

RISK MANAGEMENT ACROSS COLLABORATIVE DELIVERY METHODS: A COMPARISON OF PROGRESSIVE DESIGN BUILD, INTEGRATED PROJECT DELIVERY AND PROJECT ALLIANCING

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ABSTRACT: In response to an aging infrastructure network, population growth, and the rising complexity of project delivery, Canada's infrastructure procurement landscape has undergone significant transformation in recent years. In light of this, collaborative project delivery methods, including Progressive Design-Build (PDB), Integrated Project Delivery (IPD) and Project Alliancing (PA) have recently gained traction in Canada as alternatives to traditional models by fostering teamwork, aligning commercial outcomes, and promoting collective accountability among stakeholders. This paper provides the results of a targeted review of existing literature on risk management characteristics of PDB, IPD, and PA across four dimensions: risk allocation and mitigation strategies, risk sharing and incentives and flexibility/adaptability in managing risk. The analysis emphasizes how these models address inefficiencies in traditional delivery systems by promoting collaboration and aligning risks and rewards equitably. To analyze the extent of adoption of the aforementioned delivery methods in Canada, this study surveys Canadian projects that have implemented PDB, IPD, or PA. The compilation of these projects forms a foundational database that supports future research on the influence of risk management practices on collaborative project delivery adoption and implementation in the Canadian context. This study identifies distinct risk management approaches across PDB, IPD, and PA, shaped by their underlying contractual frameworks. Preliminary findings from Canadian projects suggest that delivery method selection is influenced by sector-specific risk profiles and the level of risk integration each delivery method supports.

1. INTRODUCTION

In recent years, Canada has witnessed a dynamic evolution in its infrastructure procurement landscape, necessitated by an aging infrastructure base, population growth, and increasing complexities in project delivery (The Canadian Council for Public-Private Partnerships & Abacus Data, 2024). Against this backdrop, innovative collaborative delivery models like Progressive Design-Build (PDB), Integrated Project Delivery (IPD), and Project Alliancing (PA) have gained traction (Engebø et al., 2020). More than 60 IPD projects have been initiated to date, with the majority concentrated in Alberta and Ontario, although adoption is gradually expanding to other provinces as well (Poirier et al., 2022). PDB is also gaining traction in Canada, particularly in transportation and healthcare sectors, as reflected in several high-profile infrastructure initiatives led by Infrastructure Ontario and other public agencies (Infrastructure Ontario, n.d.; Syed, 2024). While PA remains far more established in Australia and New Zealand, recent developments suggest a growing interest in alliance-style frameworks within Canada's infrastructure sector—especially for large-scale, complex projects that demand deep collaboration and adaptability (Chamber of Commerce

of Metropolitan Montreal, 2023). These delivery methods emphasize early stakeholder involvement, shared risk/reward mechanisms, and a commitment to collaboration—elements that are critical in addressing Canada’s infrastructure challenges.

On the same hand, the Canadian Council for Public-Private Partnerships (CCPPP) has highlighted the growing relevance of these collaborative models as alternatives to traditional procurement methods, particularly in municipal contexts (The Canadian Council for Public-Private Partnerships, 2024). The selection of these three methods as the focus of this research is grounded in their position between traditional and fully privatized procurement methods, indicating their ability to optimize collaboration between public and private sector partners while maintaining sufficient owner control over project outcomes, as depicted in the CCPPP’s latest guide for municipalities (The Canadian Council for Public-Private Partnerships, 2024). While most existing research focuses on collaborative project delivery methods in the U.S (Alleman & Tran, 2020; D. D. Gransberg, 2023; Ma et al., 2022; Rashed & Mutis, 2023) and other international contexts (Australian Government & Department of Infrastructure and Regional Development, 2015; Department of Treasury and Finance, 2010), there is limited exploration of how these collaborative models are applied in Canada. Therefore, this research explores Canadian projects that have implemented these project delivery methods, laying the groundwork for a database of case studies, facilitating future research on risk management in collaborative delivery methods.

2. METHODOLOGY

While extensive literature exists on the procedural aspects of collaborative project delivery methods, there remains a lack of clarity on how these mechanisms specifically influence risk management practices. To address this gap, insights from the literature were synthesized to differentiate the risk management approaches employed by PDB, IPD and PA. This research follows a multi-step methodology structured around three key phases, as illustrated in Comparative Summary

. The first phase consists of a targeted literature review aimed at identifying and comparing risk allocation, mitigation, risk sharing, and risk management adaptability strategies associated with each delivery method. This forms the basis for a risk management-focused theoretical comparison between the three project delivery methods.

