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One Future.

Building Canada's maintenance sector advantage through collaboration, competitiveness and safety-led productivity

An Independent Advisory Panel Discussion Paper
Commissioned by the Association of Maintenance Contractors of Canada
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AMCC
Association of Maintenance Contractors of Canada

One Industry. One Workforce. One Future. is a landmark discussion paper authored by an Independent Advisory Panel and commissioned by the Association of Maintenance Contractors of Canada, charting a path forward for Canada's maintenance industry.

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Understanding the Need for Industry Change

Canada's maintenance industry is at a critical turning point. Facing an aging workforce, technological disruption, inconsistent certification standards, supply chain vulnerabilities, and economic and regulatory uncertainties, the sector confronts challenges that are no longer isolated but deeply ingrained. While these pressures differ by region and project type, there is a growing consensus among industry stakeholders – including owners, contractors, unions, regulators, and training providers – that the current path is unsustainable. Through interviews, workshops, and Advisory Panel sessions, a clear message has emerged: the industry must shift from fragmented practices to coordinated systems, from reactive management to proactive planning, and from isolated excellence to collective capacity.

This report highlights the drivers for change and the structural shifts needed to develop a more resilient, future-ready maintenance ecosystem for Canada.

Advisory Panel

The Association of Maintenance Contractors of Canada extends its sincere gratitude to the members of the Independent Advisory Panel for their dedication, expertise, and thoughtful contributions to this discussion paper. Their insights reflect the diverse perspectives of Canada's maintenance industry and provide an invaluable foundation for continued dialogue and collaboration.

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The Discussion Paper

Canada's maintenance industry supports our economy, keeping industrial facilities running, worksites safe, and communities strong. Yet the sector has long faced pressures from fragmentation, workforce instability, and increasing demands on productivity and competitiveness.

Recognizing the need for long-term solutions, the Association of Maintenance Contractors of Canada (AMCC) convened an Advisory Panel in 2024, bringing together owners, contractors, unions, regulators, and training providers from across the country. Over the course of a year, the Panel listened, debated, and shared perspectives to uncover the systemic issues holding the industry back and the opportunities that collaboration can unlock.

The Panel findings show that the way forward rests on building systems based on industry collaboration that replace silos with shared accountability. When stakeholders work together, the sector can unlock the productivity, competitiveness, and workforce strength it needs. Safety is the foundation that sustains this system, and with it the industry can thrive and prosper.

When owners, contractors, unions, regulators, and training providers work together, the sector can break down silos and deliver safer, more predictable, and more competitive results. Collaboration is not simply an aspiration; it becomes the system that enables every other outcome.

Executive Summary

Canada's maintenance industry is the backbone of the country's critical infrastructure – ensuring the safe and reliable operation of energy facilities, utilities, petrochemicals, manufacturing plants, and transportation systems. It employs tens of thousands of skilled workers, sustains local communities, and supports billions of dollars of industrial activity. Yet today, the sector is at a turning point.

An aging workforce, difficulty in sourcing skilled trades due to workforce misalignment, labour market disconnects, and workforce deployment inefficiencies, fragmented contracting practices, and uneven adoption of technology are eroding performance. At the same time, demand for maintenance services is rising as governments and industry invest in new energy corridors, infrastructure renewal, and sustainability goals. Unless the industry adapts, these pressures will drive up costs, delay projects, weaken safety, and undermine Canada's ability to compete globally.

The tools for adaptation already exist. Digital platforms, AI-powered forecasting, predictive maintenance, and collaborative data systems are transforming global heavy industry. Canada's maintenance sector must seize these tools of the future, embedding modernization into every project, contract, and training program. Failing to do so risks Canada being left behind.

To address these challenges, the Association of Maintenance Contractors of Canada (AMCC) convened an Advisory Panel of owners, contractors, unions, regulators, and training providers. Over the course of a year, the Panel undertook extensive consultation, analyzed leading industrial maintenance organizations' operations, and reviewed

international benchmarks. The Panel concluded that the way forward lies in building systems of collaboration that turn fragmentation into alignment, trust, and shared accountability.

FROM SILOS TO SYSTEMS

For decades, the Canadian maintenance industry has operated in silos. Owners focused on cost control, contractors on project delivery, unions on worker representation, regulators on compliance, and training providers on curricula. Each group advanced its mandate, but often in isolation, resulting in fragmentation, duplication, and missed opportunities.

The central finding of this paper is that collaboration must replace fragmentation. Building systems based on industry collaboration is the only way to unlock lasting improvements in productivity, workforce mobilization, competitiveness, and safety.

Evidence from leading organizations demonstrates the power of collaboration:

- A large North American petrochemical operation adopted “radical transparency” in procurement, engaging contractors early and using weighted scorecards that balanced safety, performance, and cost. The result was faster execution, fewer incidents, and measurable cost savings.

- A large, complex western Canadian utility organization centralized its supply chain and standardized contracts, embedding Indigenous procurement as a core practice. This approach increased efficiency, improved governance, and strengthened trust with both contractors and communities.

- A major Canadian power generation organization integrated collaboration into its Life-Extension Program through leadership training, contractor scorecards, and cultural renewal, demonstrating that alignment across stakeholders improves both safety and productivity.

These examples show that when owners, contractors, unions, regulators, and training providers work together, the sector can break down silos and deliver safer, more predictable, and more competitive results. Collaboration is not simply an aspiration; it

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becomes the system that enables every other outcome.

But there is a necessary tension. Collaboration can drive productivity and competitiveness only if safety is assured. Without a safe work environment, workers will not be attracted or retained, and no amount of collaboration can achieve results. Safety remains the foundation on which collaboration and competitiveness depend.

PRODUCTIVITY

Collaboration only matters if it translates into results. Productivity gains are essential to ensuring projects are delivered predictably, efficiently, and at lower cost. At present, overlapping project schedules, fragmented planning, and inconsistent contracting approaches lead to duplication, delays, and wasted resources.

Collaboration, when structured and intentional, is the enabler of solutions to the industry's most pressing challenges:

1. **Productivity:** improving planning, reducing duplication, and streamlining project delivery to make the best use of resources and time.
2. **Workforce utilization and mobilization:** ensuring skilled workers are deployed effectively, apprentices are retained and developed, and projects have the people they need when they need them.
3. **Competitiveness:** aligning standards and delivery models to attract investment and position Canada as a global leader.
4. **Safety:** embedding shared practices, transparent reporting, and collective learning that make every site safer.

WORKFORCE UTILIZATION AND MOBILIZATION

Canada's maintenance workforce is under pressure from retirements, demographic shifts, and growing demand. Alberta's major industrial projects are already experiencing labour crunches, driving costs higher and weakening safety outcomes. Productivity depends on deploying the right skills at the right time, keeping apprentices employed, and ensuring supervisors are equipped to lead effectively.

COMPETITIVENESS

Competitiveness is the outcome of better collaboration, workforce deployment, and productivity. Canada's ability to attract investment and talent depends on delivering projects safely, on time, and within predictable costs. When the industry operates in silos, it loses efficiency and trust. With collaboration there is the opportunity to build resilience and position Canada's maintenance industry as a global leader in industrial maintenance.

A FOUNDATION OF SAFETY

Safety underpins the entire system. Collaboration can improve workforce mobility and integrated models can drive competitiveness, but without a safe work environment, none of it is sustainable. Workers will not enter or stay in unsafe environments; owners cannot maintain productivity when incidents erode trust and disrupt projects.

The industry has made progress in reducing injury rates, with some contractors approaching world-leading safety benchmarks. Yet serious incidents still occur, and variability in safety culture persists. The Canadian power generation organization highlighted in appendix 2.1 found a path forward by embedding safety into contracts, training, and leadership, resulting in measurable improvements in both safety and productivity.

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The Tension

There is a necessary tension in the industry's future model. Collaboration is the enabler of productivity and competitiveness. But collaboration cannot hold without the foundation of safety. If workplaces are unsafe, workers will not be attracted to or retained in the industry. Without workers, there is no workforce to deploy, and no productivity to capture. In this sense, safety is not one pillar among others, it is the condition that makes collaboration possible and competitiveness achievable.

THE PATH FORWARD

The Advisory Panel's recommendations provide a practical blueprint for collaboration in action: shared benchmarking and data platforms, harmonized certification, integrated workforce planning, performance-based contracting, structured mentorship, and safer workplaces, and the adoption of advanced digital and AI-enabled tools that will define the industry's next era.

The choice before the industry is clear. Continuing in silos will mean growing workforce shortages, higher costs, more incidents, and declining competitiveness. Building systems of collaboration, grounded in a culture of safety, will produce stronger workforce pipelines, predictable project delivery, safer workplaces and a globally recognized standard of maintenance excellence.

The time for action is now. Canada's maintenance industry cannot wait for incremental change. Every stakeholder—owners, contractors, unions, regulators, and training providers—must step up, align efforts, and act with urgency. With courage and cooperation, the sector can secure its future, modernize with the tools of tomorrow, and establish Canada as a global leader in safety, productivity, and resilience.

Building systems of collaboration, grounded in a culture of safety, will produce stronger workforce pipelines, predictable project delivery, safer workplaces, and a globally recognized standard of maintenance excellence.

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Failing to act decisively risks deepening fragmentation, inefficiency, and worsening workforce shortages that threaten major projects nationwide. Conversely, with cooperation and structured collaboration, Canada has the opportunity to set a new global standard for maintenance excellence—delivering safer workplaces, stronger productivity, and a more resilient industry for the future.

1.0 | Introduction

The Association of Maintenance Contractors of Canada (AMCC) is committed to promoting innovation and ensuring the industry's long-term sustainability and competitiveness. Recognizing the urgency of change, AMCC brought together a multidisciplinary Advisory Panel to chart a collective path forward for Canada's maintenance sector.

Over the past year, the Advisory Panel has worked to identify the sector's most pressing challenges and opportunities, engaging experts from across the country and listening to voices from every corner of the industry. The result is this discussion paper: a set of practical recommendations and strategies that reflect both the reality of today's maintenance environment and the potential for tomorrow.

The Canadian maintenance industry now stands at a crossroads. It faces increasing challenges from workforce shortages, inconsistent certification standards, economic uncertainty, and varied technology adoption. These are not isolated problems—they are interconnected issues that demand a unified response. Owners, contractors, unions, regulators, and training providers all have a role to play.

Safety is a central part of this story. Over the past three decades, North American heavy industry has reduced total recordable injury rates (TRIR) to historic lows, now averaging 2.4 per 100 full-time workers, with leading contractors nearing 0.25. Yet even at these levels, the inherent risk in heavy industry remains far higher than in most other sectors. The reality is that despite these gains, serious incidents still occur. "Zero" remains the right goal, but not the best measure. Leading companies now pair the aspiration of zero with system discipline and ongoing learning—treating safety as a behaviour and a benchmark for continuous improvement, not just a statistic. Safety must be a core pillar of the Canadian maintenance industry, alongside collaboration, competitiveness, and modernization.

To meet these challenges and seize emerging opportunities, the sector must build systems of collaboration that replace fragmentation with alignment, transparency, and shared accountability. This paper advocates for shared benchmarking, pre-competitive data sharing, harmonized training programs, and integrated project models—each designed to strengthen performance, resilience, and innovation.

External research reinforces this urgency: BuildForce Canada stresses

that “collaborative approaches between stakeholders are critical to ensuring a skilled, available, and mobile workforce capable of meeting future demands” (BuildForce, 2025). Without intentional cooperation, isolated efforts will continue to yield fragmented results and missed opportunities for modernization.

A high-functioning maintenance ecosystem depends on alignment, transparency, and mutual accountability among all stakeholders. Transformation will require mechanisms like tripartite working groups, shared digital platforms, joint workforce planning, and harmonized regulatory frameworks. Advisory Panel interviews confirm that companies that have embraced partnership models and transparency saw significant improvements in safety, productivity, and workforce engagement.

