness within global construction innovation.

4.4 Barriers

While evaluation methods focus on opportunities, the CIC also examines barriers that may impede project success. Recognizing these obstacles early allows mitigation strategies to be built directly into the roadmap.

1. **High Implementation Costs**: The most frequently cited obstacle, particularly for technologies such as modularization, digital twins, or advanced materials.

2. **Resistance to Change**: Organizational culture and risk aversion slow adoption.

3. **Regulatory Delays**: Existing codes and approval processes often lag behind technological advancement.

4. **Limited Industry Collaboration**: This can reduce economies of scale and shared learning.

5. **Data Interoperability Gaps**: These can undermine the effective use of digital tools.

6. **Workforce Capacity Constraints**: These represent a critical challenge, with shortages of skilled labor and limited digital literacy across the sector.

7. **Uncertain Market Demand:** Companies hesitate to invest without clear signals of uptake.

8. **Short Planning Horizons:** The tendency to prioritize immediate cost savings over long-term transformation.

By mapping these eight barriers alongside evaluation methods, CIC ensures that its roadmap is both aspirational and grounded. Every initiative is therefore designed not only to score highly on impact and scalability but also to anticipate and address the real-world challenges of adoption.

4.5 Industry Impact Assessment Criteria

To ensure research activities generate meaningful benefits across Alberta's construction ecosystem, all project proposals will be evaluated against six criteria that reflect the project's proposed impact on the industry. In addition to providing a unified evaluation framework, these assessments strengthen the CIC's accountability for measurable outcomes and directly align CIC research with industry partner priorities.

These criteria are based on stakeholder input and supported by benchmarking research. Researchers submitting proposals to the CIC are expected to demonstrate if and how their proposed projects address each of the six criteria and by what measurable outcomes (Table 4).

Table 4. Impact Criteria and Potential Measurable Outcomes.

	Impact Criteria	**Potential Measurable Outcomes**
1	Improved productivity	• reduced cycle times • improved coordination • fewer delays and rework events • greater labour and process efficiency
2	Improved cost efficiency	• reduced cost overruns

		• improved budgeting and forecasting • lifecycle cost efficiencies • more consistent delivery performance
3	Reduced resources and waste	• minimize material waste on-site • reduce rework • eliminate redundant steps and coordination inefficiencies • improve equipment and labour utilization
4	Increased workforce capacity and skills development	• new training requirements • new skill pathways • upskilling and reskilling opportunities • equitable access to emerging roles
5	Improved safety and wellbeing	• reducing incidents and near misses • improving ergonomic and physical safety • supporting mental and physical well-being • enhancing risk prediction and mitigation
6	Improved scalability and replicability	• mechanisms for replication • barriers to adoption for SMEs • alignment with procurement or regulatory frameworks • potential for multi-project or multi-owner impact

Note: potential measurable outcomes are not exhaustive.

4.6 Illustrative Projects by Category

The framework comes to life when the intersections between priority research themes (the "WHAT") and delivery enablers (the "HOW") are translated into practical initiative. Table 5 illustrates this process through a set of representative projects, demonstrating how the roadmap

moves from abstract priorities to actionable outcomes. In this table, each category represents an intersection between one research priority (the 'WHAT') and one delivery enabler (the 'HOW'), illustrating how specific combinations translate into practical, Alberta-focused project examples. The examples are not exhaustive but serve to show the breadth of possibilities, from advancing workforce capacity and digital adoption to accelerating low-carbon construction and modernizing regulatory pathways.

What stands out across the spectrum is the diversity of innovation pathways: some projects emphasize near-term implementation through training or pilot facilities, while others chart medium- to long-term shifts in materials, data integration, or governance. Collectively, the examples highlight Alberta's ability to leverage both its strengths (such as cold-climate expertise and strong apprenticeship networks) and its emerging opportunities (such as digital twins, AI for safety, and circular economy approaches).

Table 5. Example Projects by Category

Innovation Theme × Delivery Mechanism (Category)	**Focus**	**Illustrative Projects (Alberta Context)**
Workforce × Training / Engagement	Building human capital and addressing skills shortages	• Apprenticeship-linked micro-credentials for modular and prefab construction. • Indigenous workforce inclusion programs co-developed with local communities. • Safety bootcamps using VR/AR to simulate high-risk site conditions. • Reverse mentorship pilots pairing younger digital-native staff with senior supervisors.
Digital Transformation × Technology / Pilots	Embedding digital tools and AI into construction workflows	• Province-wide Digital Twin Hub for major infrastructure projects. • AI-driven safety monitoring systems in oil sands and industrial sites. • Interoperability testbed for BIM platforms across SMEs.

		• Robotics pilots for repetitive tasks in concrete finishing.
Sustainability × Commercialization / Policy	Accelerating adoption of green materials and practices	• Low-carbon cement trials with Alberta's cement producers. • Mass timber modular housing pilot addressing affordability. • Construction waste circular-economy hub in Edmonton/Calgary. • Net-zero retrofits program for public schools and hospitals.
Resiliency × Collaboration / Regulation	Preparing for climate change and ensuring reliable infrastructure	• Cold-climate building envelope research and demonstration homes. • Flood-resilient infrastructure pilots in Calgary/Red Deer. • Wildfire-resistant construction materials in northern communities. • Emergency housing prototypes deployable after natural disasters.
Productivity × Funding / Industry Partnerships	Improving efficiency and reducing costs	• Prefab housing demonstration village to shorten construction cycles. • AI-enabled scheduling and supply-chain optimization pilots. • Lean construction "living lab" with top Alberta general contractors. • Shared equipment and tool-tracking digital platform for SMEs.
Policy & Governance × Advisory / Knowledge Hubs	Aligning regulation with innovation pathways	• Building code sandbox for low-carbon materials and digital permitting. • Open data portal on construction productivity metrics.

	• Provincial construction innovation dashboard for policymakers. • Standardization of digital asset management requirements.

4.7 Strategic Calls to Action

Delivering this roadmap requires joint ownership across industry, academia, and government. Key calls to action include:

- **For Industry:** Step forward with co-investment and pilot participation. Share data, open project sites for living labs, and help push proven solutions into mainstream adoption.
- **For Academia:** Align research timelines with industry needs. Prioritize applied collaboration, data-sharing, and interdisciplinary teams that deliver results in the field, not just in journals.
- **For Government:** Provide catalytic funding, regulatory flexibility, and early involvement in pilots to avoid delays. Shape policies that enable innovation instead of reacting after the fact.
- **For CIC:** Stay lean but effective. Focus on coordination, evidence-based facilitation, and maintaining a balanced, inclusive ecosystem that serves both large players and SMEs.
- **For Community and Associations:** Bring workforce, local, and underrepresented perspectives into the mix so Alberta's innovation story is broad-based and inclusive.

As one stakeholder put it: *"Innovation dies in silos. CIC's role is to make sure the pieces add up to more than the sum of their parts."*

5 Conclusion

Alberta's construction sector has the resources, expertise, and entrepreneurial spirit to redefine how innovation is adopted and scaled. The roadmap provides a plan, but its success depends on commitment from all partners. To sustain momentum, CIC and its partners must:

- **Keep the focus tight.** Choose a small number of high-impact priorities and deliver visible early wins.
- **Embed evaluation and accountability.** Use dashboards, TRL tracking, and impact reports to show real progress, not just activity.

- **Build resilience.** Diversify funding sources, rely on strong partnerships, and maintain flexibility to pivot as technologies evolve.
- **Institutionalize collaboration.** Move beyond ad hoc pilots toward permanent mechanisms—such as the Alberta Construction Data Hub, standardized IP frameworks, and recurring living labs.
- **Look outward when ready.** Focus first on Alberta-wide adoption, then scale select solutions nationally and, eventually, internationally.

More than a research approach, this is a blueprint for change. By aligning priorities with services, embedding accountability, breaking down barriers, and strengthening governance and financial resilience, CIC will achieve measurable impact and ensure innovation is not only created but adopted at scale thus transforming Alberta's and Canada's more efficient, resilient, and globally competitive construction ecosystem.

Appendix

A1 - Construction's Blind Spots: Issues Lacking Sufficient Research

1. Scalable Modular Housing & Affordable Financing Solutions
2. Process Efficiency & Cost Reduction
3. Affordable Energy Retrofits & Eco-Materials
4. Smart Infrastructure & IoT Integration
5. Automation & Robotics for SMEs
6. Digital Transformation & Alternative Methods
7. Real-Time Data for Site Management [Using live data to guide budgeting and project control
8. Construction Safety & Worker Health
9. Blockchain for Transparency [Applications in procurement, payments, and project tracking]
10. Collaborative Standardized Contract Models
11. Structural Codes & Resilience Design
12. Advancing code development and earthquake-resistant structures
13. Human Factors & Waste Reduction
14. Process modeling to enhance safety, efficiency, and sustainability

A2 - Questionnaire Miscellaneous Ideas

1. **Streamline Decision-Making**: Approval processes are too slow, reducing momentum. Adopt faster, responsive models to accelerate decisions without compromising accountability.
2. **Standardize Reporting & Improve Accountability:** Inconsistent reporting creates inefficiencies. Develop clear templates and implement follow-up processes to ensure insights are timely, actionable, and lead to real-world application.
3. **Strengthen Data Collection from Industry**: Industry data is inconsistent and delayed. Address barriers and incentivize transparent, timely data sharing to better assess impact and guide decisions.
4. **Clarify Governance Roles**: The EMC and SAC have potential but need clearer mandates, stronger strategic alignment, and integration with execution to be more effective.
5. **Align Around a Clear Identity and Purpose**: Define what the CIC stands for—e.g., innovation, benchmarking, collaboration—to focus efforts, build credibility, and attract committed partners.
6. **Focus Research on Real-World Needs:** Ensure research is rooted in practical, high-priority industry challenges. Alignment with current sector needs will improve scalability and relevance.
7. **Enable Co-Development Across Sectors**: Move beyond academic delivery to true co-creation with industry and government. Engage policymakers early to reduce implementation friction.
8. **Translate Interest into Impact**: Stakeholders like CIC's initiatives but need tangible benefits. Deliver tools and insights that directly enhance strategy, operations, and outcomes.
9. **Focus Resources Strategically**: Too many initiatives risk burnout and diluted impact. Prioritize high-value projects to ensure sustainable, focused progress.
10. **Leverage Strategic Partnerships**: Support broader industry needs—beyond CIC's direct mandate—through alliances, advocacy, and ecosystem leadership without straying from core goals.

11. **Create a 'Fail-Forward' Innovation Sandbox**: Introduce a safe, low-stakes space for rapid experimentation where failure is expected and learning is prioritized. This could encourage bold ideas and accelerate solution testing without formal delays.
12. **Implement Reverse Mentorship Across Sectors**: Pair emerging professionals or students with senior leaders in "reverse mentorship" roles to infuse new thinking into leadership circles and bridge generational or innovation gaps**.**
13. **Competency Management**: Integrate competency tracking into project planning, ensuring the right skills are matched with the right tasks.
14. **Gamify Participation and Progress**: Introduce elements of gamification—like milestones, leaderboards, or digital badges—for research contributions, data submissions, or collaborative efforts to boost engagement and ownership.
15. **Host an Annual 'Unconference'**: Hold an open-format, participant-led event where stakeholders define the agenda in real time. This promotes dynamic, cross-sector dialogue that surfaces issues and insights not captured in traditional planning.
16. **Strengthen Operational Backbone**: Establish clear internal structures for project management, communication, and support services to ensure the center runs smoothly and scales efficiently. A well-run center is a precondition for high-impact work.
17. **Diversify and Stabilize Funding Models**: Move beyond project-based or grant-dependent funding by exploring long-term investment strategies, tiered membership models, or public-private co-funding frameworks to ensure financial resilience and autonomy.
18. **Appoint Dedicated Sector Liaisons**: Designate liaison roles for key stakeholder groups—industry, government, academia—to ensure proactive engagement, faster feedback loops, and stronger alignment with sector needs.
19. **Operationalize Agility**: Embed agile methodologies into the center's daily operations—not just for decision-making, but for how priorities are revisited, teams are formed, and feedback is incorporated across cycles.
20. **Create a Centralized Knowledge Hub**: Build an internal platform that houses standardized templates, research outcomes, data tools, and engagement histories—accessible to all partners—to reduce duplication and promote knowledge continuity.

A3 – Detailed Comparative Analysis of Global Innovation Centers

ID# 1: Construction Innovation Centre (CIC)

- Relevance to Alberta's Construction Industry: High. Strong alignment with innovation and climate adaptability.
- Industry Collaboration: High. Emphasis on local partnerships and technology transfer.
- Economic Impact: High. Potential for job creation and fostering exportable technologies.
- Focus on Sustainability: High. Promotes net-zero, circular economy, and renewable energy.
- AI and Digital Innovation: Moderate. May integrate Building Information Modeling (BIM) and other digital tools.
- Workforce Development: High. Likely involved in education and training.
- Policy and Standards Influence: Moderate. Could shape industry practices and building codes.
- Regional Collaboration Potential: High. Synergistic with Alberta's needs.
- Funding and Economic Models: Likely funded through public-private partnerships.
- Track Record and Impact: Moderate. Emerging center with growing contributions.

ID# 2: International Council for Research and Innovation in Building and Construction (CIB)

- Relevance to Alberta's Construction Industry: High. Focuses on global research and innovation in construction, aligning well with Alberta's need for advanced practices and knowledge-sharing.
- Industry Collaboration: High. Actively collaborates with academic institutions, industry stakeholders, and government agencies worldwide.
- Economic Impact: Moderate. Facilitates innovation and knowledge exchange but does not directly drive local economic benefits.
- Focus on Sustainability: High. Strong emphasis on sustainable construction practices and environmental stewardship.
- AI and Digital Innovation: Moderate. Promotes the integration of digital tools and technologies but not a leader in AI-driven solutions.
- Workforce Development: Moderate. Supports professional development through conferences and knowledge-sharing networks but lacks hands-on training programs.
- Policy and Standards Influence: High. Influences global construction standards and practices through its research output.
- Regional Collaboration Potential: High. Can contribute to Alberta's construction sector by providing access to global expertise and best practices.
- Funding and Economic Models: High. Supported by membership fees, research grants, and international partnerships.
- Track Record and Impact: High. Renowned for fostering innovation and collaboration in the global construction industry.

ID# 3: Alberta Innovates

- Relevance to Alberta's Construction Industry: High. Directly focused on Alberta's priorities, including innovation and sustainability.
- Industry Collaboration: High. Actively collaborates with local and global industries.