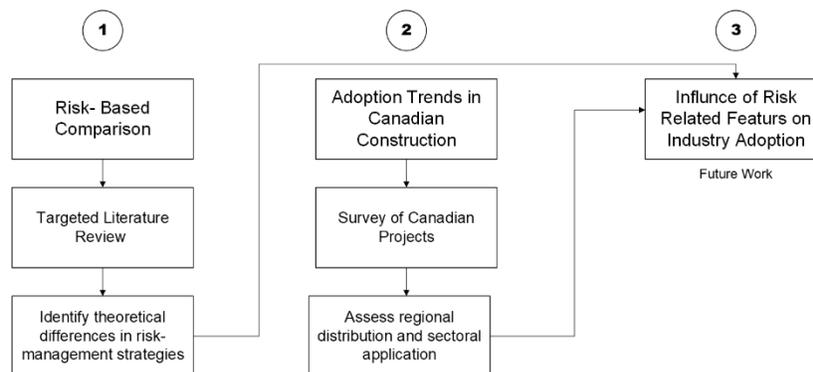


Figure 1: Three-Phase Research Design

The second phase presents a preliminary survey of Canadian projects that have implemented these delivery models. The collected data was systematically analyzed to identify key sectors of application, offering a broader understanding of where and how these models are being employed. This forms the basis of Phase 3, which integrates findings from both the literature review and gathered project data to explore potential correlations between the adoption trends of each delivery method and its underlying risk management characteristics. While Phase 3 is beyond the scope of this paper, it represents a critical direction for future research aimed at understanding how risk-related features influence the selection and practical performance of collaborative delivery methods in the Canadian construction industry.

3. LITERATURE REVIEW

Typically, conventional contracts (E.g. Design-Bid-Build (DBB)) place risks, such as material cost increases, on a single party, often the downstream contractor, resulting in adversarial relationships and cost overruns (Arrow et al., 2014). In response, collaborative delivery models have emerged to address these shortcomings by promoting shared accountability and proactive risk management. In recent years, the PDB model has seen a rise in popularity (Woodhead et al., 2023) since it emerged in Canada, particularly for use in complex and high-risk transit projects (Jiang, 2022). This contract is a modified version of the traditional design-build agreement which provides the owner with a single point of accountability and allows for the involvement of a well-rounded design-builder early in the project. However, in the PDB model the owner and design-builder are set up to collaborate from the beginning, working jointly to establish project requirements, design, pricing, and risk (Woodhead et al., 2023). It delays finalizing price, schedule, and performance commitments until the design has been thoroughly developed through an iterative, collaborative pre-construction process. A PDB project progresses through two main phases usually with two separate contracts, Design/Budgeting and Construction, each with a separate contract.

Cohen (Cohen, 2010) defines IPD as "a method where a contractual agreement between the owner, designer, and builder ensures shared risk and reward, with stakeholder success tied to overall project success". This work highlights the fundamental characteristics of IPD as early involvement of key participants including the subcontractors, through a single multiparty agreement for the whole project, where collaborative decision making and control is encouraged, and key team members waive liability between one another. PA is defined by The Department of Treasury and Finance (Department of Treasury and Finance, 2010) as "a delivery method for major capital assets, where both the owner and non-owner participants form an integrated, collaborative team. They act with integrity, make unanimous, best-for-project decisions, jointly manage risks, and share project outcomes." In forming the project alliance, which acts as a multi-stakeholder project team, the owner's emphasis is placed on the expertise of key individuals, team experience, and willingness to work collaboratively, rather than solely on pricing.

While this approach is similar to the IPD model, a significant difference has traditionally been that IPD contracts include the use of Building Information Modeling (BIM) protocols, advanced project management strategies to streamline workflow and control costs, and early-stage team collocation in a "Big Room" environment (Dave et al., 2015). In addition, in an Alliance the subcontractors are not considered part of the team. However, the general contractor oversees subcontracts for the alliance, making sure all subcontracted work adheres to the alliance's overall goals and standards (The Canadian Council for Public-Private Partnerships, 2024). The following section examines how the three project delivery methods – IPD, PA and PDB – approach risk management differently across the following key dimensions: risk allocation, risk mitigation, risk sharing and incentives and the flexibility/adaptability in managing risk. Rather than presenting an exhaustive review, this section aims to distill the distinguishing risk-related characteristics of each method, providing a foundation for the comparison that follows.