The conclusion is clear: Canada’s maintenance sector cannot succeed through siloed efforts. To stay competitive in a growing, complex, and global marketplace, collaboration must become the sector’s operating principle, not just an aspiration.

Failing to act decisively risks deepening fragmentation, inefficiency, and growing workforce shortages that threaten major projects nationwide. Conversely, with cooperation and structured collaboration, Canada has an opportunity to set a new global standard for maintenance excellence—delivering safer workplaces, stronger productivity, and a more resilient industry for the future.

Highlighting that the Canadian maintenance industry requires consistent daily excellence in planning, verifying, and executing work that could seriously harm people with just one mistake. A strong commitment to workforce safety will be built through shared language, collective learning, and an industry-wide scorecard that encourages stakeholders to manage the most critical risks.

2.0 | Overview

2.1 OBJECTIVES

The AMCC Advisory Panel established several strategic objectives to guide the development of this paper and support long-term success:

Informed Decision-Making: The main strategic goal was to equip the broader industry with insights necessary for making informed choices. The panel made sure the recommendations were practical and impactful by collecting feedback at each phase of the discussion paper's development and adjusting strategies based on direct industry input and on-the-ground experience.

Policy Influence: The Advisory Panel's work will help shape policy debates at both the federal and provincial levels. The discussion paper's findings will allow AMCC and other organizations to influence policy, building support for necessary changes.

Industry Engagement: The Panel's findings promote broad industry involvement throughout the project, ensuring that the final recommendations accurately reflect diverse perspectives and industry needs. This will be accomplished by sharing progress at major conferences and gathering feedback through various channels.

Sustainability and Competitiveness: This project will support the long-term sustainability and competitiveness of the Canadian maintenance industry. Through strategic guidance and practical insights, the discussion paper aims to equip the industry with the tools and knowledge needed to succeed in an era of significant change.

2.2 SCOPE

The scope of this discussion paper is to offer strategic insights and practical recommendations to help the Canadian maintenance industry navigate a complex and changing landscape. It also aims to promote a supportive public policy environment that encourages ongoing investment in sectors dependent on the maintenance workforce, thereby sustaining the industry's global competitiveness.

The discussion paper is not intended to influence bargaining, bargaining rights, or labour relations within the maintenance sector. Instead, it adopts a proactive approach to shaping the future of the Canadian maintenance industry.

Key elements of the paper's scope include:

- Identifying and analyzing the most significant industry trends, including technological advancements, workforce dynamics, regulatory changes, and market shifts.

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- Addressing the challenges faced by industry professionals and organizations, especially regarding skills development, productivity, and safety, is essential. Safety must be seen as the non-negotiable foundation for productivity and skills development.
- Exploring new opportunities for growth and collaboration within the sector, with a focus on sustainability and innovation.
- Highlighting that the Canadian maintenance industry requires consistent daily excellence in planning, verifying, and executing work that could seriously harm people with just one mistake. A strong commitment to workforce safety will be built through shared language, collective learning, and an industry-wide scorecard that encourages stakeholders to manage the most critical risks.

2.3 STAKEHOLDERS

By leveraging the expertise of the Advisory Panel and engaging with a wide range of stakeholders, AMCC will provide the industry with the tools and knowledge necessary to succeed in a changing environment.

The discussion paper's findings and recommendations will be shared with AMCC members and the broader industry through reports, workshops, and other information-sharing activities. These insights are expected to guide policy development and operational strategies within the industry, ultimately supporting its growth and resilience.

The recommendations and implementation tactics presented in this paper target the five stakeholder groups identified in the Canadian maintenance sector.

OWNERS

- Entities that commission, fund, and oversee maintenance projects, and are responsible for setting performance expectations, selecting contractors, and aligning outcomes with long-term operational goals.

CONTRACTORS

- Organizations that perform maintenance work and oversee on-site operations, workforce deployment, safety, and delivery performance per project specifications.

UNIONS

- Worker representation bodies that advocate for fair labour practices, develop and deliver structured mentoring and training programs, and ensure skilled workforce mobility and readiness across projects.

REGULATORS

- Government and industry oversight bodies that create and enforce standards, safety regulations, and certification frameworks, while supporting innovation and alignment through compliance tools and incentives.

TRAINING PROVIDERS

- Educational institutions and workforce development organizations that provide competency-based instruction, collaborate with industry to co-create curricula, and contribute to building a future-ready maintenance workforce. This includes Joint Apprenticeship Training Committees (union training) and academic institutions that may conduct technology research and development activities benefiting the maintenance industry.

2.4 PROCESS

The Advisory Panel followed a structured, year-long process to ensure this document reflects both vision and practical realities. From its formation to final approval, the Panel based its work on research, industry engagement, and ongoing feedback, producing recommendations that directly address the sector's most urgent needs.

By aligning its work with key industry events and testing early insights with stakeholders, the Panel produced a discussion paper that is forward-looking yet firmly grounded in the day-to-day realities of the maintenance industry.

The following describes the process used to develop the discussion paper:

Panel Formation and Members Appointed

- The AMCC established the Advisory Panel to guide the development of the discussion paper and ensure its relevance to the industry.
- Co-chaired by Mandy Kaiser (Connect Group Inc.) and Robert Kucheran (IUPAT and Canada's Building Trades Unions), the panel included senior leaders from organizations including SkillPlan, BuildForce Canada, General Presidents' Maintenance Committee and National Maintenance Council for Canada (GPMC/NMC), Canada's Building Trades Unions, Construction Labour Relations Association of Ontario (CLRAO), and Supply Chain Canada West.
- Members were chosen for their expertise in maintenance operations, workforce development, contracting strategy, and regulatory issues, ensuring a multidisciplinary perspective.

Discovery and Background Research

- Conducted a comprehensive review of industry reports, workforce studies, and policy documents.

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- Gathered insights from Advisory Panel interviews with leading industrial maintenance organizations. Their transformation strategies in contracting, workforce development, and technology adoption were analyzed and documented.
- Utilized both Canadian and international viewpoints, citing findings and benchmarks on collaboration and innovation.

Engagement and Interviews

- Conducted interviews with a diverse range of industry stakeholders, including owners, contractors, unions, regulators, and training providers.
- Engaged stakeholders at key industry events, including the National Construction Labour Relations Alliance of Canada (NCLRA) conference and the Canada's Building Trades Union (CBTU) conference.
- Conducted focused interviews on current challenges such as workforce shortages, inconsistent certification standards, and fragmented information sharing.

Theme and Recommendations Development

- Synthesized research and interview data into eight core themes, including workforce development, integrated project models, contracting strategies, and technology.
- Identified systemic gaps, such as inadequately skilled workforce development pipelines and fragmented communication among stakeholders.
- Developed cross-cutting recommendations that highlight collaboration, data sharing, and structural reforms within the industry.

Validation and Industry Testing

- Presented early insights and recommendations at industry events to test alignment with sector priorities.
- Utilized examples from leading industrial maintenance organizations to confirm the feasibility and relevance of recommendations.
- Iteratively refined recommendations based on feedback from senior industry leaders and policy influencers.

Initial and Subsequent Drafts

- Developed an initial draft of the discussion paper's themes and recommendations between January and March 2025, incorporating research, interviews, and panel deliberations.
- Shared a draft summary of findings in April 2025 at the CBTU conference, capturing stakeholder reactions and adjusting recommendations accordingly.
- Delivered a further draft of themes and recommendations at the AMCC Annual General Meeting in June 2025, incorporating additional technical and strategic refinements.

Feedback and Validation

- Incorporated broad-based feedback from AMCC members, industry associations, and academic partners during July–August 2025.
- Ensured recommendations aligned with real-world use and cross-sector standards through structured review sessions.
- Finalized the discussion paper for release at the AMCC Industry Symposium in September 2025, outlining concrete steps for implementation.

Federal and provincial governments are increasing spending on infrastructure projects, including conventional and renewable energy, as well as public transit, which will require extensive future maintenance services. This presents a valuable opportunity for workforce development.

3.0 | Current Situation

Using the traditional SWOT (Strengths, Weaknesses, Opportunities, Threats) approach, the current condition of the Canadian maintenance industry can be assessed.

STRENGTHS

- **Steady market growth across sectors:** The Canadian maintenance industry is expected to expand at a compound annual growth rate (CAGR) of 4.3% until 2028, driven by demand in the industrial, facility, and infrastructure sectors.
- **Emphasis on Digital Transformation:** Owners and contractors are increasingly adopting technologies such as AI-driven diagnostics, Internet of Things (IoT) sensors, and predictive analytics to enhance maintenance efficiency and decrease downtime.
- **Strong Institutional Support and Collaboration:** Organizations like the AMCC are actively shaping the industry's future through strategic initiatives and encouraging collaboration among stakeholders.
- **Diverse Sectoral Demand:** The Canadian maintenance sector serves multiple industries, including energy, facilities, manufacturing, and public infrastructure, providing resilience against industry-specific downturns.

WEAKNESSES

- **Reactive Maintenance Culture:** Industry stakeholders frequently work within reactive and time-based models instead of adopting a more comprehensive, strategic approach rooted in best practices, economics, and predictive maintenance.
- **Workforce Shortages and Aging Workforce:** The industry faces significant workforce shortages, especially in the skilled trades. Alberta's major industrial maintenance projects are beginning to experience a workforce crunch due to competing industrial developments. These shortages may result in less experienced crews that struggle to identify hazards, follow procedures, and maintain overall site safety. Changing demographics and increasing industrial and commercial maintenance demands make the problem worse. Canadian immigration policy is also a concern, as the current system prioritizes admitting individuals with high human capital instead of skilled tradespersons.
- **Ongoing Need to Improve Safety Culture:** As the industry nears a zero TRIR, progress has slowed, and serious

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incidents still occur, often catching even top-tier owners and contractors off guard. The main challenge is no longer a missing program or initiative; it is the variability of human performance on any given day, at that moment, under real-world conditions.

- **Supply Chain Vulnerabilities:** Continuous disruptions in the supply chain, worsened by global events and trade tensions, are causing delays in acquiring essential maintenance parts and equipment.
- **Inconsistent Certification and Competency Standards:** Differences in certification and training requirements across provinces restrict workforce mobility and create inefficiencies in workforce deployment. This mobility issue also results in uneven safety practices caused by varying provincial standards.
- **Limited Data Sharing Practices:** The absence of standardized, anonymized, and aggregated data sharing and benchmarking practices across the industry hinders the adoption of best practices and slows performance improvements. While it is lawful in Canada for companies to share information, many are hesitant due to concerns that workforce and project coordination might be seen as anti-competitive. As a result, projects often overlap and exhaust the available workforce, leading to annual shortages and a reliance on temporary foreign workers to fill gaps in the required labour force.

OPPORTUNITIES

- **Government infrastructure investments:** Federal and provincial governments are increasing spending on infrastructure projects, including conventional and renewable energy, as well as public transit, which will require extensive future maintenance services. This presents a valuable opportunity for workforce development.
- **Advances in Predictive Maintenance:** Integrating predictive maintenance technologies provides opportunities to cut costs, enhance asset reliability, and modernize Canadian industrial infrastructure.
- **Focus on Sustainability:** As organizations work towards long-term goals, there is a rising demand for maintenance practices that support sustainability, such as energy-efficient systems and waste reduction. Collaborating with Indigenous groups and engaging with the communities where maintenance services are provided is crucial.
- **Expansion into Emerging Markets:** Canadian maintenance firms have opportunities to broaden their services into developing markets by leveraging expertise in sectors like oil and gas, mining, and infrastructure development. However, this will only be possible if the industry can, in a pan-Canadian manner, increase recruitment, training, and retain its skilled workforce.

THREATS

- **International trade tensions:** Tariffs and other protectionist measures on Canadian imports and exports have increased costs and caused operational inefficiencies across the maintenance sector throughout the industry supply chain.
- **Economic Uncertainty:** Fluctuations in global markets and economic instability present risks to investments in maintenance projects, which may result in budget constraints for owners.
- **Technological Disruption:** Rapid technological progress may outpace the industry's capacity to adapt, potentially rendering traditional maintenance methods obsolete. Ongoing training of skilled workers is crucial to effectively utilize new technologies and enhance productivity.
- **Regulatory Changes:** Evolving regulations, especially those concerning environmental standards and labour laws, could raise compliance costs and operational challenges for maintenance providers.