- Economic Impact: High. Drives economic diversification, job creation, and export opportunities.
- Focus on Sustainability: High. Supports renewable energy, circular economy, and net-zero initiatives.
- AI and Digital Innovation: High. Focuses on cutting-edge technologies, including AI and digital twins.
- Workforce Development: High. Provides funding for education, training, and workforce innovation.
- Policy and Standards Influence: Moderate. Shapes regional innovation policies but not specific to building codes.
- Regional Collaboration Potential: High. Integral to Alberta's innovation ecosystem.
- Funding and Economic Models: Publicly funded with diverse economic partnerships.
- Track Record and Impact: Strong. Significant history of supporting impactful projects in Alberta.

ID# 4: Construction Technology Centre at SAIT

- Relevance to Alberta's Construction Industry: High. Directly aligned with Alberta's technology needs.
- Industry Collaboration: High. Works closely with local industries for applied research.
- Economic Impact: High. Focused on technology adoption, job training, and exportable knowledge.
- Focus on Sustainability: High. Promotes green construction and renewable energy solutions.
- AI and Digital Innovation: High. Focus on digital tools like BIM and smart infrastructure.
- Workforce Development: High. Provides hands-on training and education.
- Policy and Standards Influence: Moderate. Limited to local technology-driven standards.
- Regional Collaboration Potential: High. Strong connections with Alberta's institutions.
- Funding and Economic Models: Public-private partnerships and grants.
- Track Record and Impact: Strong. Proven success in training Alberta's workforce and developing local technologies.

ID# 4: AMII (Alberta Machine Intelligence Institute)

- Relevance to Alberta's Construction Industry: Moderate. Indirect relevance via AI applications.
- Industry Collaboration: High. Active in AI partnerships across industries.
- Economic Impact: High. Supports job creation and exportable AI expertise.
- Focus on Sustainability: Moderate. Potential for AI applications in energy and construction sustainability.
- AI and Digital Innovation: High. Expertise in AI, digital twins, and smart systems.
- Workforce Development: High. Focus on AI education and skills development.
- Policy and Standards Influence: Low. Limited to AI-specific standards.
- Regional Collaboration Potential: High. Well-integrated into Alberta's innovation ecosystem.
- Funding and Economic Models: Public funding and industry partnerships.
- Track Record and Impact: Strong. Renowned for driving AI advancements in Alberta.

ID# 5: Smart Infrastructure and Construction Research Cluster

- Relevance to Alberta's Construction Industry: High. Focus on digital infrastructure solutions is directly applicable to Alberta's needs.
- Industry Collaboration: Strong. Frequent partnerships with engineering firms and government agencies.
- Economic Impact: High. Innovations improve asset longevity and reduce operational costs.
- Focus on Sustainability: High. Emphasizes energy efficiency and climate resilience.
- AI and Digital Innovation: High. Leaders in AI, IoT, and advanced analytics integration.
- Workforce Development: Moderate. Offers emerging tech training, less focus on traditional skills.
- Policy and Standards Influence: High. Actively contributes to smart infrastructure policies.
- Regional Collaboration Potential: High. Significant potential in Alberta's urban and transportation sectors.
- Funding and Economic Models: Government-funded and industry-partnered.
- Track Record and Impact: Strong. Proven success in modernizing infrastructure systems.

ID# 6: Off-site Construction Research Centre (OCRC)

- Relevance to Alberta's Construction Industry: High. Focus on digital infrastructure solutions is directly applicable to Alberta's needs.
- Relevance to Alberta's Construction Industry: High. Well-suited for remote regions and harsh climates.
- Industry Collaboration: Strong. Works closely with modular construction firms.
- Economic Impact: High. Reduces construction time and labor costs.
- Focus on Sustainability: Moderate. Focused on reducing material waste and transportation impacts.
- AI and Digital Innovation: Moderate. Utilizes digital tools but limited AI emphasis.
- Workforce Development: Moderate. Provides training in prefabrication techniques.
- Policy and Standards Influence: Moderate. Involved in modular construction standards development.
- Regional Collaboration Potential: High. Aligns with Alberta's rural and urban construction needs.
- Funding and Economic Models: Industry-driven with research grants.
- Track Record and Impact: Strong. Success in advancing off-site construction adoption.

ID# 7: Centre for Building Science

- Relevance to Alberta's Construction Industry: High. Focused on energy efficiency and performance, critical for Alberta's climate.
- Industry Collaboration: Moderate. Collaborates mainly with architects and energy consultants.
- Economic Impact: Moderate. Promotes long-term savings through energy performance improvements.
  Focus on Sustainability: High. Specializes in green building design and energy efficiency.
- AI and Digital Innovation: Moderate. Employs digital modeling with less emphasis on advanced AI.

- Workforce Development: Moderate. Offers training for energy performance professionals.
- Policy and Standards Influence: High. Influential in green building codes and energy standards.
- Regional Collaboration Potential: High. Alberta could benefit from its energy efficiency focus.
- Funding and Economic Models: Research grants and private-sector partnerships.
- Track Record and Impact: Strong. Well-established expertise in building performance.

ID# 8: Construction Innovation Research Network

- Relevance to Alberta's Construction Industry: Moderate. Focuses on collaborative research but less Alberta-specific relevance.
- Industry Collaboration: Strong. Promotes partnerships between academia and industry.
- Economic Impact: Moderate. Encourages innovation but limited direct economic benefits.
- Focus on Sustainability: Moderate. Sustainability is considered but not a core focus.
- AI and Digital Innovation: Moderate. Encourages digital innovation but lacks leadership in AI.
- Workforce Development: High. Facilitates skill-building through workshops and knowledge-sharing.
- Policy and Standards Influence: Moderate. Supports innovation but limited policy influence.
- Regional Collaboration Potential: Moderate. Could support Alberta but lacks regional alignment.
- Funding and Economic Models: Collaborative, often dependent on academic funding.
- Track Record and Impact: Moderate. Known for knowledge-sharing, but fewer tangible outcomes.

ID# 9: Construction Research Centre (CRC)

- Relevance to Alberta's Construction Industry: High. Focuses on innovative construction practices aligned with Alberta's needs.
- Industry Collaboration: Strong. Collaborates with contractors, government bodies, and developers.
- Economic Impact: High. Contributes to cost reduction and construction efficiency.
- Focus on Sustainability: Moderate. Growing emphasis on sustainability but not a core focus.
- AI and Digital Innovation: High. Active in exploring AI-driven solutions for construction.
- Workforce Development: High. Offers training in advanced construction practices.
- Policy and Standards Influence: High. Plays a role in shaping industry standards.
- Regional Collaboration Potential: High. Relevant to Alberta's diverse construction landscape.
- Funding and Economic Models: Industry-supported with academic contributions.

- Track Record and Impact: Strong. Recognized for advancing construction practices.

ID# 10: Canadian Centre for Housing Technology (CCHT)

- Relevance to Alberta's Construction Industry: Moderate. Focused on residential technology, with less emphasis on commercial or industrial sectors.
- Industry Collaboration: Moderate. Collaborates with housing developers and technology providers.
- Economic Impact: Moderate. Encourages energy-efficient housing, contributing to long-term cost savings.
- Focus on Sustainability: High. Pioneers in energy-efficient and green housing innovations.
- AI and Digital Innovation: Moderate. Employs digital modeling but limited AI advancements.
- Workforce Development: Low. Limited direct workforce training programs.
- Policy and Standards Influence: Moderate. Influential in energy-efficient housing standards.
- Regional Collaboration Potential: Moderate. Relevant to Alberta's residential construction needs.
- Funding and Economic Models: Government-funded with industry partnerships.
- Track Record and Impact: Strong. Known for energy-efficient housing innovation.

ID# 11: Centre for Infrastructure Performance and Reliability

- Relevance to Alberta's Construction Industry: High. Focuses on improving infrastructure resilience, directly applicable to Alberta's industrial and urban needs.
- Industry Collaboration: Strong. Works closely with government and infrastructure providers.
- Economic Impact: High. Enhances infrastructure durability, reducing maintenance and replacement costs.
- Focus on Sustainability: High. Emphasizes sustainability through long-lasting infrastructure solutions.
- AI and Digital Innovation: Moderate. Utilizes predictive modeling but limited emphasis on advanced AI.
- Workforce Development: Moderate. Offers training in infrastructure management and reliability engineering.
- Policy and Standards Influence: High. Contributes to global standards for infrastructure reliability.
- Regional Collaboration Potential: High. Highly relevant to Alberta's resource-based industries and infrastructure challenges.
- Funding and Economic Models: Government and industry-funded, with a focus on applied research.
- Track Record and Impact: Strong. Proven contributions to infrastructure reliability and resilience globally.

ID# 12: Center for Integrated Facility Engineering (CIFE)

- Relevance to Alberta's Construction Industry: High. Specializes in digital construction methods, relevant to Alberta's growing infrastructure needs.
- Industry Collaboration: Strong. Engages extensively with the construction and tech industries.
- Economic Impact: High. Promotes cost savings and efficiency through virtual design and construction.
- Focus on Sustainability: Moderate. Addresses sustainability through optimized construction processes.
- AI and Digital Innovation: High. Leaders in using AI and digital twins for construction planning.
- Workforce Development: High. Provides advanced training in virtual construction technologies.
- Policy and Standards Influence: Moderate. Influences standards for integrated project delivery and digital workflows.
- Regional Collaboration Potential: High. Aligns well with Alberta's emphasis on efficient, tech-driven construction.
- Funding and Economic Models: Industry-supported with academic and research grants.
- Track Record and Impact: Strong. Recognized for advancing digital construction practices.

ID# 13: Harvard Center for Green Buildings and Cities

- Relevance to Alberta's Construction Industry: Moderate. Focused on sustainable building practices, relevant to Alberta's urban development.
- Industry Collaboration: Moderate. Collaborates with designers and policymakers rather than builders.
- Economic Impact: Moderate. Emphasizes long-term savings through energy-efficient design.
- Focus on Sustainability: High. Leaders in green building research and climate-resilient solutions.
- AI and Digital Innovation: Low. Limited use of AI; more focused on material and design innovation.
- Workforce Development: Low. Primarily focuses on academic research rather than industry training.
- Policy and Standards Influence: High. Influential in green building policies and standards.
- Regional Collaboration Potential: Moderate. Potential to contribute to Alberta's sustainability goals but lacks direct industry partnerships.
- Funding and Economic Models: University-funded with philanthropic contributions.
- Track Record and Impact: Strong. Widely regarded for advancing sustainable architecture.

ID# 14: BRE Innovation Park

- Relevance to Alberta's Construction Industry: Moderate. Focuses on showcasing innovations, with indirect applicability to Alberta's industry.
- Industry Collaboration: High. Acts as a hub for collaboration between innovators, builders, and policymakers.
- Economic Impact: Moderate. Demonstrates cost-effective sustainable building practices.
- Focus on Sustainability: High. Emphasizes renewable materials, energy efficiency, and sustainable urban development.
- AI and Digital Innovation: Low. Limited focus on AI; concentrates on physical innovations.
- Workforce Development: Low. More focused on showcasing solutions than providing training.
- Policy and Standards Influence: High. Influential in promoting sustainability standards.
- Regional Collaboration Potential: Moderate. Could inspire Alberta's industry, but lacks direct alignment with regional challenges.
- Funding and Economic Models: Publicly and privately funded as a demonstration hub.
- Track Record and Impact: Strong. Widely recognized for showcasing cutting-edge sustainable solutions.

ID# 15: Singapore-ETH Centre - Future Cities Laboratory

- Relevance to Alberta's Construction Industry: Moderate. Focused on urban planning and smart cities, indirectly applicable to Alberta's needs.
- Industry Collaboration: Strong. Collaborates globally with cities, governments, and industries.
- Economic Impact: High. Promotes innovative solutions for urban efficiency and livability.
- Focus on Sustainability: High. Research heavily focuses on climate-resilient and energy-efficient urban systems.
- AI and Digital Innovation: High. Leaders in AI-driven urban analytics and digital twin technologies.
- Workforce Development: High. Offers training in urban innovation and sustainability practices.
- Policy and Standards Influence: Moderate. Contributes to urban sustainability policies but less construction-specific.
- Regional Collaboration Potential: Moderate. Alberta could benefit from its smart city expertise but lacks direct focus on rural or resource industries.
- Funding and Economic Models: Internationally funded with research and government grants.
- Track Record and Impact: Strong. Known for pioneering research in urban innovation and sustainability.

ID# 16: Graz Center of Sustainable Construction

- Relevance to Alberta's Construction Industry: High. Strong focus on sustainable construction aligns with Alberta's growing emphasis on green building practices.
- Industry Collaboration: High. Known for strong partnerships with construction companies and policymakers.
- Economic Impact: High. Promotes cost-effective sustainability practices with potential for long-term savings.
- Focus on Sustainability: High. Emphasizes sustainable materials, energy efficiency, and lifecycle optimization.
- AI and Digital Innovation: Moderate. Limited focus on AI, but uses digital tools for sustainability analysis.
- Workforce Development: Moderate. Provides training in sustainable construction but not a core focus.
- Policy and Standards Influence: High. Influential in shaping sustainability-focused policies and standards.
- Regional Collaboration Potential: High. Well-suited to Alberta's goals for sustainable growth.
- Funding and Economic Models: High. Supported by public and private funds with research grants.
- Track Record and Impact: High. Recognized for advancing sustainable construction practices globally.

ID# 17: University of Tokyo - Institute of Industrial Science (IIS)

- Relevance to Alberta's Construction Industry: Moderate. Focused on industrial innovation with some relevance to Alberta's infrastructure needs.
- Industry Collaboration: High. Actively collaborates with global construction and industrial partners.
- Economic Impact: Moderate. Indirect contributions through advanced technologies and innovation.
- Focus on Sustainability: High. Strong emphasis on green technologies and energy efficiency.
- AI and Digital Innovation: High. Leaders in AI, robotics, and digital construction methods.
- Workforce Development: High. Offers advanced training in industrial and construction technologies.
- Policy and Standards Influence: Moderate. Focused more on global standards than regional policies.
- Regional Collaboration Potential: Moderate. Limited direct alignment with Alberta-specific challenges.
- Funding and Economic Models: High. Supported by government and private funding with global partnerships.
- Track Record and Impact: High. Renowned for cutting-edge research in industrial and construction innovation.