3.1 Risk Allocation

In PDB, risk allocation is more fluid and collaborative than in traditional DB, with the owner assuming a greater share of design-phase risks due to their active participation in scope development. Risk is progressively shared and then reallocated as design matures, with open-book agreements and contingency use providing flexibility and transparency throughout the project lifecycle (Shang & Migliaccio, 2020). A key disadvantage in risk allocation under PDB is that if the Guaranteed Maximum Price (GMP) cannot be finalized, the owner may be forced to off-ramp prior to Phase 2 and re-tender the project under a DBB approach (D. Gransberg et al., 2022). This transition shifts all previously allocated risks back onto the owner, undermining the benefits of earlier risk transfer and exposing the project to greater uncertainty. PA adopts the most integrated approach, fully distributing risk ownership among all participants under a "no blame, no dispute" framework, ensuring that success or failure impacts everyone equally. According to (Walker et al., 2022), PA encourages owners to take responsibility for the risks they are best suited to manage. The inclusive nature of PA fosters early collaboration, allowing project parties to openly discuss uncertainties and determine whether the public owner or the alliance team is better positioned to manage

and budget for specific risks. This proactive approach is further supported through the Target Outturn Cost (TOC) and Target Adjustment (TAE) process, during which alliance members collectively identify potential risks and formulate appropriate mitigation strategies (Department of Infrastructure and Transport, 2011). IPD shares a similar risk allocation approach to PA where risks are collectively owned and managed by the core project team, which includes at least the owner, designer, and contractor (Kent et al., 2010; Pishdad-Bozorgi & Beliveau, 2016; Rached & Hamzeh, 2014) and tied to a jointly developed target cost. The multi-party agreement central to IPD formalizes this shared responsibility by aligning all participants with common project objectives and establishing a structure for joint risk decision-making (Mesa et al., 2016).

3.2 Risk Mitigation

PDB's main risk mitigation strategy is engaging the design-builder during the predesign phase which allows for the early identification and assessment of project risks, reducing uncertainties before they escalate into major cost or schedule impacts (D. D. Gransberg & Molenaar, 2019). In addition, transparent cost modeling, and a collaborative design process allow for continuous scope refinement and contingency management (Shang & Migliaccio, 2020). By ensuring that construction staff remain involved from the design phase through to construction, the project avoids a learning curve, leading to greater efficiency and reduced risk. In PA, the TOC and TAE processes enhance risk mitigation by enabling early, in-depth exploration of known and uncertain project elements. Rather than assigning blame or preparing for claims, project participants engage in open dialogue to collectively assess, understand, and address potential risks (Australian Government & Department of Infrastructure and Regional Development, 2015). This collaborative environment shifts the focus from reactive risk handling to proactive issue resolution. Incentivization mechanisms in the Project Alliance Agreement (PAA) foster a unified, best-for-project mindset, aligning team behaviors and cultural norms with the project's risk governance framework and promoting shared responsibility for managing uncertainty (Department of Infrastructure and Transport, 2011). IPD employs several mechanisms to proactively mitigate risk throughout a project's lifecycle. Key participants—such as contractors and consultants—are engaged early during the design phase, enabling constructability input and joint decision-making that reduce design errors and risks (Ling et al., 2020; Pishdad-Bozorgi & Beliveau, 2016). The use of shared risk and reward structures fosters a non-adversarial environment where stakeholders are incentivized to collaborate and resolve issues collectively. Transparent information sharing, often supported by digital tools like BIM, enhances risk visibility and enables faster responses to emerging challenges (Kent et al., 2010; Lahdenperä, 2012; Pishdad-Bozorgi & Beliveau, 2016; Rached & Hamzeh, 2014). Additionally, practices such as continuous client involvement, regular constructability reviews, and milestone-based cost modeling contribute to early problem identification and more robust planning (Ashcraft Howard et al., 2013). Together, these strategies form a coordinated approach to risk mitigation.