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The industry must shift from fragmented practices to coordinated systems, from reactive management to proactive planning, and from isolated excellence to collective capacity.

4.0 | Need for Change

Canada's maintenance industry is at a critical turning point. Facing an aging workforce, technological disruption, inconsistent certification standards, supply chain vulnerabilities, and economic and regulatory uncertainties, the sector confronts challenges that are no longer isolated but deeply ingrained.

While these pressures differ by region and project type, there is a growing consensus among industry stakeholders – including owners, contractors, unions, regulators, and training providers – that the current path is unsustainable. Through interviews, workshops, and Advisory Panel sessions, a clear message has emerged: the industry must shift from fragmented practices to coordinated systems, from reactive management to proactive planning, and from isolated excellence to collective capacity.

The following highlights the drivers for change and the structural shifts needed to develop a more resilient, future-ready maintenance ecosystem for Canada.

MAKING WORKER SAFETY A PRIORITY EVERY SINGLE DAY

There are no quick fixes left to reach the goal of zero TRIR. The way forward is to rely on the best of what we already know: world-class practices, proven equipment, and focused leadership – every day, on every job, throughout the entire Canadian maintenance industry.

This means reinforcing core principles, managing all tasks with discipline, and openly sharing lessons and controls so no contractor or owner learns the hard way what another has already discovered.

Reaching zero also requires building fail-safe methods into the work itself – systems and practices designed to prevent human error from becoming human harm. Safety isn't just about doing things right; it is about ensuring that when things go wrong, people are still protected.

FOSTERING COLLABORATION AND DATA SHARING

The lack of standardized data sharing and benchmarking across the industry prevents the adoption of best practices and slows down performance improvements. Developing collaborative platforms for data exchange can stimulate innovation, improve efficiency, and encourage a culture of ongoing improvement.

More broadly, the industry requires collaboration across sectors involving owners, contractors, unions, regulators, and training providers. Shared benchmarking, pre-competitive data exchange, harmonized training programs, and integrated project management models all highlight the urgent need for a unified approach to improve performance, resilience, and innovation.

ADDRESSING THE SKILLED WORKFORCE CHALLENGE

The industry is facing a significant shortage of skilled workers. Increasing maintenance needs and competition from other industrial projects will make this problem worse. This shortage not only raises costs but also causes project delays and safety concerns, such as higher incident rates, weakened safety controls, and more fatigue-related risks. To overcome these issues, the industry needs to invest in workforce development, including training programs, improved safety training, and efforts to attract new talent.

Changing workforce demographics significantly contribute to the skilled workforce shortage. Replacing a qualified tradesperson with a new one leads to productivity problems because less experienced tradespeople do not have the same skills as seasoned professionals. As a result, productivity often drops.

To maintain the quality and size of the Canadian industrial maintenance workforce, it is essential to enhance industry access to immigrants with the skills necessary to fill gaps in local recruitment. Relying on temporary foreign workers (TFW) is not only costly but also introduces more uncertainty into the project timeline, as processing times for TFWs can be lengthy, especially on projects that may require security clearances.

EMBRACING TECHNOLOGICAL ADVANCEMENTS

Technological disruption presents both challenges and opportunities. While rapid advances can make traditional maintenance methods outdated, they also create opportunities for greater efficiency and cost savings. However, uneven adoption across the industry prevents these benefits from being fully realized. A collective effort to adopt and standardize technological innovations is crucial.

NAVIGATING ECONOMIC AND REGULATORY UNCERTAINTIES

The industry operates within a volatile economic environment marked by trade tensions and regulatory changes. Evolving regulations, especially those related to environmental standards and labour laws, may increase compliance costs and operational complexities for maintenance providers. Engaging proactively with policymakers and adopting adaptable strategies are crucial for managing these uncertainties.

Predictability is also necessary. Changes in government policy often create uncertainty and lead owners to delay investments until clearer policies emerge. Governments cannot alter policies every few years when investment cycles span 10 to 20 years.

CAPITALIZING ON INFRASTRUCTURE INVESTMENTS

Government infrastructure investments present significant opportunities. Federal and provincial governments are increasing funding for infrastructure projects, including energy corridors, which will require extensive maintenance services. By aligning industry capabilities with these investments, maintenance providers can achieve long-term growth and remain relevant. However, this opportunity will only exacerbate the workforce shortage unless these projects also help develop the future workforce.

At the core of these recommendations is the idea that collaboration is essential. Owners, contractors, unions, regulators, and training providers each contribute their own strengths, but only by working together can the industry address today's major challenges—workforce shortages, technological changes, and increasing project complexity.

5.0 | Recommendations and Implementation

The recommendations in this paper aim to transform Canada's maintenance industry from disjointed efforts into a coordinated system that enhances safety, productivity, and competitiveness. Each recommendation is based on the work of the Advisory Panel and shaped by extensive consultation with stakeholders across the country.

At the core of these recommendations is the idea that collaboration is essential. Owners, contractors, unions, regulators, and training providers each contribute their own strengths, but only by working together can the industry address today's major challenges—workforce shortages, technological changes, and increasing project complexity.

Implementation will require adopting new habits of transparency, data sharing, and joint problem-solving. By committing to these changes, the industry can unlock new capacity, strengthen resilience, and improve outcomes for both businesses and workers.

The following sections outline recommendations for industry-wide action, including specific responsibilities and implementation strategies for each stakeholder group. Collectively, they form a roadmap to transform industrial maintenance into a high-trust, high-performance industry.

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Canada's industrial maintenance sector must promote a culture of responsible information sharing to encourage innovation, decrease risks, and improve workforce outcomes.

5.1 INDUSTRY INFORMATION SHARING

Canada's industrial maintenance sector must promote a culture of responsible information sharing to encourage innovation, decrease risks, and improve workforce outcomes. This section explains how stakeholders can collaborate through structured data exchange, benchmarking, and transparency to build a more connected and competitive industry.

- **Owners** are encouraged to join benchmarking consortia, share anonymized performance data, and work together on common challenges such as sustainability, cybersecurity, and skills development. Collaborative projects and shared digital platforms will promote coordinated problem-solving and increased efficiency across the sector.
- **Contractors** can create non-competitive collaboration that can help standardize training, streamline data, and optimize initiatives and technology by playing a vital role in advancing technological interoperability, standard data formats, and collaborative R&D initiatives within industry "sandboxes."
- **Unions** are encouraged to use data-sharing tools to improve workforce forecasting, training coordination, and scenario planning. Collaborations with supply chain and workforce stakeholders will assist unions in adapting to evolving workforce dynamics and supporting the mobility of skilled workers across projects.
- **Regulators** are positioned to support this ecosystem by creating open data platforms, standardizing reporting formats, and employing big data tools for proactive risk monitoring. They can also promote transparency through tax credits, compliance relief, and jointly developed policy frameworks.
- **Training Providers** are encouraged to support the ecosystem by using real-time workforce data to co-create programs and launch innovation challenges. They are also essential for piloting applied research and incentivizing participation in data-sharing initiatives.

Together, these efforts create the foundation for a high-trust, high-performance industrial sector – one that uses shared insights to manage risk, increase capacity, and stay ahead of evolving challenges.

Key recommendations for this section include:

1. Industry benchmarking and data sharing
2. Strategic and pre-competitive collaboration
3. Evidence-based decision-making
4. Forward-focused workforce planning
5. Optimization of industry associations

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OWNERS

Recommendations

- Establish industry benchmarking groups to share anonymized performance data, including safety performance data, near-miss reports, and best practices.
- Join trade associations and think tanks to collaborate on regulatory, operational, and innovation challenges.
- Encourage pre-competitive collaboration in fields like sustainability, cybersecurity, workforce development, and demand forecasting.

Implementation Tactics

- Participate in structured industry forums that promote responsible information exchange.
- Develop internal data-sharing policies supported by legal frameworks to manage confidentiality and ensure compliance with anti-competition laws.
- Utilize third-party platforms to consolidate and anonymize shared data.
- Start co-creating projects for cross-industry issues, like joint pilots or collective procurement.
- Mandate the open and anonymized sharing of safety lessons across the industry.
- Publish an annual Canadian maintenance industry safety report that showcases benchmarks and trends.
- Use consistent, risk- and safety-based language across companies so owners and contractors can compare easily and improve more quickly.

CONTRACTORS

Recommendations

- Establish industry benchmarking groups to share anonymized performance data, including safety performance data, near-miss reports, and best practices.
- Create controlled innovation environments, or industry sandboxes, for sharing non-competitive research and development.
- Develop open application programming interfaces (APIs) and data exchange standards to promote technological interoperability.
- Collaborate with industry to align certification and training programs and develop field-tested standards across the sector to ensure consistent workforce competencies.
- Encourage third-party or government-led reviews to evaluate how industry associations promote innovation, workforce growth, and data-sharing initiatives.

Implementation Tactics

- Develop structures and frameworks for confidential sharing.
- Build cross-company alliances for shared R&D projects.
- Work with training providers to stay aligned with changing industry needs.
- Support open-source tools and platforms that advantage the entire industry.
- Establish formal quarterly forums to track and manage feedback.
- Create a shared contractor knowledge base managed by an industry association or rotating steward contractor.
- Mandate the open and anonymized sharing of safety lessons across the industry.
- Publish an annual Canadian maintenance industry safety report that showcases benchmarks and trends.
- Use consistent, risk- and safety-based language across companies so owners and contractors can compare easily and improve more quickly.

UNIONS

Recommendations

- Use shared demand forecasting platforms to track workforce trends and training needs.
- Partner with owners and contractors to align workforce development with emerging trends, such as predictive maintenance and other innovative approaches.
- Strengthen long-term planning by establishing clear strategies and milestone frameworks that guide local unions. A unified direction ensures consistent goals across regions, avoids “reinventing the wheel” each election cycle, and supports continuity in workforce development, innovation, and equity.
- Implement sustainable industry practices and establish business continuity plans at the operational levels of organizations.

Implementation Tactics

- Work with stakeholders to access anonymized workforce data and use forecasting tools.
- Invest in secure data-sharing technologies.
- Engage in industry supply chain councils to improve coordination and transparency.
- Implement a structured plan for “what-if” situations using shared risk reviews with contractors.
- Pilot programs that support skilled workforce mobility across projects.

REGULATORS

Recommendations

- Develop open data platforms to centralize anonymized industry metrics and data, facilitating seamless access and analysis.
- Foster public-private partnerships to support evidence-based policymaking.
- Create audits that evaluate alignment with current industry needs, the value delivered to members, and the effectiveness of inter-association collaboration.

Implementation Tactics

- Form working groups with industry to co-develop voluntary reporting guidelines.
- Incentivize data-sharing with tax relief or compliance credits. Consider workforce mobility deductibility provisions or other incentives aimed at owners and contractors to help offset training and apprenticeship costs.
- Create regulatory advisory councils to align policy with industry needs, third-party, or government-facilitated reviews to assess how industry associations support innovation, workforce development, and data-sharing initiatives.,
- Adopt AI and big data tools for proactive regulatory monitoring and risk detection.
- Publish productivity reports based on aggregated industry information.
- Harmonize provincial apprenticeship development and certification, as well as safety standards.
- Mandate the open and anonymized sharing of safety lessons across the industry.

TRAINING PROVIDERS

Recommendations

- Co-create training and certification programs informed by real-time workforce data.
- Utilize industry sandboxes for applied research, internships, and curriculum testing.
- Launch innovation challenges to solve sector-specific issues in partnership with industry.

Implementation Tactics

- Form advisory boards with stakeholders from across the industry to guide curriculum design.
- Deploy learning platforms that incorporate real-world case studies and hybrid training opportunities.
- Track job placement and competency data to refine educational programming.
- Apply AI-driven analytics to assess and predict industry risks using shared data and develop needed training programs.