ID# 18: Centre for Advanced Construction Technology (CACT)

- Relevance to Alberta's Construction Industry: High. Focuses on innovative construction technologies that align with Alberta's needs.
- Industry Collaboration: High. Works closely with construction firms and technology providers.
- Economic Impact: High. Drives efficiency and cost reduction through advanced technologies.
- Focus on Sustainability: Moderate. Includes sustainability but not as a primary focus.
- AI and Digital Innovation: High. Actively uses AI and digital tools in construction innovation.
- Workforce Development: High. Provides extensive training in emerging construction technologies.
- Policy and Standards Influence: High. Contributes to policies and standards for advanced construction methods.
- Regional Collaboration Potential: High. Highly relevant to Alberta's diverse construction landscape.
- Funding and Economic Models: High. Supported by industry and government grants.
- Track Record and Impact: High. Known for impactful advancements in construction technology.

ID# 19: Construction Industry Institute (CII)

- Relevance to Alberta's Construction Industry: High. Strong alignment with Alberta's industrial and infrastructure needs.
- Industry Collaboration: High. Renowned for engaging extensively with contractors, owners, and academia.
- Economic Impact: High. Focuses on improving productivity and reducing costs in the construction sector.
- Focus on Sustainability: Moderate. Includes sustainability in its research agenda but not a core focus.
- AI and Digital Innovation: Moderate. Encourages digital innovation but not a leader in AI adoption.
- Workforce Development: High. Offers a wide range of educational and professional development programs.
- Policy and Standards Influence: High. Influential in setting industry standards and best practices.
- Regional Collaboration Potential: High. Relevant to Alberta's energy and industrial construction sectors.
- Funding and Economic Models: High. Supported by industry-driven research initiatives.
- Track Record and Impact: High. Widely recognized for improving construction efficiency and practices.

ID# 20: Skanska Innovation Lab

- Relevance to Alberta's Construction Industry: Moderate. Focuses on innovation, with potential relevance to Alberta's goals.
- Industry Collaboration: High. Collaborates with industry partners on innovation and technology development.
- Economic Impact: Moderate. Focused on project-specific improvements rather than systemic changes.
- Focus on Sustainability: High. Emphasizes green building innovations and energy efficiency.
- AI and Digital Innovation: High. Actively incorporates AI and digital tools in construction projects.
- Workforce Development: Moderate. Limited focus on workforce training programs.
- Policy and Standards Influence: Moderate. Influences policies through innovative practices, but not a key driver.
- Regional Collaboration Potential: Moderate. Could bring innovation to Alberta but lacks direct alignment with local priorities.
- Funding and Economic Models: Moderate. Primarily project-funded with limited systemic investment.
- Track Record and Impact: High. Recognized for innovative contributions to sustainable construction practices.

ID# 21: Arup Foresight, Innovation, and Research

- Relevance to Alberta's Construction Industry: Moderate. Focuses on global trends and future-oriented construction practices, with indirect relevance to Alberta's industry.
- Industry Collaboration: High. Works extensively with international clients and partners to drive innovation.
- Economic Impact: Moderate. Supports strategic decision-making and innovative practices but less direct economic impact.
- Focus on Sustainability: High. Strong emphasis on sustainable and future-ready solutions.
- AI and Digital Innovation: High. Leaders in adopting AI and digital tools for future-focused projects.
- Workforce Development: Moderate. Provides thought leadership and research but limited direct training programs.
- Policy and Standards Influence: Moderate. Contributes insights to global standards but less Alberta-specific.
- Regional Collaboration Potential: Moderate. Could bring global insights to Alberta, but lacks direct local alignment.
- Funding and Economic Models: High. Supported by private sector projects and partnerships.
- Track Record and Impact: High. Widely recognized for driving innovation and foresight in the construction industry.

ID# 22: China Academy of Building Research (CABR)

- Relevance to Alberta's Construction Industry: High. Focuses on building technologies and standards relevant to Alberta's infrastructure needs.
- Industry Collaboration: High. Collaborates extensively with construction firms and policymakers.
- Economic Impact: High. Plays a significant role in driving cost-effective and efficient construction practices.
- Focus on Sustainability: Moderate. Includes sustainability in its research but not as a primary focus.
- AI and Digital Innovation: Moderate. Incorporates some digital innovation but not AI leadership.
- Workforce Development: Moderate. Provides technical training and certifications.
- Policy and Standards Influence: High. Strongly influences construction standards and practices.
- Regional Collaboration Potential: High. Relevant expertise in large-scale and innovative construction projects.
- Funding and Economic Models: High. Supported by government and private-sector investments.
- Track Record and Impact: High. Renowned for advancing construction technologies and standards in Asia

ID# 23: Technical University of Denmark (DTU) - Construction Innovation Research

- Relevance to Alberta's Construction Industry: Moderate. Focused on research with some alignment to Alberta's needs.
- Industry Collaboration: High. Works with European construction firms on innovative solutions.
- Economic Impact: Moderate. Promotes innovation but less direct economic contribution.
- Focus on Sustainability: High. Strong emphasis on sustainable construction methods and materials.
- AI and Digital Innovation: High. Leaders in AI-driven solutions for construction innovation.
- Workforce Development: High. Provides training for advanced construction technologies.
- Policy and Standards Influence: High. Influences European construction policies with global relevance.
- Regional Collaboration Potential: Moderate. Could contribute indirectly to Alberta's goals.
- Funding and Economic Models: High. Supported by European research grants and private partnerships.
- Track Record and Impact: High. Well-regarded for innovative and sustainable construction practices.

ID# 24: Future Infrastructure and Built Environment Research Centre

- Relevance to Alberta's Construction Industry: High. Focuses on infrastructure and built environments that align with Alberta's needs.
- Industry Collaboration: High. Engages with construction firms and public-sector stakeholders.
- Economic Impact: High. Advances cost-effective and efficient infrastructure practices.
- Focus on Sustainability: High. Strong emphasis on climate-resilient and sustainable designs.
- AI and Digital Innovation: High. Leaders in integrating digital tools and AI for infrastructure projects.
- Workforce Development: High. Provides training in sustainable and smart infrastructure.
- Policy and Standards Influence: High. Influences infrastructure policies and standards globally.
- Regional Collaboration Potential: High. Well-suited to Alberta's needs for innovative infrastructure solutions.
- Funding and Economic Models: High. Supported by government and private-sector funding.
- Track Record and Impact: High. Recognized for impactful contributions to infrastructure development.

ID# 25: DARPA (Defense Advanced Research Projects Agency)

- Relevance to Alberta's Construction Industry: Moderate. Focused on defense and technology, with indirect relevance to Alberta's industry.
- Industry Collaboration: Moderate. Works with government contractors and tech firms but less construction-specific.
- Economic Impact: Moderate. Promotes innovation in defense technologies with limited construction impact.
- Focus on Sustainability: Low. Sustainability is not a primary focus.
- AI and Digital Innovation: High. Pioneers in AI, robotics, and advanced technologies.
- Workforce Development: Low. Limited focus on construction-specific training.
- Policy and Standards Influence: Low. Focused on defense-specific policies.
- Regional Collaboration Potential: Low. Minimal alignment with Alberta's construction needs.
- Funding and Economic Models: Moderate. Funded by U.S. government with project-specific investments.
- Track Record and Impact: Moderate. Known for groundbreaking defense innovations with limited construction relevance.

ID# 26: European Construction Technology Platform (ECTP)

- Relevance to Alberta's Construction Industry: Moderate. Focuses on European construction challenges and technologies, with some indirect relevance to Alberta.
- Industry Collaboration: High. Strong partnerships with European industries and stakeholders.

- Economic Impact: Moderate. Promotes innovation but with limited direct impact on Alberta.
- Focus on Sustainability: High. Emphasizes sustainable construction practices and energy efficiency.
- AI and Digital Innovation: Moderate. Incorporates digital tools but not a leader in AI.
- Workforce Development: Moderate. Provides some industry training but not a primary focus.
- Policy and Standards Influence: High. Influential in shaping European construction policies and standards.
- Regional Collaboration Potential: Moderate. Could bring insights to Alberta but lacks direct alignment.
- Funding and Economic Models: High. Supported by European public and private funding.
- Track Record and Impact: High. Well-regarded for advancing construction technologies in Europe.

ID# 27: Global Construction Technology Research Network (GCTRN)

- Relevance to Alberta's Construction Industry: Moderate. Focuses on global construction challenges, with some relevance to Alberta's needs.
- Industry Collaboration: High. Promotes collaboration between global industry players and researchers.
- Economic Impact: Moderate. Encourages innovation with indirect economic benefits for Alberta.
- Focus on Sustainability: Moderate. Sustainability is included but not a central focus.
- AI and Digital Innovation: High. Active in advancing digital tools and AI in construction.
- Workforce Development: Moderate. Provides opportunities for knowledge-sharing but lacks direct training.
- Policy and Standards Influence: Moderate. Supports global policies but limited regional focus.
- Regional Collaboration Potential: Moderate. Potential to support Alberta through global insights.
- Funding and Economic Models: High. Supported by international partnerships and funding.
- Track Record and Impact: Moderate. Encourages global collaboration but fewer tangible outcomes.

ID# 28: World Green Building Council (WGBC)

- Relevance to Alberta's Construction Industry: High. Strong focus on green building practices aligns with Alberta's sustainability goals.
- Industry Collaboration: Moderate. Works with developers and policymakers rather than contractors.
- Economic Impact: Moderate. Promotes long-term savings through green building initiatives.

- Focus on Sustainability: High. Leaders in advocating for sustainable building practices worldwide.
- AI and Digital Innovation: Low. Limited use of AI or digital innovation; focuses on policy and advocacy.
- Workforce Development: Low. Primarily focused on advocacy rather than training programs.
- Policy and Standards Influence: High. Influential in global green building policies and certifications.
- Regional Collaboration Potential: High. Alberta could benefit from its global sustainability expertise.
- Funding and Economic Models: Moderate. Funded through memberships and partnerships.
- Track Record and Impact: High. Widely recognized for promoting sustainable building practices globally.

ID# 29: Global Alliance for Buildings and Construction (Global ABC)

- Relevance to Alberta's Construction Industry: High. Focuses on decarbonization and sustainable construction, highly relevant to Alberta's goals.
- Industry Collaboration: High. Engages with global industry stakeholders and governments.
- Economic Impact: High. Encourages energy-efficient practices that lower costs and emissions.
- Focus on Sustainability: High. Strong emphasis on climate action in the building and construction sector.
- AI and Digital Innovation: Moderate. Utilizes digital tools for emissions tracking but not a leader in AI.
- Workforce Development: Moderate. Provides policy-driven support but lacks direct training programs.
- Policy and Standards Influence: High. Key player in global climate action policies for construction.
- Regional Collaboration Potential: High. Alberta could benefit from its decarbonization strategies.
- Funding and Economic Models: High. Supported by global public and private partnerships.
- Track Record and Impact: High. Recognized for driving climate action in the construction sector.

ID# 30: KICT (Korea Institute of Civil Engineering and Building Technology)

- Relevance to Alberta's Construction Industry: High. Focused on innovative building technologies and infrastructure, relevant to Alberta's needs.
- Industry Collaboration: High. Strong partnerships with industry and government stakeholders.
- Economic Impact: High. Drives cost-effective and efficient construction practices.

- Focus on Sustainability: High. Emphasizes sustainable and resilient infrastructure.
- AI and Digital Innovation: High. Leaders in integrating AI and advanced digital tools in construction.
- Workforce Development: High. Provides extensive training programs in innovative construction practices.
- Policy and Standards Influence: High. Influential in shaping construction standards in Asia and globally.
- Regional Collaboration Potential: High. Well-suited to Alberta's need for innovative infrastructure solutions.
- Funding and Economic Models: High. Supported by government funding and private partnerships.
- Track Record and Impact: High. Renowned for advancing civil engineering and building technology.

ID# 31: CSIRO - Advanced Construction Materials Program

- Relevance to Alberta's Construction Industry: High. Focuses on advanced materials, which align with Alberta's industrial and environmental needs.
- Industry Collaboration: High. Works with manufacturers and construction firms to commercialize materials.
- Economic Impact: High. Develops cost-effective, high-performance materials with potential for industry-wide savings.
- Focus on Sustainability: High. Emphasizes materials with lower environmental impacts and energy efficiency.
- AI and Digital Innovation: Moderate. Limited focus on AI but uses digital tools for materials research.
- Workforce Development: Moderate. Offers technical knowledge-sharing but less emphasis on direct training.
- Policy and Standards Influence: High. Contributes to national and international materials standards.
- Regional Collaboration Potential: High. Alberta could benefit from its expertise in advanced materials for harsh climates.
- Funding and Economic Models: High. Government and industry-funded, with research grants.
- Track Record and Impact: High. Known for groundbreaking contributions to advanced construction materials.

ID# 32: Advanced Infrastructure Materials Research Centre

- Relevance to Alberta's Construction Industry: High. Focused on durable and resilient materials for infrastructure, relevant to Alberta's needs.
- Industry Collaboration: High. Engages with civil engineering firms and government agencies.
- Economic Impact: High. Develops long-lasting materials that reduce lifecycle costs.

- Focus on Sustainability: High. Strong emphasis on environmentally friendly and recyclable materials.
- AI and Digital Innovation: Moderate. Incorporates digital modeling but minimal AI integration.
- Workforce Development: Moderate. Provides knowledge-sharing opportunities but lacks direct training programs.
- Policy and Standards Influence: High. Influences infrastructure material standards globally.
- Regional Collaboration Potential: High. Highly relevant to Alberta's infrastructure needs in extreme climates.
- Funding and Economic Models: High. Supported by public and private research funding.
- Track Record and Impact: High. Renowned for durable and sustainable material innovations.

ID# 33: Sustainable Construction and Innovation through Procurement (SCIP)

- Relevance to Alberta's Construction Industry: Moderate. Focused on procurement strategies, with indirect relevance to Alberta's construction processes.
- Industry Collaboration: High. Works closely with contractors and procurement professionals.
- Economic Impact: Moderate. Promotes cost savings through efficient procurement strategies.
- Focus on Sustainability: High. Advocates for sustainable procurement to reduce environmental impact.
- AI and Digital Innovation: Moderate. Limited focus on AI; emphasizes digital tools for procurement analysis.
- Workforce Development: Moderate. Provides training for procurement professionals.
- Policy and Standards Influence: High. Contributes to procurement standards that promote sustainability.
- Regional Collaboration Potential: Moderate. Could support Alberta's efforts in improving procurement processes.
- Funding and Economic Models: High. Publicly funded with industry contributions.
- Track Record and Impact: High. Recognized for advancing sustainable procurement practices.