By coordinating efforts among all stakeholders, we can establish a foundation for a more capable, mobile, and resilient workforce, prepared to face the future of Canada's maintenance sector with confidence and clarity.

5.2 WORKFORCE MANAGEMENT

The industrial maintenance sector in Canada is evolving, driven by rising demands for workforce efficiency, mobility, and sustainability over the long term. This section offers practical strategies to improve workforce management through coordinated efforts among industry stakeholders, including owners, contractors, unions, regulators, and training providers.

- **Owners and Contractors** are encouraged to implement digital workforce platforms, predict workforce needs using real-time data, and invest in enhanced skills and supervisory training to ensure project alignment and continuity.
- **Unions** play a vital role in promoting structured mentorship, increasing apprenticeship participation, and integrating development programs to support worker advancement and retention.
- **Regulators** are responsible for enforcing national competency standards, aligning wellness and certification initiatives, and incentivizing companies to focus on workforce development and equitable employment practices.
- **Training Providers** are encouraged to modernize their curricula through industry cooperation, provide competency-based certifications, and implement hybrid training models that combine technical instruction with the development of soft skills.

By coordinating efforts among all stakeholders, this framework establishes a foundation for a more capable, mobile, and resilient workforce, prepared to face the future of Canada's maintenance sector with confidence and clarity.

Key recommendations for this section include:

1. Establish competency frameworks and standardized certification
2. Advance workforce forecasting, planning, and mobility
3. Strengthen training, leadership development, and training provider alignment
4. Enhance performance, health, well-being, and productivity monitoring

OWNERS

Recommendations

- Perform competency-based assessments aligned with job roles and site conditions that also support ongoing training. Include safety-related competencies such as lockout/tagout, confined space entry, and hazard communication.
- Adopt workforce forecasting tools to project workforce needs accurately

Implementation Tactics

- Establish quarterly or turnaround-specific workforce planning cycles,

incorporating input from supply chain, operations, and labour relations teams.

- Implement forecasting software or platforms that allow scenario planning based on project phase, region, and skill requirements.
- Utilize real-time workforce tracking to identify gaps and redeploy resources efficiently.
- Collaborate with unions and contractors to pilot standardized pre-job competency assessments, including safety-critical tasks.
- Improve workforce oversight by creating a standard safety training pathway for front-line leaders focused on planning, controls, and making real-time risk decisions.

CONTRACTORS

Recommendations

- Use integrated scheduling tools to align workforce supply with project timelines.
- Deliver ongoing training to strengthen supervisory and leadership capacity.
- Establish performance metrics to monitor workforce productivity and project success.
- Create a structured and shareable competencies platform that includes safety-critical tasks and emergency preparedness.

Implementation Tactics

- Sync scheduling software with workforce availability databases for efficient deployment and scheduling.
- Implement structured apprenticeship and supervisory development programs.
- Utilize performance tracking tools to adjust workforce deployment dynamically.
- Conduct quarterly reviews to assess workforce efficiency and alignment with project goals.
- Partner with unions to establish joint apprenticeship pathways.
- Enhance workforce supervision by establishing a standardized safety training pathway for front-line leaders focused on planning, controls, fail-safe methods, and real-time risk decisions.

UNIONS

Recommendations

- Lead the development of structured mentorship and leadership development programs.
- Assist in developing broad-based digital industry competency assessments and training for skilled professionals.
- Enhance partnerships with owners and contractors to establish joint apprenticeship pathways.

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Implementation Tactics

- Conduct ongoing feedback and tracking mechanisms to identify training and development priorities.
- Integrate structured mentorship programs, continuous learning, and leadership development language into policies and training mandates.
- Track apprenticeship participation and completion rates to guide program refinement.

REGULATORS

Recommendations

- Mandate standardized, industry-wide competency certification programs.
- Promote mental and physical wellness initiatives across the industry.
- Harmonize national safety and trade certification standards, and apprenticeship development training to enable workforce mobility.

Implementation Tactics

- Develop a centralized compliance dashboard to track certifications, safety credentials, and workforce standards in real time.
- Align workforce audits with broader wellness, enhanced skills training, and career development frameworks to ensure comprehensive support.
- Offer policy-driven incentives for companies that adopt certified competency and well-being programs.

TRAINING PROVIDERS

Recommendations

- Provide industry-endorsed, competency-based certifications and training.
- Collaborate closely with industry leaders to ensure the relevance of curricula and training.

Implementation Tactics

- Co-develop curricula updates with industry based on workforce market intelligence.
- Launch hybrid training models that combine technical and soft skills development.
- Establish feedback loops for all stakeholders to ensure continuous program responsiveness and improvement.

We need leadership in creating high-performing, safe, and respectful worksites. This involves using performance analytics and predictive tools to deploy crews effectively, prevent burnout, and increase productivity; investing in training and skill development; and maintaining a zero-tolerance policy towards harassment or misconduct to retain and attract skilled workers.

5.3 WORKFORCE PERFORMANCE

Enhancing workforce performance is vital for the long-term success and sustainability of Canada's industrial maintenance sector. This section outlines a coordinated approach to boosting performance, involving the collective efforts of owners, contractors, unions, regulators, and academic and training providers.

- **Owners** are encouraged to implement key performance indicators (KPIs), digital performance dashboards, and personalized development plans. Safety KPIs, such as incident frequency and near-miss trends, are just as important as productivity KPIs.
- **Contractors** must lead in creating high-performing, safe, and respectful worksites. This involves using performance analytics and predictive tools to deploy crews effectively, prevent burnout, and increase productivity; investing in training and skill development; and maintaining a zero-tolerance policy towards harassment or misconduct to retain and attract skilled workers.
- **Unions** are key to building equitable, opportunity-rich careers in the maintenance trades. They drive structured mentorship, clear career progression, and workforce development, while using member and contractor feedback to advocate for safer, fairer, and more supportive work environments.
- **Regulators** are encouraged to establish benchmarks and incentivize wellness programs.
- **Training Providers** are called to align curricula and training with industry performance needs, enhance experiential learning, and support continuous improvement through research and industry feedback.

Collectively, these strategies form an integrated approach to building a high-performing, resilient, and future-ready workforce for Canada's maintenance sector.

Key Recommendations for this section include:

1. Early engagement of and planning with all stakeholders
2. Performance measurement and data use
3. Training, development, and competency
4. Worker well-being and equity

OWNERS

Recommendations

- Engage contractors early in the planning, scheduling, and engineering phases to ensure seamless project execution.
- Implement KPIs to measure workforce efficiency and effectiveness.

Implementation Tactics

- Establish early engagement protocols requiring contractor involvement during project kickoff meetings, engineering reviews, and schedule development phases.
- Define KPIs such as time-on-tools and safety incident rates. Owners establish expectations of the contractor.
- Deploy performance dashboards integrating data from timekeeping, quality checks, and supervision feedback.
- Introduce incentive programs tied to performance outcomes, including bonuses.
- Conduct regular performance reviews with contractors to provide ongoing feedback and input.

CONTRACTORS

Recommendations

- Integrate performance and competency tracking into workforce management systems to enhance overall effectiveness.
- Conduct ongoing evaluations and training based on competency and performance.
- Implement a comprehensive employee well-being program that integrates physical safety, mental health support, and work-life balance initiatives into day-to-day operations.
- Promote ongoing workforce development, including enhanced work site orientation and onboarding based upon project and workforce needs.
- Adopt the management discipline that every worker must be physically prepared, mentally alert, and professionally competent on the day and at the work site. Prepare, support, and lead the workforce to go home safely after every shift, without exception.

Implementation Tactics

- Link performance tracking tools with human resources and job allocation software to streamline processes.
- Develop a skills and certification database to guide staff deployment and allocation.
- Schedule regular performance reviews that incorporate peer and supervisor assessments.
- Apply predictive analytics to detect risks of underperformance or project delays.
- Incorporate structured mentorship as a strategy to accelerate skill development.
- Develop a site-level well-being strategy that includes access to mental health resources, fatigue management protocols, and wellness check-ins led by supervisors.
- Define KPIs such as rework percentages and attendance rates. Contractors establish expectations of the workforce based on the owner's expectations.

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- Promote ongoing professional development on-the-job, including enhancing work site orientation and onboarding based upon project and workforce needs.

UNIONS

Recommendations

- Align internal structures to react to member deployment.
- Establish structured career progression with programs that build leadership, soft skills, and technical competence.
- Communicate with owners and contractors regarding KPIs such as time-on-tools, safety incident rates, rework percentages, and attendance rates.
- Implement feedback mechanisms to gauge worker satisfaction and wellness.
- Implement feedback mechanisms to utilize member input for improved workforce efficiency, effectiveness, and safety.

Implementation Tactics

- Establish formal mentorship programs pairing senior and junior workers.
- Utilize performance data to inform proposals for portable benefits and wellness initiatives for transient workers.
- Gather anonymized performance data through surveys or digital feedback tools.
- Partner with owners and contractors to enhance training and ongoing skills development.

REGULATORS

Recommendations

- Develop and maintain industry-wide benchmarks for workforce performance and productivity.
- Support initiatives promoting mental and physical well-being (e.g., Building Resiliency Program).

Implementation Tactics

- Establish and update performance benchmarks through a multi-stakeholder task force.
- Integrate workforce data collection into compliance audits and funding criteria to ensure accurate and timely reporting.
- Provide incentives, such as tax credits or grants, to encourage the adoption of wellness and resilience programs along with workforce career progression.
- Distribute toolkits and frameworks to help small and mid-sized firms meet performance standards.

TRAINING PROVIDERS

Recommendations

- Partner with unions, contractors, and owners to deliver structured mentorship and experiential learning opportunities.
- Conduct industry research to inform workforce development and retention strategies.
- Integrate mental health, physical wellness, soft skills, and resilience training into apprenticeship and technical education programs to prepare students for the demands of the industrial workforce.

Implementation Tactics

- Collaborate with industry and workforce to co-design relevant curricula.
- Blend soft skills (communication, teamwork) with technical instruction.
- Offer certification training in areas such as safety leadership and digital literacy.
- Maintain industry feedback loops to update training in line with performance trends and ongoing performance improvements.
- Develop efficient support systems for at-risk apprentices, including online and accessible training options, to enhance their learning experience and support their overall development.
- Embed wellness and skill enhancement modules into core curricula, covering topics such as stress management, fatigue awareness, substance use education, psychological safety in high-risk work environments, mentorship, climate literacy, and others.

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A resilient and future-ready workforce relies on significant investment in skills development and apprenticeships.

5.4 SKILLS DEVELOPMENT AND APPRENTICESHIP

A resilient and future-ready workforce relies on significant investment in skills development and apprenticeships. This section describes a collaborative effort among owners, contractors, unions, regulators, and academic and training providers to ensure that Canada's industrial maintenance sector has the talent pipelines needed for continuous growth.

- **Owners** are encouraged to take a proactive role by integrating wellness, mentorship, and training into workforce planning. Recommendations include strengthening onboarding through site-specific safety orientation and ongoing hazard recognition training, aligning curricula with business needs, and ensuring consistent apprenticeship opportunities across sites.
- **Contractors** are encouraged to formalize multi-year apprenticeship pipelines, incorporate career resilience training, and track mentorship outcomes using performance metrics. Ongoing safety training must be fundamental to all skills development.
- **Unions** drive mentorship, training, and apprenticeship programs, and work to ensure the workforce has the capacity and skills required to meet Canada's maintenance industry needs.
- **Regulators** are positioned to drive system-wide consistency and equity through standardized certifications, mandated apprenticeship ratios on public projects, and targeted funding. Strategic policies and incentives—such as grants, tax credits, and national curriculum alignment—are essential to attract, retain, and advance skilled workers, particularly those from underrepresented groups.
- **Training Providers** provide the physical, technological and digital, and programming infrastructure to train the workforce.

Together, these recommendations offer a blueprint for developing an adaptable workforce supported by clear development pathways, inclusive opportunities, and coordinated industry engagement.