ID# 34: MIT Concrete Sustainability Hub (CSHub)

- Relevance to Alberta's Construction Industry: High. Focuses on sustainable concrete solutions relevant to Alberta's construction sector.
- Industry Collaboration: High. Works with concrete manufacturers and industry stakeholders.
- Economic Impact: High. Develops cost-effective, low-carbon concrete technologies.
- Focus on Sustainability: High. Strong emphasis on reducing concrete's carbon footprint and improving durability.

- AI and Digital Innovation: Moderate. Uses digital modeling for material performance but less focus on AI.
- Workforce Development: Moderate. Provides educational resources but limited direct training.
- Policy and Standards Influence: High. Influences global standards for sustainable concrete.
- Regional Collaboration Potential: High. Alberta could benefit from its expertise in low-carbon concrete.
- Funding and Economic Models: High. Supported by academic and industry partnerships.
- Track Record and Impact: High. Renowned for sustainable advancements in concrete technology.

ID# 35: ETH Zurich - Department of Civil, Environmental and Geomatic Engineering

- Relevance to Alberta's Construction Industry: Moderate. Focused on global challenges, with some indirect relevance to Alberta.
- Industry Collaboration: High. Collaborates with European construction firms and global stakeholders.
- Economic Impact: Moderate. Promotes innovation but less direct impact on Alberta's economy.
- Focus on Sustainability: High. Emphasizes sustainable design and engineering.
- AI and Digital Innovation: High. Leaders in integrating AI into civil engineering solutions.
- Workforce Development: High. Provides advanced training for engineering and construction professionals.
- Policy and Standards Influence: High. Influential in shaping engineering standards globally.
- Regional Collaboration Potential: Moderate. Limited alignment with Alberta-specific challenges.
- Funding and Economic Models: High. Supported by European funding and partnerships.
- Track Record and Impact: High. Renowned for cutting-edge engineering research.

ID# 36: TU Delft - Faculty of Architecture and the Built Environment

- Relevance to Alberta's Construction Industry: Moderate. Focused on architecture and urban planning, with indirect relevance to Alberta's needs.
- Industry Collaboration: High. Engages with European and global partners in architecture and construction.
- Economic Impact: Moderate. Promotes efficient urban planning but limited direct construction impact.
- Focus on Sustainability: High. Leaders in sustainable architecture and urban design.
- AI and Digital Innovation: High. Incorporates digital tools and AI in urban planning and building design.
- Workforce Development: High. Provides training in architecture and urban innovation.

- Policy and Standards Influence: High. Influences global standards in architecture and sustainability.
- Regional Collaboration Potential: Moderate. Limited alignment with Alberta's infrastructure needs.
- Funding and Economic Models: High. Supported by European research grants and industry funding.
- Track Record and Impact: High. Known for innovative and sustainable architectural solutions.

ID# 37: Loughborough University - Smart Construction Research Group

- Relevance to Alberta's Construction Industry: High. Focuses on digital construction and smart technologies, directly relevant to Alberta's industry.
- Industry Collaboration: High. Strong partnerships with construction firms and technology providers.
- Economic Impact: High. Promotes efficiency and cost savings through digital innovations.
- Focus on Sustainability: Moderate. Includes sustainability in its research but not a primary focus.
- AI and Digital Innovation: High. Leaders in applying AI and digital twins to construction.
- Workforce Development: High. Offers training in smart construction technologies.
- Policy and Standards Influence: High. Influences standards for digital construction practices.
- Regional Collaboration Potential: High. Highly relevant to Alberta's goals for tech-driven construction.
- Funding and Economic Models: High. Supported by public and private funding.
- Track Record and Impact: High. Renowned for advancing digital construction practices.

ID# 38: Construction Safety Research Alliance (CSRA)

- Relevance to Alberta's Construction Industry: Moderate. Focus on safety is critical, but less emphasis on innovation in energy efficiency and climate adaptability.
- Industry Collaboration: Strong. Known for partnerships with contractors and safety leaders.
- Economic Impact: Moderate. Focus on reducing accidents and costs, indirect job creation potential.
- Focus on Sustainability: Low. Primarily focused on safety, not sustainability.
- AI and Digital Innovation: Low. Minimal AI or digital construction focus.
- Workforce Development: High. Offers safety training and educational resources.
- Policy and Standards Influence: High. Contributes to safety standards and compliance practices.
- Regional Collaboration Potential: Moderate. Could support Alberta's safety challenges but limited focus on energy or climate-specific issues.
- Funding and Economic Models: Industry-funded and research-driven.

- Track Record and Impact: Strong. Proven success in reducing workplace accidents.

ID# 40: Sirindhorn International Institute of Technology – Construction and Maintenance Technology Research Center (CONTEC)

- Relevance to Alberta's Construction Industry: High. Focused on advanced construction technologies and maintenance solutions, which align with Alberta's infrastructure needs.
- Industry Collaboration: High. Collaborates with industry partners and academic institutions to address real-world construction challenges.
- Economic Impact: High. Promotes cost-effective maintenance and construction practices to extend infrastructure lifecycle and reduce costs.
- Focus on Sustainability: High. Emphasizes sustainable construction materials and practices to minimize environmental impacts.
- AI and Digital Innovation: Moderate. Uses digital tools and simulation modeling but with limited emphasis on AI-driven innovation.
- Workforce Development: Moderate. Provides training and research opportunities for students and professionals in construction technology.
- Policy and Standards Influence: Moderate. Contributes to regional construction standards but limited global influence.
- Regional Collaboration Potential: High. Relevant expertise in tropical and regional construction challenges, which can be adapted to Alberta's needs.
- Funding and Economic Models: High. Supported by government funding, research grants, and industry partnerships.
- Track Record and Impact: High. Known for its contributions to maintenance and construction technology solutions.

ID# 41: National Taiwan University of Science and Technology – Taiwan Building Technology Center

- Relevance to Alberta's Construction Industry: Moderate. Focuses on innovative building technologies with some applicability to Alberta's urban infrastructure.
- Industry Collaboration: High. Works with local and international firms to advance building technologies.
- Economic Impact: High. Develops efficient building solutions that promote long-term savings in energy and material usage.
- Focus on Sustainability: High. Strong emphasis on energy-efficient building systems and green technologies.
- AI and Digital Innovation: High. Active in integrating AI and smart building systems for modern construction.
- Workforce Development: Moderate. Offers research opportunities but less direct workforce training programs.
- Policy and Standards Influence: Moderate. Contributes to regional policies but less impact on global standards.
- Regional Collaboration Potential: Moderate. Focused on Asian construction challenges, with limited direct relevance to Alberta's industry.

- Funding and Economic Models: High. Supported by government and industry-backed initiatives.
- Track Record and Impact: High. Renowned for advancements in sustainable building technologies and smart systems.

A4 – Geographical Distribution and Classification of Leading Construction Innovation and Research Centers Benchmarked in this Study

ID #	Center Name	Center Location	Center Designation
1	Construction Innovation Centre (CIC)	Edmonton, Canada	Academia, Industry
2	International Council for Research and Innovation in Building and Construction (CIB)	Ottawa, Canada	NGO, Research
3	Alberta Innovates	Edmonton, Canada	Government, Research
4	Construction Technology Centre at SAIT	Calgary, Canada	Academia, Industry
5	AMII (Alberta Machine Intelligence Institute	Edmonton, Canada	Academia, Research
6	Smart Infrastructure and Construction Research Cluster	Cambridge, United Kingdom	Academia, Research
7	Off-site Construction Research Centre (OCRC)	Fredericton, Canada	Academia, Industry
8	Centre for Building Science	Toronto, Canada	Academia, Research
9	Construction Innovation Research Network	Various, Australia	Academia, Research
10	Construction Research Centre (CRC)	Ottawa, Canada	Government, Research
11	Canadian Centre for Housing Technology (CCHT)	Ottawa, Canada	Government, Academia
12	Centre for Infrastructure Performance and Reliability	Newcastle, Australia	Academia, Research
13	Center for Integrated Facility Engineering (CIFE)	Stanford, USA	Academia, Industry
14	Harvard Center for Green Buildings and Cities	Cambridge, USA	Academia, Research
15	BRE Innovation Park	Watford, United Kingdom	Industry, Research
16	Singapore-ETH Centre - Future Cities Laboratory	Singapore	Academia, Research, Industry

17	Graz Center of Sustainable Construction	Graz, Austria	Academia, Research
18	University of Tokyo - Institute of Industrial Science (IIS)	Tokyo, Japan	Academia, Research
19	Centre for Advanced Construction Technology (CACT)	Hong Kong, China	Academia, Industry
20	Construction Industry Institute (CII)	Austin, USA	Academia, Industry
21	Skanska Innovation Lab	Stockholm, Sweden	Industry, Research
22	Arup Foresight, Innovation, and Research	London, United Kingdom	Industry, Research
23	China Academy of Building Research (CABR)	Beijing, China	Government, Research
24	Technical University of Denmark (DTU) - Construction Innovation Research	Lyngby, Denmark	Academia, Research
25	Future Infrastructure and Built Environment Research Centre	Cambridge, United Kingdom	Academia, Research
26	DARPA (Defense Advanced Research Projects Agency)	Arlington, USA	Government, Research
27	European Construction Technology Platform (ECTP)	Brussels, Belgium	NGO, Research
28	Global Construction Technology Research Network (GCTRN)	Various	Academia, Research
29	World Green Building Council (WGBC)	London, United Kingdom	NGO, Research
30	Global Alliance for Buildings and Construction (Global ABC)	Paris, France	NGO, Research
31	KICT (Korea Institute of Civil Engineering and Building Technology)	Ilsan, South Korea	Government, Research
32	CSIRO - Advanced Construction Materials Program	Canberra, Australia	Government, Research
33	Advanced Infrastructure Materials Research Centre	Beijing, China	Academia, Research
34	Sustainable Construction and Innovation through Procurement (SCIP)	Various, United Kingdom	NGO, Research

35	MIT Concrete Sustainability Hub (CSHub)	Cambridge, USA	Academia, Research
36	ETH Zurich - Department of Civil, Environmental and Geomatic Engineering	Zurich, Switzerland	Academia, Research
37	TU Delft - Faculty of Architecture and the Built Environment	Delft, Netherlands	Academia, Research
38	Loughborough University - Smart Construction Research Group	Loughborough, United Kingdom	Academia, Research
39	Construction Safety Research Alliance	Colorado, USA	Academia, Industry
40	Sirindhorn International Institute of Technology – Construction and Maintenance Technology Research Center (CONTEC)	Pathum Thani, Thailand	Academia, Research
41	National Taiwan University of Science and Technology – Taiwan Building Technology Center	Taipei, Taiwan	Academia, Research

A5 – Qualitative Ranking of Global Innovation Centers

ID #	Center Name	Center Location	Center Designation	Comparison Criteria Focused on Alberta's Needs									
				Relevance to Alberta's Construction Industry	Industry Collaboration	Economic Impact	Focus on Sustainability	AI and Digital Innovation	Workforce Development	Policy and Standards Influence	Regional Collaboration Potential	Funding and Economic Models	Track Record and Impact
1	**Construction Innovation Centre (CIC)**	Edmonton, Canada	Academia, Industry	High	High	High	High	Moderate	High	Moderate	High	High	Moderate
2	**International Council for Research and Innovation in Building and Construction (CIB)**	Ottawa, Canada	NGO, Research	High	High	Moderate	High	Moderate	Moderate	High	High	High	High
3	**Alberta Innovates**	Edmonton, Canada	Government, Research	High	High	High	High	High	Moderate	High	High	High	Strong
4	**Construction Technology Centre at SAIT**	Calgary, Canada	Academia, Industry	High	High	High	High	High	High	Moderate	High	High	Strong
5	**AMII (Alberta Machine Intelligence Institute**	Edmonton, Canada	Academia, Research	Moderate	High	High	Moderate	High	High	Low	High	High	Strong
6	**Smart Infrastructure and Construction Research Cluster**	Cambridge, United Kingdom	Academia, Research	High	High	High	High	High	Moderate	High	High	High	High
7	**Off-site Construction Research Centre (OCRC)**	Fredericton, Canada	Academia, Industry	High	High	High	Moderate	Moderate	Moderate	Moderate	High	High	High
8	**Centre for Building Science**	Toronto, Canada	Academia, Research	High	Moderate	Moderate	High	Moderate	Moderate	High	High	High	High
9	**Construction Innovation Research Network**	Various, Australia	Academia, Research	Moderate	High	Moderate	Moderate	Moderate	High	Moderate	Moderate	Moderate	Moderate
10	**Construction Research Centre (CRC)**	Ottawa, Canada	Government, Research	High	High	High	Moderate	High	High	High	High	High	High

11	**Canadian Centre for Housing Technology (CCHT)**	Ottawa, Canada	Government, Academia	Moderate	Moderate	Moderate	High	Moderate	Low	Moderate	Moderate	High	High
12	**Centre for Infrastructure Performance and Reliability**	Newcastle, Australia	Academia, Research	High	High	High	High	Moderate	Moderate	High	High	High	High
13	**Center for Integrated Facility Engineering (CIFE)**	Stanford, USA	Academia, Industry	High	High	High	High	High	High	High	High	High	High
14	**Harvard Center for Green Buildings and Cities**	Cambridge, USA	Academia, Research	Moderate	Moderate	Moderate	High	Low	Moderate	High	Moderate	High	High
15	**BRE Innovation Park**	Watford, United Kingdom	Industry, Research	Moderate	High	Moderate	High	Low	Low	High	Moderate	High	High
16	**Singapore-ETH Centre - Future Cities Laboratory**	Singapore	Academia, Research, Industry	Moderate	High	High	High	High	High	High	Moderate	High	High
17	**Graz Center of Sustainable Construction**	Graz, Austria	Academia, Research	High	High	High	High	Moderate	Moderate	High	High	High	High
18	**University of Tokyo - Institute of Industrial Science (IIS)**	Tokyo, Japan	Academia, Research	Moderate	High	Moderate	High	High	High	Moderate	Moderate	High	High
19	**Centre for Advanced Construction Technology (CACT)**	Hong Kong, China	Academia, Industry	High	High	High	Moderate	High	High	High	High	High	High
20	**Construction Industry Institute (CII)**	Austin, USA	Academia, Industry	High	High	High	Moderate	Moderate	High	High	High	High	High
21	**Skanska Innovation Lab**	Stockholm, Sweden	Industry, Research	Moderate	High	Moderate	High	High	Moderate	Moderate	Moderate	Moderate	Moderate
22	**Arup Foresight, Innovation, and Research**	London, United Kingdom	Industry, Research	Moderate	High	Moderate	High	High	Moderate	Moderate	Moderate	High	High
23	**China Academy of Building Research (CABR)**	Beijing, China	Government, Research	High	High	High	Moderate	Moderate	Moderate	High	High	High	High
24	**Technical University of Denmark (DTU) - Construction**	Lyngby, Denmark	Academia, Research	Moderate	High	Moderate	High	High	High	High	Moderate	High	High