Key recommendations for this section include:

1. Build strong apprenticeship pathways
2. Support mentorship and career growth
3. Make training more accessible
4. Keep training relevant to job requirements
5. Use data to improve programs

OWNERS

Recommendations

- Establish wellness, career resiliency, soft skills, and structured mentorship programs to support well-being

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and career development. Engage succession planning.

- Implement enhanced onboarding to strengthen early-stage skills development and leadership development, thereby improving overall performance.
- Form partnerships with training institutions to ensure curriculum alignment with business needs and objectives.
- Maintain consistent employment opportunities for skilled tradespersons and apprentices across projects and locations.
- Formalize multi-year apprenticeship pipelines aligned with project forecasts.
- Include mental health in core skills development.
- Collaborate with industry stakeholders to develop and implement the above programs.

Implementation Tactics

- Conduct annual workforce planning sessions tied to project cycles to forecast apprenticeship demand.
- Co-design owner-specific training modules with unions, contractors, and training providers.
- Require contractors to include a specified minimum apprenticeship dispatch and retention clauses in project contracts to foster tradesperson career development and skills growth.

CONTRACTORS

Recommendations

- Deliver structured mentoring and training, including on-the-job, to address both technical and soft skills gaps.
- Collaborate with clients to ensure apprentices are employed across consecutive projects.
- Expose apprentices to planning, budgeting, and scheduling within cross-functional teams.
- Align apprenticeship programs with ISO and COR compliance efforts.
- Current workforce strategies often underestimate the value of integrated training approaches that prepare workers for multidisciplinary settings. Cross-training techniques should be promoted, especially for smaller, remote, and fast-paced sites, where workforce flexibility and overlapping skills are essential for maintaining operations.

Implementation Tactics

- Utilize competency tracking platforms to match apprentices with suitable roles, supervision, enhanced skills development, and training supports.
- Develop site rotation programs that cover all phases of project work.
- Incorporate apprentice evaluations into project debriefs and lessons-learned reviews.

- Support industry standardization by supporting the delivery of soft skills and site leadership training modules for mentors and journey-level workers to strengthen interpersonal and supervisory effectiveness.
- Launch internal dashboards to monitor apprenticeship progress, safety, and retention.

UNIONS

Recommendations

- Develop structured mentorship programs to enhance leadership skills and improve technical competencies at all levels. Include mentorship in senior roles with compensation incentives.
- Advocate for the recognition of trade skills by owners, contractors, regulators, and training providers.
- Strengthen partnerships with owners, contractors, regulators, and training providers to co-deliver industry-relevant learning.
- Promote tools for mapping career progression from apprentice to leadership.
- Support flexible training formats, including weekend, modular, and online delivery.
- The industry lacks a formal system to communicate emerging field-level priorities and bottlenecks, such as apprenticeship intake issues, training program completion rates, and gaps in training programs, to regulatory bodies. Creating a structured feedback loop between contractors, unions, training providers, and regulators is crucial for making timely adjustments to program approvals, developing and implementing training funding models, and guiding policy decisions.

Implementation Tactics

- Establish union-led apprenticeship hubs that provide job matching and mentor evaluation.
- Develop soft skills and leadership modules for mentors and journeypersons.
- Collaborate with regulators to develop union-endorsed enhanced skills development, including onsite leadership.

REGULATORS

Recommendations

- Standardize training certifications to support national mobility.
- Promote policies that encourage long-term career progression in the trades.
- Expand incentives for hiring and training apprentices, such as grants and tax credits.
- Mandate apprenticeship employment ratios for publicly funded projects.

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Implementation Tactics

- Create a National Apprenticeship Equivalency Council to align curriculum and certifications.
- Require workforce development plans with measurable apprenticeship targets in RFP submissions.
- Develop digital tracking systems to audit apprenticeship engagement in public projects.

TRAINING PROVIDERS

Recommendations

- Review and update the curricula annually, with industry feedback, to incorporate emerging technologies and sustainability principles.
- Offer stackable enhanced certifications that support Red Seal certification and career progression programming.
- Leverage data analytics to monitor apprenticeship outcomes and program impact.
- Provide online and accessible training options for diverse learner needs.

Implementation Tactics

- Form Advisory Councils with owner, contractor, union, and regulator representation to review the relevance of curricula.
- Review the development of cross-training methodologies, where workforce flexibility and overlapping competencies are crucial for operational continuity.
- Deploy mobile and virtual training modules for learners in rural and remote areas.
- Implement apprenticeship alumni tracking systems to measure long-term success and ROI.

As projects in Canada's industrial maintenance sector grow more large and complex, adopting a more coordinated and collaborative approach becomes crucial. The Integrated Project Model offers a framework to align all stakeholders – including owners, contractors, unions, regulators, and academic and training providers – around shared objectives, simplified planning, and consistent execution strategies.

5.5 INTEGRATED PROJECT MODEL

As projects in Canada's industrial maintenance sector grow ever more complex and large-scale, adopting a more coordinated and collaborative approach becomes crucial. The Integrated Project Model offers a framework to align all stakeholders – including owners, contractors, unions, regulators, and academic and training providers – around shared objectives, simplified planning, and consistent execution strategies.

- **Owners** are encouraged to involve all stakeholders early by using integrated schedules and joint risk management practices. The focus is on early contractor involvement, quality-based selection, clear scope boundaries, and fostering a "one team" culture. Implementation strategies include shared dashboards, collaborative planning systems, and structured project charters that establish behavioural expectations, performance metrics, shared safety objectives, and joint hazard mitigation plans.
- **Contractors** are responsible for using shared planning tools, managing scope changes openly, and designating dedicated integration leads for key projects. By applying scenario planning and contingency strategies, contractors can reduce risks related to workforce and supply chain uncertainties.
- **Unions** contribute by enhancing workforce forecasting, fostering consistent communication, and integrating training and mentorship into project delivery. Participation in pre-job planning and tripartite working groups improves alignment between workforce supply and project demand.
- **Regulators** are called upon to support this model through standardized contract templates, pan-Canadian credential recognition, and regulatory sandboxes to pilot innovative project delivery methods. They play a crucial role in ensuring that risk is fairly shared and best practices are broadly adopted.
- **Training Providers** support this model by synchronizing apprenticeship schedules with project requirements, providing improved skills development credentials in collaborative delivery, and conducting applied research on integrated project management practices.

Together, these coordinated efforts create a more agile, transparent, and high-performing project environment—one that ensures industrial execution is timely, cost-effective, and sustainable.

Key Recommendations for this section include:

1. Early engagement and strategic collaboration
2. Project planning and integrated scheduling
3. Performance-based contractor selection and unified team culture

4. Adaptive risk management and real-time response planning
5. Standardized delivery models, innovation pilots, and industry learning

OWNERS

Recommendations

- Engage all stakeholders early in the project using a 'T-minus' scheduling approach.
- Build trust with third-party providers to enable strategic input in planning and execution.
- Develop integrated project schedules that facilitate the efficient deployment of the workforce.
- Clearly define project scope boundaries and establish limits on scope changes.
- Adopt contractor selection criteria that prioritize quality and past performance over price alone.
- Cultivate a 'one team' culture by sharing goals, fostering accountability, and promoting collaboration among team members.
- Conduct peer reviews focused on turnaround readiness and incorporate lessons learned.

Implementation Tactics

- Host joint pre-project workshops to align objectives, define roles, and establish a risk-sharing structure.
- Develop collaborative planning protocols and shared project management systems with access to industry data.
- Create a formal project charter that outlines behavioural expectations, KPIs, and dispute resolution processes.
- Utilize joint dashboards for real-time tracking of schedules, costs, and quality metrics.

CONTRACTORS

Recommendations

- Leverage shared planning tools to coordinate workforce, equipment, and materials logistics.
- Foster open communication to identify risks early and manage expectations effectively.
- Align project execution plans with workforce availability using integrated schedules.
- Manage scope changes proactively through transparent engagement with owners.

Implementation Tactics

- Assign a dedicated collaboration or integration manager for major projects to ensure seamless collaboration and integration.
- Apply scenario planning tools to adapt workforce strategies in response to unforeseen events.

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- Include detailed contingency clauses in contracts addressing supply chain and staffing risks.

UNIONS

Recommendations

- Facilitate clear and consistent communication among contractors, owners, and the workforce to ensure seamless collaboration and coordination.
- Collaborate in the creation of realistic workforce projections based on integrated planning.
- Promote the integration of apprenticeship training into project planning and management training programs.

Implementation Tactics

- Form tripartite working groups to jointly develop staffing plans and conflict resolution protocols.
- Utilize digital forecasting tools to align workforce dispatch and training with project requirements.
- Ensure union involvement in pre-job planning meetings for long-term or high-risk projects.

REGULATORS

Recommendations

- Promote collaborative contracting policies and models across jurisdictions to enhance efficiency and effectiveness.
- Standardize project planning templates and documentation formats to ensure consistency and efficiency.
- Ensure equitable risk allocation among stakeholders.
- Encourage the development and sharing of industry-wide best practices to promote innovation and collaboration.

Implementation Tactics

- Develop integrated contract templates with clauses on joint governance, performance, and risk-sharing.
- Establish multi-stakeholder advisory panels to evaluate the compliance of large-scale project proposals.
- Implement digital platforms to monitor compliance with safety, workforce, and environmental standards.
- Launch pilot projects within regulatory sandboxes to test integrated delivery methods and evaluate their effectiveness.

TRAINING PROVIDERS

Recommendations

- Conduct applied research on collaborative project planning methods.
- Align apprenticeship programming timelines and delivery methods with major project schedules to ensure seamless integration and coordination.

- Strengthen academic offerings that support integrated project delivery models.

Implementation Tactics

- Develop co-designed curricula and training in collaboration with owners, unions, and contractors, with a focus on effective technical and soft skills development and risk management.
- Provide enhanced skills development and certification in digital scheduling, collaborative delivery, and integrated contract principles.
- Coordinate apprenticeship block releases and training delivery to match project timelines.

Contracts should also serve as tools to support inclusive procurement and enhance Indigenous participation, supplier diversity, and the creation of long-term local value. In this context, supplier diversity means intentionally including businesses owned, operated, and controlled by individuals from underrepresented or historically marginalized groups. Removing procurement barriers that might exclude smaller or non-traditional vendors helps strengthen local supply capacity.

5.6 CONTRACTING STRATEGY

A modern and collaborative contracting approach is vital for enhancing performance, equity, and sustainability in Canada's industrial maintenance sector. This section outlines a unified strategy to improve contract consistency, fairness, and alignment among stakeholders, including owners, contractors, unions, regulators, and academic and training providers.

- **Owners** are encouraged to establish standard contract frameworks, promote early contractor engagement, and include performance-based incentives linked to safety, quality, and workforce results. Safety incentives should be tied to leading indicators of safety performance, not just lagging indicators. Contracts should also serve as tools to support inclusive procurement and enhance Indigenous participation, supplier diversity, and the creation of long-term local value. In this context, supplier diversity means intentionally including businesses owned, operated, and controlled by individuals from underrepresented or historically marginalized groups. Removing procurement barriers that might exclude smaller or non-traditional vendors helps strengthen local supply capacity.
- **Contractors** are encouraged to adopt collaborative contracting models that distribute risk and reward equitably, invest in thorough contractual risk analysis, and enhance internal skills in negotiation, dispute resolution, and compliance.
- **Unions** must be aware of and understand workforce clauses and training standards within contracts and engage in joint audit processes to ensure alignment with collective agreements and workforce protections.
- **Regulators** play a vital role in promoting fairness and transparency by utilizing standardized templates, compliance-integrated contracts, and ongoing oversight. Tools such as Contracting Health Reports and training for procurement officials will help raise standards for both public and private contracting.
- **Training Providers** must support this shift by providing relevant, applied contract management education that combines legal, operational, and real-world dispute case studies to prepare the next generation of industry professionals.

Together, these recommendations aim to create a more transparent, performance-oriented, and socially responsible contracting environment, ensuring value for all parties while enhancing project delivery and workforce outcomes.

Key recommendations for this section include:

1. Standardization and modernization of contracts
2. Early engagement and practical design
3. Performance, risk, and accountability
4. Skills development and capacity building
5. Inclusive and community-based procurement

OWNERS

Recommendations

- Create standardized contract frameworks to improve consistency and clarity.
- Enhance collaboration with Indigenous communities and implement local procurement strategies through centralized supply chains for inclusive procurement.
- Foster early involvement of contractors in contract design and planning.
- Incorporate performance-based incentives linked to safety, quality, and workforce retention.
- Implement right-sized risk allocation in contracts with robust and transparent conversations on contractor risks and how such risks are being managed.
- Engage change management and standardization best practices and seek clarity in contracting.
- Ensure a standard contractor prequalification process exists across all owner groups.
- Practice a thoughtful application of the release of funds to contractors to manage cash flows, including the implementation of prompt payment processes to remove administrative overhead and the slow transfer of funds.
- Develop a common sourcing strategy, one that takes a long-term approach. The sourcing strategy should support the desired outcomes required by the equally long-term maintenance strategy.
- Integrate digital tools and real-time reporting to improve communication and drive efficiencies. Apply AI agents to process, interpret, and identify opportunities in data-intensive spaces.
- Provide site logistics and material flow clarity for effective planning and maintenance execution.
- Create efficiencies by working together with contractors early in the project's life.

Implementation Tactics

- Develop a Contract Strategy Playbook to guide model selection based on project characteristics.

- Utilize dashboards to monitor key contracting KPIs, including disputes, change orders, and satisfaction levels.
- Implement digital contract lifecycle management platforms for efficient drafting, revisions, and compliance tracking.

CONTRACTORS

Recommendations

- Invest in risk analysis tools to model contractual exposure across delivery formats.
- Support collaborative contract models that share risks and incentives.
- Expand internal skills in negotiation, administration, and dispute resolution.
- Encourage Indigenous participation and adopt sustainable supply chain practices that consider factors such as Indigenous participation, supplier diversity, local sourcing, decarbonization, environmental sustainability, and social procurement.
- Strengthen contracting skills to better manage downstream value chains.
- Practice effective contract onboarding and transition to execution.

Implementation Tactics

- Establish a Contracting Center of Excellence to review strategic and high-value contracts, ensuring compliance with relevant regulations and standards.
- Train key personnel in contractual risk management and model assessment.
- Participate in industry-wide reform initiatives to shape future contracting practices.

UNIONS

Recommendations

- Engage senior leadership to review labour-related owner contract language for alignment with collective agreements.
- Advocate for inclusion of union-established training benchmarks within contract provisions, including Indigenous workforce inclusion, workplace diversity, and technical and soft skills training.

Implementation Tactics

- Create a best practice contracting guide for union leaders and stewards.
- Establish audit teams to oversee compliance with labour-related contract clauses.

REGULATORS

Recommendations

- Encourage the use of standardized templates with built-in compliance mechanisms to ensure consistent and accurate data.

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- Include maintenance services in the Prompt Payment and Construction Lien Act (PPCLA) and provide greater act clarity.
- Provide clarity to the supply chain regarding what can and cannot be shared in respect of the Competition Act.

Implementation Tactics

- Publish annual Contracting Health Reports that analyze trends, disputes, and best practices.
- Provide training for procurement and inspection staff on contract fairness and regulatory alignment.

TRAINING PROVIDERS

Recommendations

- Develop certificate and degree programs in industrial contract management.
- Embed real-world contract disputes and resolution methods into training programs.
- Develop and deploy soft skills training related to supply chain management and procurement.
- Enhance the connection with industry and fine-tune training content to match industry needs.
- Adopt training to deploy AI in contracting and contract administration.

Implementation Tactics

- Include contract law instruction in trade-level programs.
- Host interdisciplinary workshops connecting trades, engineering, and legal students.
- Publish applied research examining evolving trends in contracting models.

This coordinated approach to technology R&D emphasizes real-world testing, workforce involvement, and collaboration among institutions. By aligning investment, policy, and training across stakeholder groups, Canada's industrial sector can drive innovation that is practical, scalable, and inclusive, ensuring long-term resilience in an increasingly digital and decarbonized economy.

5.7 TECHNOLOGY RESEARCH AND DEVELOPMENT

To stay competitive and ready for the future, Canada's industrial maintenance sector must incorporate innovation and technology into its operations, workforce, and education systems. This section provides coordinated recommendations and actions for key stakeholders – owners, contractors, unions, regulators, and academic and training institutions – to accelerate the adoption of new technologies and promote innovation on a large scale.

- **Owners** are encouraged to invest directly in pilot programs, form internal innovation teams, and collaborate with academic partners to foster innovation. Strategies for implementation include testing technologies in real projects and creating systems that enable frontline employees to submit ideas for improvement.
- **Contractors** are well-positioned to introduce innovations that improve project delivery, cut inefficiencies, and digitize operations. Collaborative innovation consortia and site-specific technology investments, such as rugged wearable devices and modular systems, are key enablers of innovation. KPIs like reduced rework, shorter schedules, and increased productivity should be used to measure success.
- **Unions** play a crucial role in guiding the adoption of technology that improves safety and safeguards job quality. Recommendations include promoting worker retraining, incorporating innovation into apprenticeship programs, and creating workforce-technology councils. Surveys, academic partnerships, and funding conditions linked to workforce transitions can help ensure that innovation remains focused on workers.
- **Regulatory** bodies should foster innovation through adaptable procurement frameworks, controlled exemptions for experimental tools, and funding for industry-wide research hubs. Strategies include creating regulatory testbeds, requiring innovation-related spending in public contracts, and establishing evaluation panels to review the outcomes of technology trials.
- **Training Providers**: Educational partners should modernize curricula, offer enhanced skills certification in advanced technologies, and promote commercialization through tech transfer initiatives. By launching innovation competitions, establishing joint labs, and integrating applied research and development into apprenticeship training, academia can actively contribute to sectoral transformation.

This coordinated approach to technology R&D emphasizes real-world testing, workforce involvement, and collaboration among institutions. By aligning investment, policy, and training across stakeholder groups, Canada's industrial sector can drive innovation that is

practical, scalable, and inclusive, ensuring long-term resilience in an increasingly digital and decarbonized economy.

Key recommendations for this section include:

1. Building internal innovation capacity
2. Funding and piloting emerging technologies
3. Policy and regulatory enablement
4. Integration of R&D with workforce needs
5. Collaboration and knowledge sharing

OWNERS

Recommendations

- Invest in pilot programs to validate emerging technologies in field settings.
- Create internal R&D or innovation teams to address sector-specific challenges.
- Collaborate with academic institutions through joint labs or field trials.
- Allocate a fixed percentage of capital budgets to support innovation projects.

Implementation Tactics

- Deploy new technologies on active job sites to assess effectiveness in real conditions.
- Leverage government R&D tax credits (e.g., SR&ED) to mitigate development costs.
- Introduce an internal idea submission system for employees to propose innovations.

CONTRACTORS

Recommendations

- Form consortia with peer contractors to fund innovation infrastructure jointly.
- Invest in technologies tailored to project environments, such as wearables and modular systems, to enhance productivity and efficiency.

Implementation Tactics

- Designate a technology integration lead for large projects to oversee the adoption of R&D.
- Use digital twins and post-project reviews to inform ongoing innovation strategies.
- Track R&D success through KPIs such as reduced rework and faster project completion.

UNIONS

Recommendations

- Champion R&D that improves safety (wearable detection systems), maintains job quality, and supports retraining.
- Advanced apprenticeships are tied to the use of new technologies.

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- Guide worker-centric innovation through dedicated workforce-technology councils.
- Explore human factors in tech adoption through ergonomic and psychological studies.

Implementation Tactics

- Secure R&D funding conditions that include workforce transition and training supports.
- Survey members on technology readiness and use findings to influence policy change and modernization.
- Partner with academia to fund R&D fellowships that address worker safety and productivity.

REGULATORS

Recommendations

- Support experimental technologies through controlled regulatory exemptions.

Implementation Tactics

- Establish regulatory testbed programs to pilot new tools before broader rollout.
- Include innovation spending requirements in public infrastructure contracts.
- Establish evaluation panels to assess the results of technology trials and make recommendations for adoption.

TRAINING PROVIDERS

Recommendations

- Modernize the curricula to incorporate emerging technologies and industry best practices for delivery.
- Establish technology transfer initiatives to bridge the gap between academic and industry innovation.
- Establish hands-on environments and collaborative spaces with support from both the business and government sectors.
- Focus grant applications on industry-identified innovation priorities, such as automation and decarbonization.
- Offer enhanced skills certification programs for R&D technologies, including AI, 3D scanning, and VR.

Implementation Tactics

- Run innovation competitions that pair students with companies using real-world challenges.
- Establish technology transfer offices to facilitate the commercialization of academic discoveries.
- Integrate applied research modules into apprenticeship training to link students to R&D activities.

Educators must modernize learning by integrating immersive technologies such as virtual and augmented reality (VR/AR), AI, personalized digital learning pathways, and industry-aligned enhanced skills certifications. Collaborating with industry to develop responsive training content and validation labs will ensure students acquire the digital skills needed for evolving job roles.

5.8 INNOVATION AND TECHNOLOGY ADOPTION

This section offers a roadmap for accelerating technology adoption in the industrial maintenance sector, presenting key recommendations and practical steps for owners, contractors, unions, regulators, and training providers to incorporate digital transformation into their operations, workforce practices, and regulatory frameworks.

It is acknowledged that the development of enabling technologies progresses rapidly, often outpacing the industry's ability to adapt and manage the significant changes that result. Prescribing a single best practice is difficult, and industry stakeholders are encouraged to collaborate, share successes and setbacks, and work together to adopt productivity-enhancing technologies.

- **Owners**: To remain competitive, businesses must adopt AI, process automation, Internet of Things (IoT) sensors, and cloud-based platforms to enhance operational efficiency, risk management, and asset performance. Creating a digital transformation plan and offering enhanced skills training in data literacy are crucial for achieving long-term value from technology investments.
- **Contractors** should adopt robotics, smart wearables (real-time hazard detection, geofencing for exclusion zones, lone-worker monitoring), and real-time site management tools to improve safety, productivity, and decision-making. Field tech champions, augmented reality (AR) for visualization, and connected workforce platforms will enhance execution and coordination on job sites.
- **Unions** play a crucial role in ensuring that the adoption of technology maintains job quality and facilitates a smooth transition of the workforce. By integrating digital literacy into apprenticeships, creating mobile engagement platforms, and negotiating data access agreements, unions can help develop a fair and future-proof skilled workforce environment.
- **Regulators**: Regulatory bodies can support digital transformation by creating policies that encourage innovation, making compliance easier with innovative monitoring tools, and adopting open data standards. Initiatives such as regulatory sandboxes and digital permitting systems will help ensure the safer and quicker adoption of new technologies.
- **Training Providers**: Educators must modernize learning by integrating immersive technologies such as virtual and augmented reality (VR/AR), AI, personalized digital learning pathways, and industry-aligned enhanced skills certifications. Collaborating with industry to develop responsive training content and validation labs will ensure

students acquire the digital skills needed for evolving job roles. Cross-trade and multi-skilled training models for site readiness are essential.

The successful adoption of digital tools and technologies depends on cross-sector coordination, policy support, and a commitment to workforce readiness. This strategy promotes a balanced approach that aligns innovation with productivity, safety, and fair labour practices, ensuring that technology benefits both performance and people in Canada's industrial sector.

Key recommendations for this section include:

1. Operational technology implementation
2. Standardization and digital collaboration
3. Policy, regulation, and enablement
4. Workforce protection and adaptation
5. Education and digital learning

OWNERS

Recommendations

- Adopt AI analytics for resource optimization and real-time decision-making.
- Standardize cloud-based collaboration platforms across all projects to ensure consistency and efficiency.
- Automate estimating and risk management through data-driven tools.