	Innovation Research												
25	**Future Infrastructure and Built Environment Research Centre**	Cambridge, United Kingdom	Academia, Research	High	High	High	High	High	High	High	High	High	High
26	**DARPA (Defense Advanced Research Projects Agency)**	Arlington, USA	Government, Research	Moderate	Moderate	Moderate	Low	High	Low	Low	Low	Moderate	Moderate
27	**European Construction Technology Platform (ECTP)**	Brussels, Belgium	NGO, Research	Moderate	High	Moderate	High	Moderate	Moderate	High	Moderate	High	High
28	**Global Construction Technology Research Network (GCTRN)**	Various	Academia, Research	Moderate	High	Moderate	Moderate	High	Moderate	Moderate	Moderate	High	Moderate
29	**World Green Building Council (WGBC)**	London, United Kingdom	NGO, Research	High	Moderate	Moderate	High	Low	Low	High	High	Moderate	High
30	**Global Alliance for Buildings and Construction (Global ABC)**	Paris, France	NGO, Research	High	High	High	High	Moderate	Moderate	High	High	High	High
31	**KICT (Korea Institute of Civil Engineering and Building Technology)**	Ilsan, South Korea	Government, Research	High	High	High	High	High	High	High	High	High	High
32	**CSIRO - Advanced Construction Materials Program**	Canberra, Australia	Government, Research	High	High	High	High	Moderate	Moderate	High	High	High	High
33	**Advanced Infrastructure Materials Research Centre**	Beijing, China	Academia, Research	High	High	High	High	Moderate	Moderate	High	High	High	High
34	**Sustainable Construction and Innovation through Procurement (SCIP)**	Various, United Kingdom	NGO, Research	Moderate	High	Moderate	High	Moderate	Moderate	High	Moderate	High	High
35	**MIT Concrete Sustainability Hub (CSHub)**	Cambridge, USA	Academia, Research	High	High	High	High	Moderate	Moderate	High	High	High	High
36	**ETH Zurich - Department of Civil, Environmental and**	Zurich, Switzerland	Academia, Research	Moderate	High	Moderate	High	High	High	High	Moderate	High	High

	Geomatic Engineering												
37	**TU Delft - Faculty of Architecture and the Built Environment**	Delft, Netherlands	Academia, Research	Moderate	High	Moderate	High	High	High	High	Moderate	High	High
38	**Loughborough University - Smart Construction Research Group**	Loughborough, United Kingdom	Academia, Research	High	High	High	Moderate	High	High	High	High	High	High
39	**Construction Safety Research Alliance**	Colorado, USA	Academia, Industry	Moderate	Strong	Moderate	Low	Low	High	High	Moderate	Moderate	Strong
40	**Sirindhorn International Institute of Technology – Construction and Maintenance Technology Research Center (CONTEC)**	Pathum Thani, Thailand	Academia, Research	High	High	High	High	Moderate	Moderate	Moderate	High	High	High
41	**National Taiwan University of Science and Technology – Taiwan Building Technology Center**	Taipei, Taiwan	Academia, Research	Moderate	High	High	High	High	Moderate	Moderate	Moderate	High	High

A6 – Quantitative Comparative Analysis of Global Innovation Centers

ID #	Center Name	Comparison Criteria Focused on Alberta's Needs										Total Ranking
		Relevance to Alberta's Construction Industry	Industry Collaboration	Economic Impact	Focus on Sustainability	AI and Digital Innovation	Workforce Development	Policy and Standards Influence	Regional Collaboration Potential	Funding and Economic Models	Track Record and Impact	
1	**Construction Innovation Centre (CIC)**	8	8	8	8	5	8	5	8	8	5	71
2	**International Council for Research and Innovation in Building and Construction (CIB)**	8	8	5	8	5	5	8	8	8	8	71
3	**Alberta Innovates**	8	8	8	8	8	5	8	8	8	10	79
4	**Construction Technology Centre at SAIT**	8	8	8	8	8	8	5	8	8	10	79
5	**AMII (Alberta Machine Intelligence Institute**	5	8	8	5	8	8	2	8	8	10	70
6	**Smart Infrastructure and Construction Research Cluster**	8	8	8	8	8	5	8	8	8	8	77
7	**Off-site Construction Research Centre (OCRC)**	8	8	8	5	5	5	5	8	8	8	68
8	**Centre for Building Science**	8	5	5	8	5	5	8	8	8	8	68
9	**Construction Innovation Research Network**	5	8	5	5	5	8	5	5	5	5	56
10	**Construction Research Centre (CRC)**	8	8	8	5	8	8	8	8	8	8	77
11	**Canadian Centre for Housing Technology (CCHT)**	5	5	5	8	5	2	5	5	8	8	56

12	**Centre for Infrastructure Performance and Reliability**	8	8	8	8	5	5	8	8	8	8	74
13	**Center for Integrated Facility Engineering (CIFE)**	8	8	8	8	8	8	8	8	8	8	80
14	**Harvard Center for Green Buildings and Cities**	5	5	5	8	2	5	8	5	8	8	59
15	**BRE Innovation Park**	5	8	5	8	2	2	8	5	8	8	59
16	**Singapore-ETH Centre - Future Cities Laboratory**	5	8	8	8	8	8	8	5	8	8	74
17	**Graz Center of Sustainable Construction**	8	8	8	8	5	5	8	8	8	8	74
18	**University of Tokyo - Institute of Industrial Science (IIS)**	5	8	5	8	8	8	5	5	8	8	68
19	**Centre for Advanced Construction Technology (CACT)**	8	8	8	5	8	8	8	8	8	8	77
20	**Construction Industry Institute (CII)**	8	8	8	5	5	8	8	8	8	8	74
21	**Skanska Innovation Lab**	5	8	5	8	8	5	5	5	5	5	59
22	**Arup Foresight, Innovation, and Research**	5	8	5	8	8	5	5	5	8	8	65
23	**China Academy of Building Research (CABR)**	8	8	8	5	5	5	8	8	8	8	71
24	**Technical University of Denmark (DTU) - Construction Innovation Research**	5	8	5	8	8	8	8	5	8	8	71
25	**Future Infrastructure and Built**	8	8	8	8	8	8	8	8	8	8	80

	Environment Research Centre											
26	**DARPA (Defense Advanced Research Projects Agency)**	5	5	5	2	8	2	2	2	5	5	41
27	**European Construction Technology Platform (ECTP)**	5	8	5	8	5	5	8	5	8	8	65
28	**Global Construction Technology Research Network (GCTRN)**	5	8	5	5	8	5	5	5	8	5	59
29	**World Green Building Council (WGBC)**	8	5	5	8	2	2	8	8	5	8	59
30	**Global Alliance for Buildings and Construction (Global ABC)**	8	8	8	8	5	5	8	8	8	8	74
31	**KICT (Korea Institute of Civil Engineering and Building Technology)**	8	8	8	8	8	8	8	8	8	8	80
32	**CSIRO - Advanced Construction Materials Program**	8	8	8	8	5	5	8	8	8	8	74
33	**Advanced Infrastructure Materials Research Centre**	8	8	8	8	5	5	8	8	8	8	74
34	**Sustainable Construction and Innovation through Procurement (SCIP)**	5	8	5	8	5	5	8	5	8	8	65
35	**MIT Concrete Sustainability Hub (CSHub)**	8	8	8	8	5	5	8	8	8	8	74
36	**ETH Zurich - Department of Civil, Environmental**	5	8	5	8	8	8	8	5	8	8	71

	and Geomatic Engineering											
37	**TU Delft - Faculty of Architecture and the Built Environment**	5	8	5	8	8	8	8	5	8	8	71
38	**Loughborough University - Smart Construction Research Group**	8	8	8	5	8	8	8	8	8	8	77
39	**Construction Safety Research Alliance**	5	10	5	2	2	8	8	5	5	10	60
40	**Sirindhorn International Institute of Technology – Construction and Maintenance Technology Research Center (CONTEC)**	8	8	8	8	5	5	5	8	8	8	71
41	**National Taiwan University of Science and Technology – Taiwan Building Technology Center**	5	8	8	8	8	5	5	5	8	8	68

A7 – Collective Ranking of the Global Innovation Centers

ID #	Center Name	Comparison Criteria Focused on Alberta's Needs										Total Ranking
		Relevance to Alberta's Construction Industry	Industry Collaboration	Economic Impact	Focus on Sustainability	AI and Digital Innovation	Workforce Development	Policy and Standards Influence	Regional Collaboration Potential	Funding and Economic Models	Track Record and Impact	
1	**Construction Innovation Centre (CIC)**	8	8	8	8	5	8	5	8	8	5	71
2	**International Council for Research and Innovation in Building and Construction (CIB)**	8	8	5	8	5	5	8	8	8	8	71
3	**Alberta Innovates**	8	8	8	8	8	5	8	8	8	10	79
4	**Construction Technology Centre at SAIT**	8	8	8	8	8	8	5	8	8	10	79
5	**AMII (Alberta Machine Intelligence Institute**	5	8	8	5	8	8	2	8	8	10	70
6	**Smart Infrastructure and Construction Research Cluster**	8	8	8	8	8	5	8	8	8	8	77
7	**Construction Research Centre (CRC)**	8	8	8	5	8	8	8	8	8	8	77
8	**Centre for Infrastructure Performance and Reliability**	8	8	8	8	5	5	8	8	8	8	74
9	**Center for Integrated Facility Engineering (CIFE)**	8	8	8	8	8	8	8	8	8	8	80
10	**Singapore-ETH Centre - Future Cities Laboratory**	5	8	8	8	8	8	8	5	8	8	74
11	**Graz Center of Sustainable Construction**	8	8	8	8	5	5	8	8	8	8	74
12	**Centre for Advanced Construction Technology (CACT)**	8	8	8	5	8	8	8	8	8	8	77
13	**Construction Industry Institute (CII)**	8	8	8	5	5	8	8	8	8	8	74

14	**China Academy of Building Research (CABR)**	8	8	8	5	5	5	8	8	8	8	71
15	**Technical University of Denmark (DTU) - Construction Innovation Research**	5	8	5	8	8	8	8	5	8	8	71
16	**Future Infrastructure and Built Environment Research Centre**	8	8	8	8	8	8	8	8	8	8	80
17	**Global Alliance for Buildings and Construction (Global ABC)**	8	8	8	8	5	5	8	8	8	8	74
18	**KICT (Korea Institute of Civil Engineering and Building Technology)**	8	8	8	8	8	8	8	8	8	8	80
19	**CSIRO - Advanced Construction Materials Program**	8	8	8	8	5	5	8	8	8	8	74
20	**Advanced Infrastructure Materials Research Centre**	8	8	8	8	5	5	8	8	8	8	74
21	**MIT Concrete Sustainability Hub (CSHub)**	8	8	8	8	5	5	8	8	8	8	74
22	**ETH Zurich - Department of Civil, Environmental and Geomatic Engineering**	5	8	5	8	8	8	8	5	8	8	71
23	**TU Delft - Faculty of Architecture and the Built Environment**	5	8	5	8	8	8	8	5	8	8	71
24	**Loughborough University - Smart Construction Research Group**	8	8	8	5	8	8	8	8	8	8	77
25	**Sirindhorn International Institute of Technology – Construction and Maintenance Technology Research Center (CONTEC)**	8	8	8	8	5	5	5	8	8	8	71

A8 – WHAT × HOW 2D Matrix with Ranking Metrics

What/How Matrix	Government-Funded Research	Academic Collaboration	Industry Partnerships	In-House R&D	Pilot Projects & Prototyping	Knowledge Dissemination & Workshops	Commercialization & Tech Transfer	Collaboration Platforms & Knowledge Hubs	Training & Capacity Building	Policy & Regulatory Engagement
Sustainable and Net-Zero Construction Management	4	5	2	2	2	3	2	2	5	3
Digital Transformation in Construction	3	3	3	3	4	3	2	5	3	5
Advanced Construction Technologies	2	3	4	3	3	2	2	5	2	5
Workforce Development and Management	2	3	3	3	2	5	2	3	5	5
Advanced Construction Materials and Applications	2	4	4	3	3	3	3	3	5	3
Policy and Regulation in Construction	3	4	5	3	3	4	2	2	2	2
Health, Safety, and Risk Management	2	2	4	2	5	5	2	3	2	3
Energy-Efficient Systems and Construction Practices	2	3	3	5	2	2	5	5	2	2
Decarbonization of Construction Processes	4	4	2	3	2	4	3	2	3	3
Construction Supply Chain Optimization	3	5	4	3	2	3	2	5	3	3
Performance Monitoring and Data-Driven Decision Making	2	2	2	2	5	4	2	5	3	2
Climate Adaptation and Disaster-Resilient Construction	3	3	5	3	2	2	2	4	3	5
Lean Construction and Manufacturing	4	2	2	3	2	5	3	4	2	3
Automated and Generative Design in Construction	3	2	3	3	5	5	3	2	4	3
Smart Procurement and Contract Management in Construction	3	5	2	3	5	2	5	2	2	2

A9 – Research Roadmap Questionnaire

Introduction:

Thank you for taking the time to participate in this interview. Your insights will help shape the **Construction Innovation Centre (CIC) Research Roadmap** by identifying key priorities, challenges, and opportunities in construction research and innovation. The following questions aim to gather **technical and non-technical perspectives** on industry trends, collaboration potential, and research impact.

Part 1 - Interviewee Information

Section 1: Industry Partner Information ***(For Industry Stakeholders)***

a. Type of Organization (Select all that apply):

- ☐ Owner
- ☐ Consultant
- ☐ Project Management Services
- ☐ General Contractor
- ☐ Specialty/Sub-Contractor
- ☐ Manufacturer/Supplier
- ☐ Engineering Firm
- ☐ Other (please specify): _____

b. Organization's Industry Sub-Sector / Specialization ***(Select all that apply or add)***

- ☐ Residential Building Construction
- ☐ Industrial Building & Structure Construction
- ☐ Commercial & Institutional Building Construction
- ☐ Water & Sewer Line Construction
- ☐ Oil & Gas Pipeline Construction
- ☐ Power & Communications Line Construction
- ☐ Highway, Street & Bridge Construction
- ☐ Prefabrication & Modular Construction
- ☐ Renewable Energy Infrastructure
- ☐ Sustainable & Net-Zero Construction
- ☐ Advanced Construction Materials & Manufacturing
- ☐ Other (please specify): _____

c. Type of Organization Ownership ***(Select all that apply or add)***

- ☐ Publicly Traded
- ☐ Privately Owned
- ☐ Employee-Owned
- ☐ Government-Owned
- ☐ Non-Profit Organization
- ☐ Other (please specify): _____

d. Years Since Establishment

☐ <10 years
☐ 10-20 years
☐ 21-30 years
☐ 31-40 years
☐ >40 years

e. Size of Organization (by Employee Count)

☐ Small: Fewer than 50 employees
☐ Medium: 50 to 499 employees
☐ Large: 500 or more employees

f. Annual Turnover (CAD Millions)

☐ <50
☐ 51-100
☐ 101-500
☐ 501-1000
☐ 1001-5000
☐ >5000

g. How long have you been working in your current stated position?

_____

h. How long have you been working in the construction industry? _____

Section 2: Academia Collaborator Information ***(For Academic Stakeholders)***

i. Faculty/Department: _____

j. Research Focus/Area of Expertise: _____

k. Years in Current Position: _____

l. Overall Experience in Construction Research and Academia:

_____

Section 3: Policymakers, Associations, and Community Representatives ***(For Non-Industry and Non-Academic Stakeholders)***

m. Type of Organization ***(Select all that apply or add)***

☐ Government Agency
☐ Regulatory Body
☐ Industry Association
☐ Community Organization
☐ Trade Union

☐ Non-Profit Organization
☐ Other (please specify): _____

n. Primary Role in Construction-Related Activities *(Select all that apply or add)*
☐ Policy Development & Regulation
☐ Funding & Grant Allocation
☐ Advocacy & Public Engagement
☐ Standards & Certification
☐ Workforce Training & Development
☐ Other (please specify): _____

Section 4: General Industry & Research Challenges

o. From your perspective (as an industry professional or academic), what are the top three challenges currently affecting the construction sector? *(Short Answer)*

_____

_____

_____

p. In your experience, which area of construction operations or research do you believe requires the most improvement? *(Short Answer)*

_____

_____

_____

q. What do you consider the primary cause of this challenge? *(Short Answer)*

_____

_____

_____

r. Have you attempted to address this issue before? *(Yes/No)*

☐**Yes →** ***What did you try, and did it work? (Short Answer)***

_____

_____

_____

☐**No →** ***Why not? (Short Answer)***

_____

_____

_____

Section 5: Research & Innovation

s. How does your organization engage in research and innovation in construction? *(Select and rank all that apply or add)*

Engagement Method	Select	Importance (1-5) Lowest 1; Highest 5

In-House R&D – Conducting internal research and development initiatives.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Industry Partnerships – Collaborating with contractors, suppliers, or technology firms.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Academic Collaboration – Partnering with universities and research institutions.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Pilot Projects & Prototyping – Testing new technologies or methods on small-scale projects.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Investment in New Technologies – Adopting AI, BIM, automation, or sustainable materials.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Employee Training & Development – Providing upskilling programs on innovative practices.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Participation in Industry Conferences – Engaging in knowledge-sharing events and expos.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Government-Funded Research – Securing grants or participating in public research programs.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Knowledge Sharing & Internal Workshops – Hosting discussions on new trends and findings.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Adoption of Digital Tools – Implementing data analytics, IoT, and digital twin technologies.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Sustainability Initiatives – Focusing on green construction and carbon reduction strategies.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Open Innovation & Crowdsourcing – Engaging external experts or public input.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Regulatory & Policy Advocacy – Working with policymakers to influence industry standards.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Monitoring Global Trends – Keeping track of international advancements in construction.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Venture Capital & Start-up Engagement – Investing in construction tech startups.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Other (please specify): _____	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐

t. How do you evaluate the success of research projects/proposals in construction? ***(Select and rank all that apply or add)***

Evaluation Method	**Select**	**Importance (1-5) Lowest 1; Highest 5**
Innovation – Introduces groundbreaking ideas, materials, or methods.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Practical Implementation – Can be effectively applied in real-world construction.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐

Industry Impact – Improves efficiency, safety, sustainability, or cost-effectiveness.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Relevance – Addresses critical industry challenges or needs.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Cost-Effectiveness – Delivers value with a strong return on investment.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Research Quality – Uses rigorous, data-driven methodologies.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Sustainability – Supports eco-friendly and energy-efficient construction.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Stakeholder Engagement – Gains industry support and collaboration.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Scalability – Adaptable for broader use in different projects or regions.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Knowledge Contribution – Published, cited, or applied in industry.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Regulatory Influence – Helps shape policies, codes, or legal standards.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Technology Integration – Advances construction through AI, BIM, or automation.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Market Viability – Has commercial potential or leads to new business opportunities.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Educational Value – Contributes to workforce training and development.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Other (please specify):	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐

u. What are the key barriers to implementing new research findings and innovations in your field? ***(Select and rank all that apply or add)***

Key Barriers	**Select**	**Importance (1-5) Lowest 1; Highest 5**
High Implementation Costs – Expensive adoption of new technologies or methods.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Resistance to Change – Industry reluctance to shift from traditional practices.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Lack of Awareness – Limited knowledge of new research among professionals.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Regulatory and Compliance Issues – Rigid building codes and slow policy adaptation.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Limited Industry Collaboration – Weak partnerships between researchers and practitioners.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐

Short-Term Focus – Preference for immediate cost savings over long-term benefits.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Technical Complexity – Difficult integration with existing systems or workflows.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Insufficient Skilled Workforce – Lack of training in new technologies or methods.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Funding Constraints – Limited financial support for innovation adoption.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Risk Aversion – Fear of failure or liability in using unproven innovations.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Scalability Challenges – Difficulty in applying research across different projects.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Supply Chain Limitations – Unavailable materials, equipment, or expertise.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Inconsistent Quality and Performance Data – Lack of proof for reliability.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Time Constraints – Tight project deadlines discouraging experimentation.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Weak Knowledge Transfer – Poor communication between academia and industry.	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Other (please specify): _____	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐

Section 5: Industry Collaboration & Engagement

v. How can CIC strengthen collaboration with industry, government, and academia? ***(Select and rank all that apply or add)***

Collaboration Methods	**Select**	**Importance (1-5) Lowest 1; Highest 5**
More industry-led projects aligned with business needs	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Joint government-industry funding programs for research	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Greater focus on commercializing research outcomes	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Stronger partnerships with international research centers	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Better communication of research impact and findings	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐
Other (please specify): _____	Y☐ N☐	1☐ 2☐ 3☐ 4☐ 5☐

w. What are the biggest barriers preventing stronger collaboration? ***(Short Answer)***

Part 2 - Strategic Plan Information

Section 1: Value-Added Services for Industry Partners

Please indicate your level of interest in each service by selecting the appropriate column.

	Proposed Research Service	Importance (1-5) Lowest 1; Highest 5
1	Customized Research & Development (R&D)	1☐ 2☐ 3☐ 4☐ 5☐
2	Technology Validation	1☐ 2☐ 3☐ 4☐ 5☐
3	Prototyping & Pilot Testing Facilities	1☐ 2☐ 3☐ 4☐ 5☐
4	Innovation Commercialization & Patent Support	1☐ 2☐ 3☐ 4☐ 5☐
5	Funding & Grant Facilitation	1☐ 2☐ 3☐ 4☐ 5☐
6	Construction Data Analytics & AI Solutions	1☐ 2☐ 3☐ 4☐ 5☐
7	Innovation Sandbox & Living Labs Hub	1☐ 2☐ 3☐ 4☐ 5☐
8	Networking, Branding & Leadership Visibility	1☐ 2☐ 3☐ 4☐ 5☐

1. Are there other services you would like CIC to offer? ***(Short Answer)***

2. What would make your organization invest more in CIC? ***(Short Answer)***

Section 2: CIC Functions Priorities

	Proposed Practical Approaches	Importance (1-5) Lowest 1; Highest 5
1	Industry-Led Innovation & Collaboration Forum	1☐ 2☐ 3☐ 4☐ 5☐
2	Industry Co-Leadership in Research Direction	1☐ 2☐ 3☐ 4☐ 5☐
3	Live Demonstrations & Implementation Pilots	1☐ 2☐ 3☐ 4☐ 5☐
4	Exclusive IP & First-Use Rights for Partners	1☐ 2☐ 3☐ 4☐ 5☐
5	Centralized Research Data & Intelligence Hub	1☐ 2☐ 3☐ 4☐ 5☐
6	Advanced Searchable Database for CIC Research	1☐ 2☐ 3☐ 4☐ 5☐
7	HQP Talent Recruitment & Placement	1☐ 2☐ 3☐ 4☐ 5☐
8	Strategic Communication & Knowledge Dissemination	1☐ 2☐ 3☐ 4☐ 5☐

1. **Are there any additional services or improvements you would like the CIC to offer that are not currently listed?** ***(Short Answer)***

_____

_____

_____

Section 3: Training and Outreach Opportunities

	Proposed Training & Outreach Opportunity	Importance (1-5) Lowest 1; Highest 5
1	Industry-Led Training Modules	1☐ 2☐ 3☐ 4☐ 5☐
2	Practical Research & Innovation Workshops	1☐ 2☐ 3☐ 4☐ 5☐
3	Student Internships at Partner Companies	1☐ 2☐ 3☐ 4☐ 5☐
4	Trainee Blog	1☐ 2☐ 3☒ 4☐ 5☐

1. **How can CIC improve the effectiveness of its training and outreach programs to better support your organization's needs?** ***(Short Answer)***

_____

_____

_____

Part 3 – Research Roadmap

Section 1: Industry Challenges & Research Impact (WHAT - Key Challenges in Construction)

This section focuses on uncovering the most pressing industry challenges from the interviewee's perspective.

1.1 Bridging Research & Industry Applications

1.1.1 Have you worked with R&D groups or teams before? ***(Yes/No)***

☐ **Yes →** ***What aspects went well, and what challenges did you face? (Short Answer)***

_____

_____

_____

☐ **No →** ***What has prevented collaboration? (Short Answer)***

_____

_____

_____

1.1.2 How can CIC improve the effectiveness of research in addressing industry challenges? ***(Select all that apply)***

☐ Case Studies – Link research to real-world projects and pilot studies

☐ Adoption Pipeline – Visualize research from R&D → applied use → prototype → deployment

☐ Industry-Aligned Research Tracks – Specialized tracks based on key industry needs, ensuring targeted and practical outcomes.
☐ KPI-Based Assessment – Measure impact via cost, time savings, and sustainability metrics

1.1.3 Are there any other methods you would suggest in making research outcomes more applicable to industry? *(Short Answer)*

_____

_____

_____

Section 2: Understanding Research Interests (WHAT - Areas for Investigation & Collaboration)
This section identifies which challenges need more research, testing, or solutions.

2.2.1 Research Priorities (Short, Medium, Long)

- Which **specific areas** of the matrix should be the primary focus for research in the next **1-3 years (S – Short)**, **3-5 years (Medium – M)**, or **5-8 years (L – Long)**, considering:
    - Industry urgency
    - Technical feasibility
    - Impact potential
    - Strategic industry transformation
    - Scalability & implementation potential
    - Regulatory & policy alignment

- **Select and categorize your focus areas.**

Priority Research Themes (16)	Selection	
Sustainable and Net-Zero Construction Management	**S** ☐ **M** ☐ **L** ☐	**NA** ☐
Digital Transformation in Construction	**S** ☐ **M** ☐ **L** ☐	**NA** ☐
Advanced Construction Technologies	**S** ☐ **M** ☐ **L** ☐	**NA** ☐
Workforce Development and Management	**S** ☐ **M** ☐ **L** ☐	**NA** ☐
Advanced Construction Materials and Applications	**S** ☐ **M** ☐ **L** ☐	**NA** ☐
Policy and Regulation in Construction	**S** ☐ **M** ☐ **L** ☐	**NA** ☐
Health, Safety, and Risk Management	**S** ☐ **M** ☐ **L** ☐	**NA** ☐
Energy-Efficient Systems and Construction Practices	**S** ☐ **M** ☐ **L** ☐	**NA** ☐
Decarbonization of Construction Processes	**S** ☐ **M** ☐ **L** ☐	**NA** ☐
Construction Supply Chain Optimization	**S** ☐ **M** ☐ **L** ☐	**NA** ☐
Performance Monitoring and Data-Driven Decision Making	**S** ☐ **M** ☐ **L** ☐	**NA** ☐

Climate Adaptation and Disaster-Resilient Construction	**S ☐ M ☐ L ☐**	**NA ☐**
Human-Centric Design and Well-Being in Built Environments	**S ☐ M ☐ L ☐**	**NA ☐**
Lean Construction and Manufacturing	**S ☐ M ☐ L ☐**	**NA ☐**
Automated and Generative Design in Construction	**S ☐ M ☐ L ☐**	**NA ☐**
Smart Procurement and Contract Management in Construction	**S ☐ M ☐ L ☐**	**NA ☐**

2.2.2 Are there any construction-related problems that you believe do not receive enough research attention? ***(Short Answer)***

_____

_____

_____

Section 3: Metrics for Evaluating CIC Research Proposals

- **What criteria should be used to assess and prioritize funding decisions for <u>new research proposals</u>?**

Metric	Definition	Importance (1-5) Lowest 1; Highest 5
Strategic Fit	Alignment with CIC's mission and industry relevance	1☐ 2☐ 3☐ 4☐ 5☐
Feasibility	Likelihood of success based on readiness and regulations	1☐ 2☐ 3☐ 4☐ 5☐
Industry Demand	Market demand and potential industry adoption	1☐ 2☐ 3☐ 4☐ 5☐
Innovation & Technical Merit	Novelty and potential breakthroughs	1☐ 2☐ 3☐ 4☐ 5☐
Collaboration Potential	Opportunities for multi-disciplinary partnerships	1☐ 2☐ 3☐ 4☐ 5☐
Economic Viability	Cost savings, efficiency, ROI potential	1☐ 2☐ 3☐ 4☐ 5☐
Sustainability Impact	Environmental and social benefits	1☐ 2☐ 3☐ 4☐ 5☐
Scalability & Transferability	Ability to expand across sectors	1☐ 2☐ 3☐ 4☐ 5☐
Skills Development	Training of Highly qualified personnel (HQP)	1☐ 2☐ 3☐ 4☐ 5☐