Implementation Tactics

- Develop a digital transformation roadmap that aligns with project funding and timelines to ensure seamless execution and optimal results.
- Pilot predictive maintenance technologies on high-value assets.
- Offer data literacy training to enhance internal analytics capabilities and improve overall data-driven decision-making.

CONTRACTORS

Recommendations

- Adopt robotic tools to streamline repetitive and complex fieldwork.
- Implement wearables and other innovative tech to boost jobsite safety and data quality.
- Link project tracking with workforce development and union collaboration platforms to enhance efficiency, effectiveness, and address training gaps.

Implementation Tactics

- Assign field tech champions to support adoption and troubleshoot onsite.
- Integrate wearable devices into hazard analysis and safety protocols to enhance operational efficiency and safety.

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- Use AR to enhance field visualization and reduce worksite and work scope interpretation errors.

UNIONS

Recommendations

- Ensure that technology implementation supports job security and fair labour practices.
- Collaborate on trade classifications that adapt to automation while protecting critical roles.
- Educate members on the impact of digital tools and the opportunities for enhanced training certification.

Implementation Tactics

- Create a union-managed credential tracking system that connects seamlessly with standardized contractor platforms for real-time verification and workforce planning.
- Embed digital literacy and cyber safety into trade apprenticeship programs.
- Enhance online learning support with tools that increase retention and accessibility.

REGULATORS

Recommendations

- Design policy frameworks that reward digital transformation and innovation.
- Encourage the use of digital permits and automated approval systems to streamline the process.
- Create technology sandboxes to test new regulatory technologies safely and effectively.

Implementation Tactics

- Form a regulatory technology working group with key industry stakeholders.
- Introduce digital compliance audits with AI-generated safety metrics.
- Mandate open data standards for regulatory reporting systems.

TRAINING PROVIDERS

Recommendations

- Integrate VR/AR into immersive learning environments for enhanced engagement.
- Develop hybrid delivery models with AI integration to support hands-on and remote learning.
- Create tailored digital learning paths aligned with specialization and career progression.
- Establish validation labs for students to interact with cutting-edge technologies before they are deployed in the field.

Implementation Tactics

- Partner with industry to co-design training modules for advanced digital tools and technologies.

- Use learning management system (LMS) data to personalize and adapt instructional strategies in real-time.
- Offer enhanced skills certifications in relevant digital applications, including drones, AI, jobsite cyber safety, and others.
- Connect skill tracking systems to enable communication between training providers, owners, contractors, and unions.

“Failing to act decisively and with urgency will have consequences. Fragmentation across jurisdictions and industry stakeholders will deepen, undermining coordination and eroding trust. Project timelines will slip as workforce shortages worsen and inefficiencies multiply. Costs – already under pressure from inflation, supply chain volatility, and regulatory complexity – will escalate further.”

6.0 | Conclusion

THE IMPERATIVE FOR INDUSTRY TRANSFORMATION

The Canadian maintenance industry faces a crucial turning point. With growing demand, rapid technological progress, shifts across generations in the workforce, and increasing regulatory and economic pressures, stakeholders must collaborate more than ever to foster the needed change for a stronger and more resilient industry. This discussion paper presents an ambitious yet feasible plan to tackle these challenges head-on. It is the dedication of industry stakeholders that will determine whether this moment leads to decline or renewal.

Workforce shortages are no longer just forecasted. They are constant, especially in skilled trades essential to the country's critical infrastructure. If current trends persist, entire parts of the maintenance sector could struggle with the pressure of attrition, as workforce skills fail to meet job demands.

Technological disruption offers a rare second chance. Predictive maintenance, AI-integrated project tracking, digital twins, and cloud-based collaboration platforms are transforming how projects are designed, scheduled, and executed. However, adoption remains inconsistent. Without a coordinated, sector-wide effort to standardize technology implementation, including workforce enhanced skills development and training alignment, the benefits will be limited to a few, leaving others behind.

This fragmentation extends to certifications, contracting, and project delivery. Different standards across provinces restrict workforce mobility. Contracting strategies often depend on the lowest-cost procurement approach, which can limit collaboration and reduce performance incentives. Additionally, a lack of real-time information sharing and pre-competitive benchmarking hinders the industry from learning from its own experiences.

What is needed is not more pilots or studies. What is needed is bold action, aligned across all stakeholders – owners, contractors, unions, regulators, and training providers. The recommendations in this paper provide that alignment. They are grounded in practicality, tested by industry input, and ready for implementation.

The opportunity is real. By acting now, Canada can protect its maintenance industry for the future, improve job quality and efficiency, speed up

OWNERS MUST
commit to collaborative contracting and shared risk.

UNIONS MUST
lead in mentorship and mobility.

CONTRACTORS MUST
invest in workforce innovation and digital integration.

REGULATORS MUST
align policy with best practice.

TRAINING PROVIDERS MUST
prepare a new generation for a new reality.

infrastructure projects, and ensure that future generations see this sector as a viable career choice rather than a last resort.

Failing to act decisively and with urgency will have consequences. Fragmentation across jurisdictions and industry stakeholders will deepen, undermining coordination and eroding trust. Project timelines will slip as workforce shortages grow and inefficiencies multiply. Costs – already under pressure from inflation, supply chain volatility, and regulatory complexity – will escalate further. Without strategic collaboration among industry stakeholders and modernization, Canada's maintenance sector – the essential backbone of our energy, transportation, industrial, and public infrastructure systems – risks decline. The time for structural, sector-wide action is now.

As stakeholders in the Canadian maintenance industry, we must uphold our shared responsibilities to the workforce and our moral obligation to safety. A TRIR near zero indicates significant progress, but the core principles of Serious Injury or Fatality (SIF) and an industry-wide scorecard should remain our ultimate goals. Success is not measured by statistics but by every worker returning home safely after each shift. Our final frontier is the individual worker on the job, ensuring they are physically prepared, mentally fit, and professionally competent. Ultimately, our measure of success depends on how well we prepare, support, and lead each worker to go home safe after every shift, without exception.

This is the moment to lead. Canada's maintenance industry cannot endure incremental changes in the face of fundamental challenges. This discussion paper offers more than just suggestions – it provides a shared blueprint for transformation, created by those who live the work every day. Now, leadership must move from principles to actions.

The tools are ready. The partnerships are taking shape. The window for action is open, but it will not be forever. Let this be the moment when Canada's maintenance sector chooses courage over caution, and action over inertia. Let us get started.

The tools are ready. The partnerships are taking shape. The window for action is open, but it will not be forever. Let this be the moment when Canada's maintenance sector chooses courage over caution, and action over inertia. Let us get started.

APPENDIX 1

Proof Points

How leading organizations are setting the standard

The project examples that follow are provided solely for illustrative and informational purposes. To ensure confidentiality and maintain neutrality, the names of companies, sectors, partners, and sensitive economic data have been removed or anonymized. The insights and lessons presented are intended to highlight industry best practices and offer strategic considerations for organizations evaluating or implementing similar approaches.

APPENDIX 1.1: A MODEL FOR INTEGRATING SAFETY CULTURE

1.0 Background

A major Canadian power generation utility undertook a massive modernization initiative that included an asset life extension program. The transformation was characterized by a shift in organizational culture, a heightened focus on safety, and the integration of technology and workforce excellence.

2.0 Problem Statement

- Cultural fatigue and disengagement, particularly among building trades and contractors.
- Supervisory skill gaps, especially among young or inexperienced frontline leaders.
- Safety inconsistencies across sites, and a need to embed a deep safety culture at all levels.
- Outdated contractor management approaches lacked consistent performance evaluation and accountability.
- High warranty claims and inefficiencies stem from poor execution and insufficient training.
- Lack of operational alignment between cost, schedule, safety, and quality.
- Underutilization of AI and automation for inspection and maintenance.
- Inefficiencies in government-regulated contracting models, such as time-and-

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materials, undermined cost control and accountability.

These systemic issues posed serious risks to the organization's ambitious refurbishment timelines, public reputation, and nuclear operational safety.

3.0 Objectives

- Transform organizational culture from passive compliance to proactive excellence.
- Reduce safety incidents and warranty claims through performance-focused supervision and accountability.
- Elevate supervisory leadership across both in-house teams and contractors.
- Align operations with a holistic excellence model that encompasses safety, quality, cost, and schedule.
- Institutionalize contractor performance management, including scorecards and structured remediation plans.
- Advance technology adoption, including automation and AI in inspection and maintenance.
- Position the organization as a global leader in nuclear safety, reliability, and isotope innovation.

4.0 Solutions Implemented

Cultural and Leadership Transformation

- Developed a Building Trades Excellence Model centred on safety, performance, and social responsibility.
- Rolled out internal leadership and soft-skills training, especially for junior supervisors, to drive people-first leadership.
- Fostered a culture shift from profit-driven contracting to performance and reliability-based work.
- Embedded a "stop when unsure" mindset across all maintenance and operations.

Operational Excellence System

- Introduced an integrated safety – quality – cost – schedule framework as the benchmark for performance evaluation.
- Applied peer review criteria to ensure accountability against global best practices.
- Elevated safety standards across contractor operations, benchmarking against top-tier industrial operators.

Contractor Management Overhaul

- Created performance scorecards evaluating contractor execution on safety, cost, quality, and productivity.
- Engaged contractors in collaborative improvement plans based on scorecard results.
- Improved onboarding, site orientation, and continuous feedback loops.

Workforce Development

- Delivered in-house technical and leadership programs, improving

supervision quality and field decision-making.

- Reduced warranty claims and increased unit capacity through frontline empowerment and field training.

Technology and Innovation

- Piloted robotics for tank inspections and digitalized work order maintenance tasks.
- Initiated AI exploration for predictive maintenance and workflow optimization.
- Expanded operations and products to better align with social responsibility and innovation mandates.

5.0 Benefits Realized

Operational and Safety Gains

- Marked improvement in equipment reliability and capacity factors, and a reduction in warranty claims.
- Improved safety incident rates and stronger regulatory compliance.
- Timely execution of complex, multi-billion-dollar refurbishment projects under the asset life extension program.

Workforce and Culture

- Shift from disengagement to high-performance culture in both trades and staff.
- Better frontline supervision and reduced turnover due to leadership investment.
- Positive alignment between strategy, mission, and organizational values.

Strategic and Industry Positioning

- Global recognition through peer benchmarking as a top operator.
- Trusted government partner in meeting Net-Zero energy emission goals

Technological Edge

- Robotics and AI have created safer and more efficient inspection practices.
- Positioned the organization as a future-ready utility, blending tradition with innovation.

6.0 Recommendations

The following recommendations are applicable to energy and infrastructure organizations:

- Make safety and operational excellence cultural cornerstones – from CEO to contractor.
- Invest heavily in leadership development, especially among first-line supervisors and field leads.
- Align performance systems across safety, cost, quality, and schedule – not just financial metrics.
- Adopt collaborative contractor scorecards that include mutual improvement plans and transparent reviews to foster ongoing improvement.

- Benchmark performance against global leaders, leveraging peer evaluations and audits.
- Use automation and AI strategically, beginning with pilot projects in inspection and preventive maintenance.
- Advance social value mandates as part of the operational mission.

7.0 Conclusion

This organization's efforts to improve turnaround demonstrates how cultural reinvention, operational rigour, and technological advancement can co-exist within a highly regulated, high-stakes industry. The organization's integrated focus on safety, performance, and people created a blueprint for any capital-intensive utility seeking resilience, trust, and innovation.

APPENDIX 1.2:
TRANSFORMING SUPPLY CHAIN AND CONTRACT STRATEGY

1.0 Background

A leading North American petrochemical producer pioneered a collaborative supply chain and contracting strategy with its maintenance partners. The innovative approach introduced greater efficiency and collaboration across teams. This foundation enabled the organization to better achieve critical milestones during a complex turnaround project.