A10 – Academic Studies Sources and References

1. Research powering innovation for Canada. NRC 2024–2029 Strategic Plan
2. Digitalization and productivity research and development roadmap. NRC 2024
3. openBIM implementations for a Canadian roadmap. NRC 2024
4. Golabchi, A., Mohamed, Y., Robinson Fayek, A., & AbouRizk, S. The University of Alberta's Construction Innovation Centre (CIC): Academia-Industry Collaboration for High-Impact Research. In *Construction Research Congress 2024* (pp. 159-169).
5. Fayek, A. R., & Golabchi, A. (2022). Framework for identification of performance metrics for research and development collaborations: Construction Innovation Centre. *Built Environment Project and Asset Management*, *12*(5), 837-852.
6. Siebelink, R., Halman, J. I., & Hofman, E. (2016). Scenario-Driven Roadmapping to cope with uncertainty: Its application in the construction industry. *Technological forecasting and social change*, *110*, 226-238.
7. Kim, C., Kim, H., Han, S. H., Kim, C., Kim, M. K., & Park, S. H. (2009). Developing a technology roadmap for construction R&D through interdisciplinary research efforts. *Automation in Construction*, *18*(3), 330-337.
8. McAuley, B., Hore, A., & West, R. (2019). Centres of Excellence and Roadmaps for digital transition: Lessons for Ireland's construction industry.
9. Kazi, A. S. S., Aouad, G., & Baldwin, A. (2009). Next generation construction IT: technology foresight, future studies, roadmapping and scenario planning. *Journal of Information Technology in Construction (ITcon)*, *14*(12), 123-128.
10. Sim, T. G., Swindles, G. T., Morris, P. J., Baird, A. J., Gallego-Sala, A. V., Wang, Y., ... & Zang, H. (2023). UVicSPACE: Research & Learning Repository. *Quaternary Science Reviews*, *305*, 108020.
11. Simonse, L. W., Hultink, E. J., & Buijs, J. A. (2015). Innovation roadmapping: Building concepts from practitioners' insights. *Journal of product innovation management*, *32*(6), 904-924.

12. Kazi, A. S., Hannus, M., Zarli, A., & Martens, B. (2007). Strategic roadmaps and implementation actions for ICT in construction. *Consortium for Strategic Actions for Realising the Vision of ICT in Construction*.

13. Burian, P. E., Rogerson, L., & Maffei III, F. R. (2010). The Research Roadmap: A Primer to the Approach and Process. *Contemporary Issues in Education Research*, *3*(8), 43-58.

14. International Council for Research and Innovation in Building and Construction (CIB),

    a) Information Integration in Construction (CIB Publication 417). 2019

    b) Integrated Design and Delivery Solutions (CIB Publication 370). 2013

    c) Intelligent and Responsive Buildings (CIB Publication 415). 2018

    d) Offsite Production and Manufacturing (CIB Publication 372). 2013

    e) Safety and Health in Construction (CIB Publication 376). 2020

15. CIB Global Report - Revisiting Offsite: A New Capability-Driven Research Roadmap for Offsite Design, Manufacturing and Construction. 2023

16. Associated General Contractors of America. (2022). AGC Safety Management Survey 2022.

17. Associated General Contractors of America. (2023). AGC Workforce Survey 2023: The Construction Industry Faces Continuing Labor Shortages.

18. BuildForce Canada. (2024). 2024–2030 Construction and Maintenance Looking Forward: Alberta. BuildForce Canada.

19. Canadian Construction Association. (2023). Industry Priorities Survey and Recommendations to Government. Canadian Construction Association.

20. Construction Industry Institute. (2021). CII Best Practices Guide: Improving Project Safety and Performance. Construction Industry Institute.

21. Construction Industry Institute. (2022). CII Best Practices and Benchmarking Report. Construction Industry Institute.

22. Construction Industry Institute. (2023). Pilot Adoption Benchmarking Study. Construction Industry Institute.

23. FMI Corporation. (2023). FMI Productivity Report 2023: Industry Trends and Drivers. FMI Corporation.

24. FMI Corporation. (2024). 2024 Construction Industry Overview. FMI Corporation.

25. Lean Construction Institute. (2019). LCI Research Report: Quantifying Waste in Construction. Lean Construction Institute.

26. McKinsey & Company. (2017). Reinventing Construction: A Route to Higher Productivity. McKinsey Global Institute.

27. McKinsey & Company. (2023). Decoding Digital Construction: The New Cost and Productivity Frontier. McKinsey & Company.

28. National Institute of Standards and Technology. (2004). Cost Analysis of Inadequate Interoperability in the U.S. Capital Facilities Industry (NIST GCR 04-867). U.S. Department of Commerce.

29. UK Construction Innovation Hub. (2022). Value Toolkit: Industry Guidance. Construction Innovation Hub.

30. Workplace Compensation Board of Alberta. (2023). Annual Statistical Review 2023. WCB Alberta.

A11 – Sample Projects Across Research Themes

This appendix provides illustrative examples of potential projects aligned with different research themes. These examples showcase practical applications of research in addressing key challenges and advancing innovation in the construction industry.

– WHAT –
Research Themes
(Challenges in Construction)

These themes represent critical challenges, gaps, and areas requiring innovation in the construction industry. They define what needs to be researched and improved.

1. Sustainable and Net-Zero Construction
Research focuses on reducing the environmental impact of buildings and infrastructure while ensuring energy efficiency and resource conservation. This includes strategies for minimizing carbon emissions, integrating renewable energy, and adopting eco-friendly materials. Challenges include meeting regulatory sustainability targets, reducing embodied carbon, and improving circularity in materials use.

2. Digital Transformation in Construction
This theme investigates the integration of digital tools, automation, and real-time data processing to improve construction efficiency, collaboration, and cost-effectiveness. Challenges include transitioning from traditional workflows, resistance to new technologies, and interoperability between digital tools.

3. Advanced Construction Technologies
Research explores cutting-edge construction methods and tools, including robotics, prefabrication, and AI-driven decision-making. Challenges include cost of adoption, skills gaps, and ensuring technology scalability for different project sizes.

4. Infrastructure Resilience and Management
This theme addresses designing, maintaining, and upgrading infrastructure to withstand natural disasters, climate change, and aging deterioration. Key challenges include integrating resilience planning into early project stages, balancing cost constraints, and managing long-term maintenance efficiently.

5. Workforce Development and Talent Management
Research explores attracting, training, and retaining skilled construction workers while adapting to automation and digitalization. The industry faces labor shortages, an aging workforce, and insufficient training for emerging technologies.

6. Advanced Construction Materials and Applications
This theme focuses on innovating materials that enhance durability, energy efficiency, and environmental sustainability. Research explores lightweight, high-strength, self-healing, and

climate-responsive materials while addressing cost, manufacturability, and performance testing standards.

7. Policy and Regulation in Construction
Research evaluates how regulations and policies impact construction processes, sustainability mandates, and industry compliance. Challenges include policy inconsistencies, regulatory delays, and balancing government intervention with industry flexibility.

8. Health, Safety, and Risk Management
This theme explores reducing hazards in construction workplaces through better training, new safety technologies, and improved regulatory compliance. Challenges include managing high-risk environments, enforcing safety culture, and ensuring compliance with evolving safety standards.

9. Energy-Efficient Systems and Construction Practices
Research focuses on reducing energy consumption through passive and active building systems, smart energy grids, and green certifications. Challenges include high upfront costs, lack of standardization, and ensuring long-term energy efficiency benefits.

10. Decarbonization of Construction Processes
This theme explores reducing carbon emissions across the construction supply chain. Research investigates low-carbon cement, carbon capture techniques, and energy-efficient equipment while addressing cost, performance, and industry adoption barriers.

11. Circular Construction Management
Research focuses on minimizing construction waste, optimizing material reuse, and promoting closed-loop construction processes. Challenges include logistical barriers, lack of material tracking systems, and limited incentives for material reuse.

12. Construction Supply Chain Optimization
This theme explores enhancing procurement efficiency, logistics management, and real-time tracking of materials and labor. Challenges include supply chain disruptions, inefficient procurement processes, and lack of transparency in supplier relationships.

13. Performance Monitoring and Data-Driven Decision Making
Research investigates real-time construction project monitoring, predictive analytics, and AI-driven decision-making. Challenges include data collection accuracy, integration with legacy systems, and ensuring cybersecurity in digital construction management.

14. Climate Adaptation and Disaster-Resilient Construction
This theme addresses designing buildings and infrastructure that can withstand extreme weather, seismic activity, and other environmental hazards. Research investigates flood-resistant materials, dynamic load-bearing structures, and predictive maintenance models.

15. Human-Centric Design and Well-Being in Built Environments

Research explores how the built environment affects mental and physical well-being. This includes designing workspaces for productivity, improving air quality, and integrating human-centered design principles into urban spaces.

16. Lean Construction and Manufacturing
This theme investigates minimizing waste, improving workflows, and maximizing efficiency in construction processes. Challenges include lack of digital integration, workforce resistance, and implementation across large-scale projects.

17. Automated and Generative Design in Construction
Research explores using AI and computational models to optimize design and decision-making. This includes parametric modeling, AI-assisted drafting, and performance-driven design automation.

18. Smart Procurement and Contract Management in Construction
This theme focuses on streamlining procurement and contract management through digitalization, smart contracts, and automation. Challenges include complex procurement structures, lack of transparency, and inefficiencies in contract negotiation and execution.

A12 – Quantitative Ranking and Questionnaire Data Collection Extract

Engagement Methods	Industry		Av. Imp. (1-5)	Wgt Av. Imp. (1-5)	Academia		Av. Imp. (1-5)	Wgt Av. Imp. (1-5)	Others		Av. Imp. (1-5)	Wgt Av. Imp. (1-5)	YES	NO	YES (%)	NO (%)	Total Importance (1-5)
	YES	NO			YES	NO			YES	NO							
In-House R&D	21	12	3	1.5	15	6	3	0.9	9	9	2	0.4	45	27	63	38	3
Industry Partnerships	28	5	4	2.0	16	5	4	1.2	11	7	3	0.6	55	17	76	24	4
Academic Collaboration	30	3	4	2.2	16	5	4	1.2	14	6	2	0.4	60	12	83	17	4
Pilot Projects & Prototyping	31	2	4	2.1	9	12	3	0.9	8	10	1	0.2	48	24	67	33	3
Investment in New Technologies	9	24	2	1.0	8	13	4	1.2	10	8	2	0.4	27	45	38	63	3
Employee Training & Development	10	23	1	0.6	9	12	2	0.6	10	8	3	0.6	29	43	40	60	2
Participation in Industry Conferences	25	2	2	1.0	15	6	4	1.2	13	5	2	0.4	42	30	58	42	3
Government-Funded Research	33	0	5	2.3	12	9	4	1.2	9	9	3	0.6	60	12	83	17	4
Knowledge Sharing & Internal Workshops	21	12	2	1.2	10	11	4	1.2	9	9	4	0.8	40	32	56	44	3
Adoption of Digital Tools	20	13	2	1.1	10	11	2	0.5	8	10	2	0.4	38	34	53	47	2
Sustainability Initiatives	2	31	1	0.5	13	8	1	0.4	5	13	2	0.4	20	52	28	72	1
Open Innovation & Crowdsourcing	2	31	1	0.5	7	14	1	0.2	8	10	2	0.4	17	55	24	76	1
Regulatory & Policy Advocacy	13	20	1	0.5	11	10	2	0.5	10	8	4	0.8	34	38	47	53	2
Monitoring Global Trends	5	28	0	0.2	8	13	1	0.4	10	8	4	0.8	23	49	32	68	1
Venture Capital & Start-up Engagement	9	24	1	0.5	7	14	1	0.2	9	9	3	0.6	25	47	35	65	1

Evaluation Methods	Industry		Av. Imp. (1-5)	Wgt Av. Imp. (1-5)	Academia		Av. Imp. (1-5)	Wgt Av. Imp. (1-5)	Others		Av. Imp. (1-5)	Wgt Av. Imp. (1-5)	YES	NO	YES (%)	NO (%)	Total Importance (1-5)
	YES	NO			YES	NO			YES	NO							
Innovation	21	12	3	1.5	18	3	3	0.9	7	11	3	0.6	38	34	53	47	3
Practical Implementation	28	5	4	2.0	17	4	4	1.2	8	10	3	0.6	60	12	83	17	4
Industry Impact	30	3	4	2.0	14	7	3	0.9	12	6	3	0.6	58	14	81	19	4
Relevance	17	16	4	2.0	12	9	4	1.2	6	12	2	0.4	48	24	67	33	4
Cost-Effectiveness	21	12	3	1.5	9	12	2	0.6	10	8	2	0.4	34	38	47	53	3
Research Quality	17	16	2	0.9	20	1	4	1.2	7	11	2	0.4	37	35	51	49	3
Sustainability	12	21	1	0.5	11	10	2	0.6	4	14	2	0.4	27	45	38	63	2
Stakeholder Engagement	23	10	3	1.5	8	13	2	0.6	5	13	2	0.4	36	36	50	50	3
Scalability	25	8	4	2.0	10	11	3	0.9	13	5	3	0.6	39	33	54	46	4
Knowledge Contribution	17	16	2	0.8	19	2	4	1.2	7	11	2	0.4	30	42	42	58	2
Regulatory Influence	15	18	1	0.6	9	12	2	0.5	8	10	2	0.4	32	40	44	56	1
Technology Integration	17	16	3	1.5	12	9	3	0.9	12	6	3	0.6	41	31	57	43	3
Market Viability	17	16	2	1.0	14	7	2	0.6	12	6	3	0.6	43	29	60	40	2
Educational Value	15	18	2	1.0	18	3	4	1.2	7	11	2	0.4	33	39	46	54	3

Key Barriers	Industry		Av. Imp. (1-5)	Wgt Av. Imp. (1-5)	Academia		Av. Imp. (1-5)	Wgt Av. Imp. (1-5)	Others		Av. Imp. (1-5)	Wgt Av. Imp. (1-5)	YES	NO	YES (%)	NO (%)	Total Importance (1-5)
	YES	NO			YES	NO			YES	NO							
High Implementation Costs	21	12	3	1.5	7	14	3	0.9	5	13	2	0.4	33	39	46	54	3
Resistance to Change	16	17	3	1.5	8	13	4	1.2	9	9	3	0.6	40	32	56	44	3
Lack of Awareness	20	13	2	1.0	11	10	3	0.9	11	7	3	0.6	42	30	58	42	3
Regulatory and Compliance Issues	17	16	2	0.9	13	8	2	0.6	10	8	3	0.6	40	32	56	44	2
Limited Industry Collaboration	14	19	1	0.7	9	12	4	1.2	9	9	3	0.6	32	40	44	56	3
Short-Term Focus	20	13	3	1.5	9	12	4	1.2	11	7	3	0.6	40	32	56	44	3
Technical Complexity	16	17	2	0.8	11	10	2	0.6	5	13	2	0.4	32	40	44	56	2
Insufficient Skilled Workforce	13	20	1	0.7	13	8	2	0.6	14	4	3	0.5	40	32	56	44	2
Funding Constraints	19	14	3	1.5	13	8	4	1.2	9	9	3	0.6	41	31	57	43	3
Risk Aversion	20	13	3	1.5	5	16	1	0.2	10	8	3	0.6	35	37	49	51	2
Scalability Challenges	13	20	2	1.0	9	12	2	0.6	8	10	3	0.6	30	42	42	58	2
Supply Chain Limitations	16	17	2	0.8	11	10	2	0.5	12	6	3	0.6	39	33	54	46	2
Inconsistent Quality and Performance Data	18	15	4	2.0	13	8	3	0.8	12	6	3	0.6	43	29	60	40	3
Time Constraints	17	16	2	0.9	7	14	4	1.2	5	13	2	0.4	29	43	40	60	2
Weak Knowledge Transfer	18	15	4	2.0	14	7	2	0.7	11	7	3	0.6	43	29	60	40	3

Collaboration Methods	Industry		Av. Imp. (1-5)	Wgt Av. Imp. (1-5)	Academia		Av. Imp. (1-5)	Wgt Av. Imp. (1-5)	Others		Av. Imp. (1-5)	Wgt Av. Imp. (1-5)	YES	NO	YES (%)	NO (%)	Total Importance (1-5)
	YES	NO			YES	NO			YES	NO							
More industry-led projects aligned with business needs	25	8	4	2.0	9	12	3	0.9	9	9	2	0.4	40	32	56	44	3
Joint government-industry funding programs for research	28	5	2	1.2	8	13	3	0.9	13	5	3	0.6	33	39	46	54	3
Greater focus on commercializing research outcomes	14	19	2	1.0	9	12	3	0.9	5	13	1	0.2	31	41	43	57	2
Stronger partnerships with international research centers	14	19	1	0.5	18	3	4	1.2	6	12	1	0.3	29	43	40	60	2
Better communication of research impact and findings	21	12	4	2.0	19	2	4	1.2	9	9	2	0.4	42	30	58	42	4

Improving Research Effectiveness	Industry		Av. Imp. (1-5)	Wgt Av. Imp. (1-5)	Academia		Av. Imp. (1-5)	Wgt Av. Imp. (1-5)	Others		Av. Imp. (1-5)	Wgt Av. Imp. (1-5)	YES	NO	YES (%)	NO (%)	Total Importance (1-5)
	YES	NO			YES	NO			YES	NO							
Case Studies	20	13	4	2.0	18	3	3	0.9	15	3	4	0.8	53	19	74	26	4
Adoption Pipeline	18	15	2	1.0	12	9	2	0.6	12	6	4	0.8	42	30	58	42	2
Industry-Aligned Research Tracks	25	8	3	1.5	15	6	3	0.9	5	13	2	0.4	45	27	63	38	3
KPI-Based Assessment	20	13	3	1.5	12	9	3	0.9	7	11	3	0.6	39	33	54	46	3

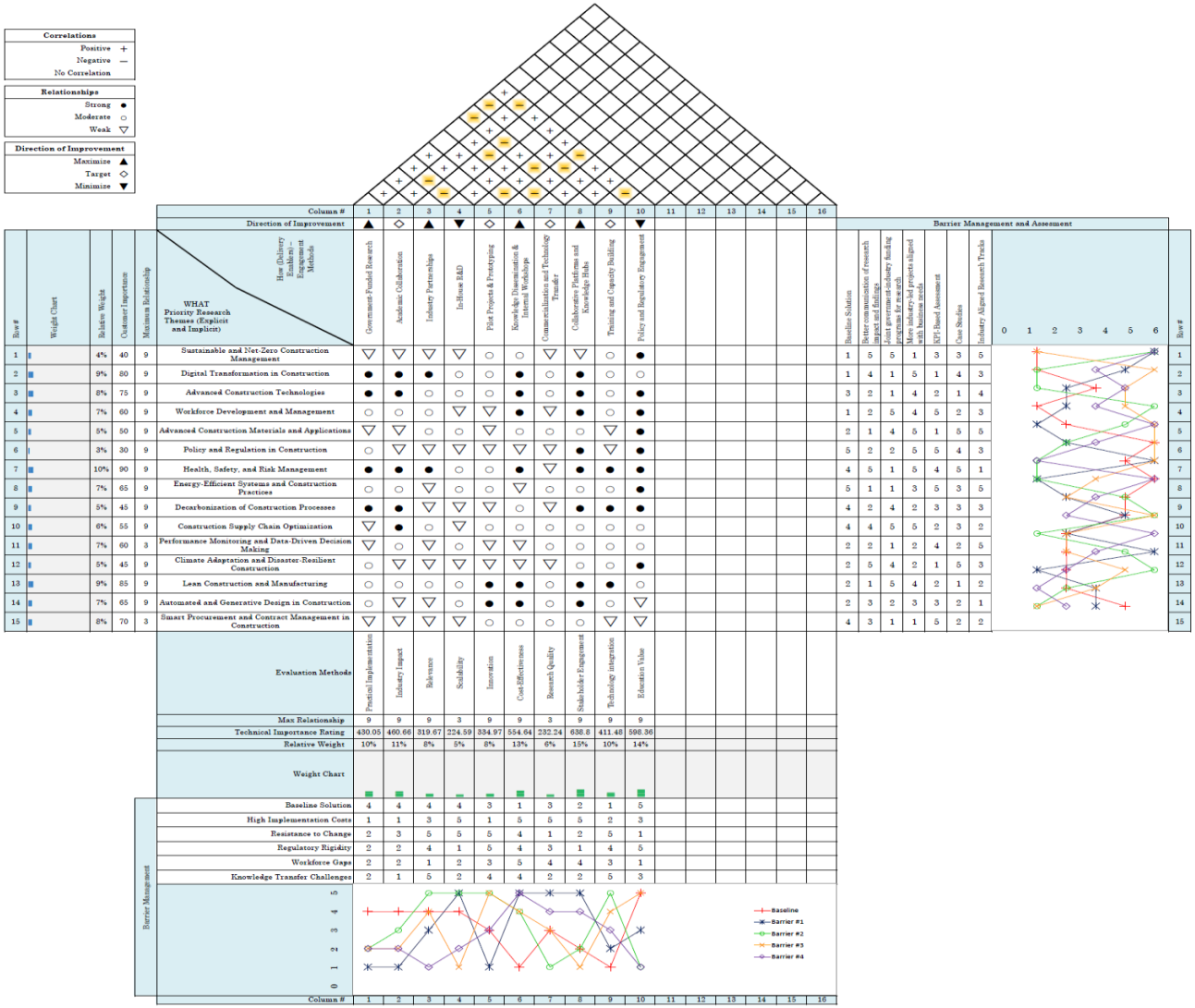
Value-Added Services for Industry Partners	Importanc (1-5)
Customized Research & Development (R&D)	5
Technology Validation	3
Prototyping & Pilot Testing Facilities	3
Pilot Projects & Prototyping	3
Innovation Commercialization & Patent Support	2
Funding & Grant Facilitation	5
Construction Data Analytics & AI Solutions	3
Innovation Sandbox & Living Labs Hub	2
Networking, Branding & Leadership Visibility	2

Training and Outreach Opportunities	Importance (1-5)
Industry-Led Training Modules	3
Practical Research & Innovation Workshops	4
Student Internships at Partner Companies	4
Trainee Blog	2

CIC Functions Priorities	Importance (1-5)
Industry-Led Innovation & Collaboration Forum	3
Industry Co-Leadership in Research Direction	4
Live Demonstrations & Implementation Pilots	3
Exclusive IP & First-Use Rights for Partners	2
Centralized Research Data & Intelligence Hub	2
Advanced Searchable Database for CIC Research	4
HQP Talent Recruitment & Placement	3
Strategic Communication & Knowledge Dissemination	4

Evaluating Metrics	Importanc (1-5)
Strategic Fit	4
Feasibility	4
Industry Demand	4
Innovation & Technical Merit	3
Economic Viability	4
Sustainability Impact	2
Scalability & Transferability	3
Skills Development	3

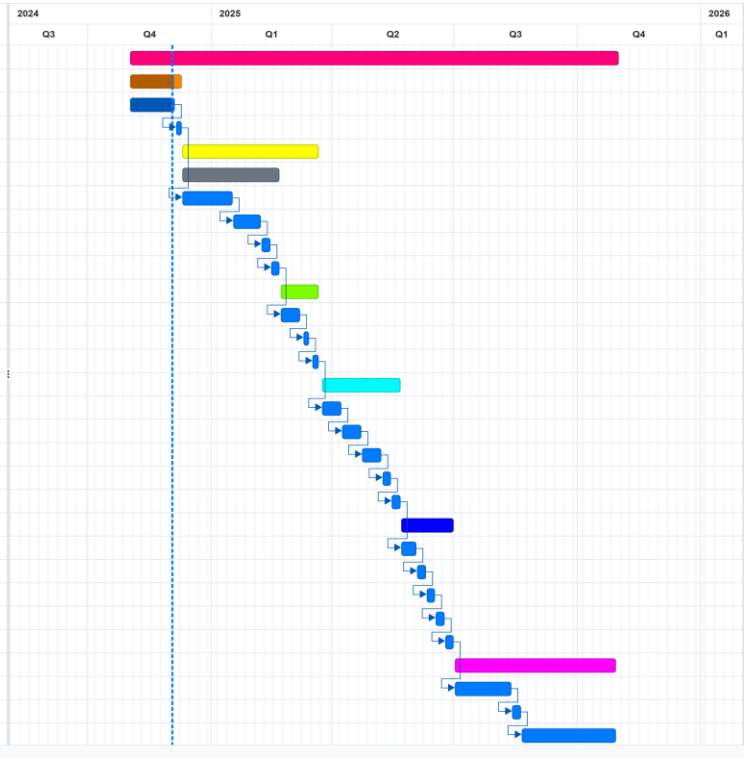
A13 – House of Quality (HoQ) Matrix



A14 – Research Roadmap Project Timeline

In addition to defining the methodological steps, the CIC Research Roadmap was structured as a phased and time-bound project plan to ensure disciplined execution. Each stage—from initial planning and analysis through methodology development, drafting, validation, and finalization—was sequenced with clear milestones, dependencies, and resource assignments. This approach not only created accountability but also provided stakeholders with transparency into how the roadmap would progress over time and when key points of engagement would occur.

ID	Task Name	Start	End	Duration	Progress %	Dependency	Resources	Color
1	CIC Agile Research Roadmap - V3	2024-11-01	2025-10-31	261 days	0		CIC,Industry	
3	Project Planning Phase (Activity 0)	2024-11-01	2024-12-09	27 days	84		CIC,Industry	
4	Define the scope, timeline,and approach	2024-11-01	2024-12-04	24 days	95		CIC	
5	Collect Feedback and Refine	2024-12-05	2024-12-09	3 days	0	4FS	Industry	
6	Analysis Phase (Activity 1)	2024-12-10	2025-03-21	74 days	0		CIC,Industry	
7	Preliminary Analysis	2024-12-10	2025-02-20	53 days	0		CIC,Industry	
8	Literature Review	2024-12-10	2025-01-16	28 days	0	5FS	CIC	
9	Interviews or Initial Survey	2025-01-17	2025-02-06	15 days	0	8FS	CIC,Industry	
14	Extract the Results	2025-02-07	2025-02-13	5 days	0	9FS	CIC	
15	Collect Feedback and Refine	2025-02-14	2025-02-20	5 days	0	14FS	Industry	
10	Methodology Development (Activity 2)	2025-02-21	2025-03-21	21 days	0		CIC,Industry	
11	Draft the Method	2025-02-21	2025-03-07	11 days	0	15FS	CIC	
12	Test the Method	2025-03-10	2025-03-14	5 days	0	11FS	CIC	
13	Collect Feedback and Refine	2025-03-17	2025-03-21	5 days	0	12FS	Industry	
16	Drafting Phase (Activity 2 and 3)	2025-03-24	2025-05-21	43 days	0		CIC,Industry	
17	Roadmap Drafting	2025-03-24	2025-04-07	11 days	0	13FS	CIC	
18	Main Survey Creation	2025-04-08	2025-04-22	11 days	0	17FS	CIC	
19	Conduct Interviews and Administer Survey	2025-04-23	2025-05-07	11 days	0	18FS	CIC,Industry	
20	Analyze the Results and Collected Data	2025-05-08	2025-05-14	5 days	0	19FS	CIC	
21	Collect Feedback and Refine	2025-05-15	2025-05-21	5 days	0	20FS	Industry	
22	Validation and Refinement Phase (Activity 4)	2025-05-22	2025-06-30	28 days	0		CIC,Industry	
23	Adjust Roadmap	2025-05-22	2025-06-02	8 days	0	21FS	CIC	
24	Workshop Preparation	2025-06-03	2025-06-09	5 days	0	23FS	CIC	
25	Conduct the Workshop (Forum)	2025-06-10	2025-06-16	5 days	0	24FS	Industry,CIC	
26	Analyze the Results and Collected Data	2025-06-17	2025-06-23	5 days	0	25FS	CIC	
27	Collect Feedback and Refine	2025-06-24	2025-06-30	5 days	0	26FS	Industry	
28	Project Finalization Phase (Activity 5)	2025-07-01	2025-10-29	87 days	0		Industry,CIC	
29	Finalize Roadmap	2025-07-01	2025-08-12	31 days	0	27FS	CIC	
30	Present and Share	2025-08-13	2025-08-19	5 days	0	29FS	Industry,CIC	
31	Mointor and Adapt	2025-08-20	2025-10-29	51 days	0	30FS	CIC	




Research Driving Change
CONSTRUCTION
INNOVATION CENTRE