2.0 Problem Statement

- Adversarial contractor relationships were driven by transactional bidding and minimal pre-engagement collaboration.
- Price-centric selection undermined long-term value and safety performance.
- Misalignment between contract models and site workforce strategies (union vs. non-union) caused execution risk.
- Lack of real-time accountability mechanisms, limiting in-project performance transparency.
- Missed optimization opportunities, with contractors not incentivized to propose cost-saving innovations.
- Workforce portability and credentialing barriers, particularly between provinces; complicated workforce planning.
- Resistance to new technology and slow adoption of innovation further inhibited efficiency gains.

These issues led to project inefficiencies, higher lifecycle costs, and cultural misalignment between the owner and contractors.

3.0 Objectives

- Foster partnership-based procurement models rooted in “radical transparency”.
- Embed workforce strategy into the contracting framework using structured decision trees.
- Use multi-dimensional scorecards for contractor selection that balance cost, safety, technical capability, and experience.
- Incentivize contractor performance using gainshare models tied to KPIs and continuous improvement.
- Promote early contractor engagement and shared accountability through structured alignment processes.
- Build a resilient workplace culture through mentorship, field leadership, and transparent communication.
- Enable cautious, thoughtful technology adoption without disrupting field-level expertise.

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4.0 Solutions Implemented

Radical Transparency and Contractor Partnerships

- The organization adopted a new relational procurement mindset: “We are both vested in success”.
- Early contractor alignment occurs before the contract, with the development of relationship charts and shared objectives.

Contractor Selection via Weighted Scorecards

- Selection is not price-based, but encompasses:
  - Safety record
  - Technical capabilities
  - Local knowledge
  - Commercial responsiveness
  - Workforce compatibility
- Multi-round selection processes ensure transparency and strategic fit.

Workforce Strategy Integration

- The site workforce strategy (union/non-union) is decided first, informing a contractor decision tree.
- Example: A turnaround may involve both union and non-union contractors to reduce risk from workforce shortages.

Performance Incentives and KPI Linkage

- Contracts include bonus/penalty clauses based on KPIs.
  - Exceeding targets → Additional margins
  - Underperforming → Reduced compensation
- KPIs include Schedule Performance Index (SPI) and Cost Performance Index (CPI).

Structured Alignment Cadence

- Engagement includes:
  - Executive oversight meetings
  - Field-level daily stand-ups
  - Weekly mid-level progress reviews
- Joint planning and war room check-ins promote in-flight course corrections.

Continuous Improvement Mechanism

- Contractors are encouraged to bring innovative ideas such as:
  - Improved supervision ratios
  - Reduced non-productive time
  - Field efficiencies
- Gains are shared with the organization, reinforcing trust and engagement.

Workforce Development and Culture

- Contracts mandate apprenticeship targets, especially for first-year apprentices.
- Mentorship programs and milestone recognition (“Picture of the Week”) build pride and retention.
- Inclusive leadership ensures visibility and transparency across project teams.

Technology Deployment

- The organization takes a cautious, “fit-for-purpose” approach to innovation:

- Digital isolation permitting
- Monitoring tools under test conditions
- AI evaluated only where it complements—not replaces—human skill.

5.0 Benefits Realized

Strategic

- Greater contractor alignment with the organization's priorities, reducing friction and enhancing quality.
- An Integrated workforce strategy improved workforce reliability and de-risked execution.
- Shared planning culture fostered accountability and stronger vendor relationships.

Operational

- Faster, better execution driven by real-time KPI tracking and active project governance.
- Contractor innovation unlocked millions in cost savings and work optimization.
- Field readiness and workforce continuity improved through support for apprenticeship and mentorship.
- Fewer safety incidents and improved compliance with safe work practices.

Cultural

- Psychological safety and inclusion improved across teams through recognition and field leadership.
- A trust-based contracting culture has replaced adversarial procurement dynamics.

Innovation

- Smart tech adoption preserved field trust while improving productivity.

6.0 Recommendations

Drawing from this organization's experience, the following recommendations apply to organizations in capital-intensive industries:

- Adopt radical transparency as a procurement ethos. Embed collaboration and co-accountability into every stage.
- Align workforce strategy with contracting decisions, starting early to reduce execution risk.
- Use multi-criteria scorecards for contractor selection, shifting focus away from the lowest price.
- Incentivize performance through measurable KPIs and gain/loss sharing.
- Mandate pre-engagement alignment, including relationship charters and regular meeting cadences.
- Drive workforce development through apprenticeship targets and an inclusive field culture.
- Encourage contractor-led innovation by rewarding insights that drive optimization and improvement.

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- Introduce thoughtful, field-accepted technologies that support the skilled workforce rather than replace it.

7.0 Conclusion

The organization's approach represents a mature, high-trust model for industrial procurement and project delivery. By embedding transparency, workforce logic, and performance-based governance, the company has set a new standard in collaborative maintenance execution. Their experience provides a compelling blueprint for industry-wide improvement, particularly in the Canadian heavy industrial and maintenance sector.

APPENDIX 1.3:
ENHANCING MAINTENANCE AND SUPPLY CHAIN

1.0 Background

A large and complex utility organization serves millions of customers through a diverse mix of generation facilities transmission and distribution networks. With dispersed assets located over thousands of kilometres apart, managing maintenance needs was complex and cumbersome resulting in operational impacts. A new approach for maintenance across the system was required.

2.0 Problem Statement

The pre-transformation era faced several systemic challenges:

- Procurement and maintenance were managed regionally, resulting in inconsistent governance, duplicated efforts, and an increased risk of fraud.
- SAP's Logistics and CCM modules were underutilized due to poor forecasting and minimal field integration. Contracting remained reactive, undermining predictive maintenance.
- Legacy contracts lacked strategic risk-sharing, were non-standard, and lacked strong incentive alignment. Vendor management suffered due to fragmented sourcing.
- Storm and outage response lacked coordination; regions often worked in silos, leading to slow activation and inconsistent contingency preparation.
- While policy frameworks existed, implementation was uneven and ad hoc. Indigenous businesses lacked structural integration in procurement practices.

3.0 Objectives

Guided by provincial Crown mandates and board accountability, the organization aimed to:

- Centralize supply chain and maintenance operations to increase efficiency, enhance oversight, and reduce administrative costs.
- Institute standardized contracts and procurement policies, embedding risk management and performance KPIs.
- Implement strategic category management and vendor performance reviews to optimize operations.
- Build in-house capability, reducing engineering, procurement and construction (EPC) outsourcing risks.
- Embed Indigenous procurement mechanisms, broadening directed and set-aside opportunities.
- Enhance emergency/outage readiness via proactive planning, centralization, and regional deployment.
- Drive cultural change and cross-functional integration to ensure consistency and alignment across all areas.

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4.0 Solutions Implemented

Governance and Centralization

- Launched a centralized supply chain reporting to the CFO.
- Introduced category management for strategic sourcing across equipment, services, and materials.
- Streamlined contract templates with standardized risk and compliance clauses.

Contracting and Vendor Management

- Carried out vendor feedback surveys, redesigned contracts to include milestone incentives and safety provisions.
- Implemented safety and performance scorecards for vendors, linking results to KPIs to encourage measurable improvements in contractor safety performance.

In-House Expertise

- Focused on technical retention, ensuring the organization had internal technical leaders who could own specifications and contract oversight.
- Reduced reliance on EPC firms by rebuilding internal capability.

Emergency and Outage Strategy

- Centralized planning and decentralized regional execution for events like storms.
- Built capability for pre-staging crews, integrating meteorological intelligence and working closely with key logistic partners, accelerating recovery.

Indigenous Engagement

- Formalized Indigenous Procurement Policy, enabling direct and set-aside contracts under relationship and impact-benefit agreements.
- Pre-qualified Indigenous businesses in regional pools were offered smaller rounds to build capacity and were introduced to multi-stage RFQs.

Systems and Tools

- Optimized usage of SAP's CCM module and Unifier despite earlier underinvestment.
- Introduced data-driven dashboards for scorecards and risk metrics.

Cultural Change and Accountability

- Performance scorecards were linked across departments.
- Executives led interest groups for cross-functional participation.
- Governance oversight included risk, safety, and procurement committees.

5.0 Benefits Realized

Operational and Financial

- Enhanced consistency through unified specifications and predictable vendor agreements.
- Cost savings by reducing emergency payment surge through pre-planning and centralized procurement.

- Risk reduction through transparent contracting, performance incentives, curtailed overpayment, and disputes.

Indigenous and Community

- Increased directed contracts via policy mandate: “award…must be at market competitive prices…meet qualifications, safety and performance standards”.
- Boosted Indigenous participation in major projects.

Governance and Efficiency

- Enhanced vendor relationships through transparent processes: surveys and scorecards led to improved performance.
- Improved data utilization with predictive maintenance dashboards.
- Faster outage response with coordinated staging, tied to regional operations.

Strategic Control

- In-house contract control helped avoid the outsourcing risks seen in the 2003 Accenture model.
- Strengthened forecasting capacity supporting planning and regulatory reporting.

6.0 Recommendations for Large Asset-Intensive Organizations

Based on the organization’s transformation, the following actionable strategies are advised for heavy-industrial utilities:

- Centralize supply chain and maintenance under strategic executive oversight.
- Standardize contracts and category processes, including risk-sharing and incentive mechanisms, to ensure consistency and efficiency.
- Rebuild internal expertise to reduce dependence on external contractors.
- Institutionalize Indigenous procurement, targeting direct awards and building vendor pipelines via relationship agreements.
- Deploy hybrid outage models, combining centralized planning with regional delivery.
- Use performance scorecards and analytics to drive accountability.
- Establish governance structures spanning risk, audit, and procurement, with cross-functional engagement.
- Focus on continuous improvement through vendor assessments and periodic strategic reviews.

7.0 Conclusion

The organization’s transformation, led by focused strategic leadership and leveraging centralized systems, technical capability, and Indigenous integration, yielded sustainable operational excellence. For major utilities navigating asset complexity, environmental exposure, and reconciliation finance mandates, this model provides a resilient and replicable blueprint.

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APPENDIX 2

Industry Stakeholders Interviewed

Micheal Rencheck – Executive Vice Chair of Bruce Power (retired President and CEO of Bruce Power)

Kerry Margetts – Vice President Manufacturing and Downstream Technical Services (Retired), Cenovus Energy

Wayne Prins – Executive Director, Christian Labour Association of Canada

Jayson Bueckert – Regional Director, Christian Labour Association of Canada

Dennis Perrin – Provincial Director, Christian Labour Association of Canada

Paul de Jong – President and CEO, Progressive Contractors Association of Canada

Irene Preto – Mill Manager, Kruger Inc. (Kamloops)

Mark Eppler – Maintenance Manager, Kruger Inc. (Kamloops)

Sean McGarvey – President, North American Building Trades Unions

Marc Wahl – Leader of Turnaround, NOVA Chemicals

Sasha Sergeev – Supply Chain Management & Procurement Senior Leader, NOVA Chemicals

Brett McKenzie – Executive Director, General Presidents Maintenance Committee/National Maintenance Council for Canada

Kyle Downie – Chief Executive Officer, SkillPlan Canada

Tony Fanelli – Executive Director, Construction Labour Relations Association of Ontario

Frank Engli – Regional Group Lead – Canada, Becht Canada (formerly of the ROSE Committee)

Mark Morrison – Director, Chair, Regional Oil Sands Operating Alliance

Scott Lang – Turnaround Manager, Shell Scotford

Graham Polischuk – Event Manager, Shell Scotford

Bruce Durnford – Vice President, Turnaround and Construction Oil Sands – Suncor

Sandy Martin – Senior Vice President, Regional Execution – Suncor

Bill Earis – Director, Commercial / Contracts – Fraser River Tunnel Project (formerly BC Hydro)

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APPENDIX 3

Supporting Documentation

Building A Strong and Vital Construction and Maintenance Workforce, BuildForce Canada, 2014-2015 Annual Report

A Framework for Recovery-Inclusive Workplaces in the Industrial, Construction and Maintenance Sectors, Building Resiliency, January 2025

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