3.3 Risk Sharing and Incentives

Unlike IPD and PA, which incorporate formalized multi-party risk–reward sharing mechanisms, PDB typically does not include explicit contractual provisions for collective gain/pain sharing. Instead, PDB relies on a two-phase contractual structure and open-book collaboration during the early design phase to foster alignment between the owner and the design-builder. While this process supports joint decision-making and transparency, the distribution of risk and reward in PDB is negotiated progressively (D. Gransberg et al., 2022) and remains primarily bilateral, without the integrated incentive pool characteristic of IPD and PA models. In PA, risk is addressed collaboratively rather than assigning financial responsibility to individual parties as in traditional construction contracts. PA, on the other hand, treats risk as a collective responsibility shared by the entire project (D. Gransberg et al., 2022). Through a gainshare/painshare mechanism, all parties share both the risks and rewards, encouraging alignment with project goals and fostering a cooperative environment. Under gain-pain sharing arrangements, participants risk their profit margins when project performance falls short of defined Key Result Areas (KRAs). Instead of fixed returns, compensation is tied to outcomes, with a structured formula determining how the achievement—or failure—of the Target Outturn Cost (TOC) affects the distribution of gains and losses among all parties (Department of Infrastructure and Transport, 2011). In IPD contracts, the project's overall performance determines compensation (Ashcraft Howard et al., 2013), with all team members sharing in the outcomes based on a predefined formula similar to PA (Pishdad-Bozorgi & Beliveau, 2016). Rather than isolating financial

responsibility, cost overruns result in reduced profits for all parties, while cost savings lead to shared bonuses distributed among participants (Kent et al., 2010). Unlike traditional delivery methods, where each party seeks to minimize their own risks and maximize personal gains, IPD fosters a collective approach to project success. From a risk management perspective, collaboration becomes more effective, as team members can rely on one another's strengths to address potential challenges (Rached & Hamzeh, 2014). Several studies (Eissa et al., 2024; Guo et al., 2023; Pishdad-Bozorgi & Srivastava, 2018; Su et al., 2021; Teng et al., 2019; Yue et al., 2015) have employed game theory to analyze risk – reward sharing in IPD projects, recognizing the cooperative nature of multi-party contracts. These approaches—ranging from Nash equilibrium models to cooperative and stochastic game frameworks—aim to optimize the distribution of risks and rewards among project stakeholders based on their roles, contributions, and risk preferences.

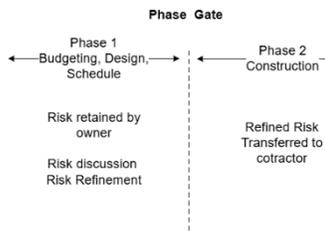
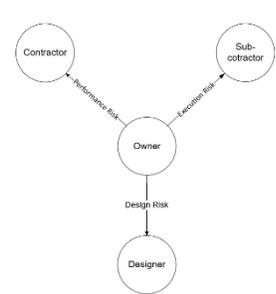
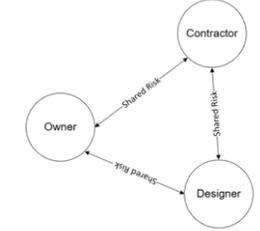
3.4 Flexibility/Adaptability in Managing Risk

In PDB, risk management is structured as a progressive and collaborative process, ensuring that risks are systematically identified, assessed, and allocated throughout the project lifecycle. A PDB project comprises two main phases where the first phase tackles budgeting, scheduling, and design, while the second includes project execution. In Phase 1, risks are jointly defined by the owner and design-builder, leveraging the most current and accurate project information to enhance decision-making. Risk costs are transparently incorporated into the GMP through an open-book estimating process, where contingencies are fully disclosed, justified, and refined iteratively (D. Gransberg et al., 2022). For instance, a 5% contingency might be included at the 30% design stage to address potential design development risks. However, the model allows for risk reassessment and refinement as the design progresses, ensuring that risk levels are either reduced, mitigated, or redistributed. By integrating progressive risk assessment, early contractor involvement, and phased risk allocation, PDB provides a structured and adaptable risk management model. PA supports adaptable risk management by allowing alliance syndicates to gain a deeper understanding of the project's scope, complexity, and the project owner's priorities. This early engagement enables the team to use their collective expertise—often through structured workshops—to develop contingency plans that realistically address potential risks and uncertainties (Walker et al., 2022). The flexibility of the TOC and TAE process, which extends from the Alliance Development Agreement (ADA) to the PAA, facilitates ongoing risk reassessment. Through the project owner's staged gateway approval process, value-for-money expectations and functional requirements are defined, ensuring that risk strategies remain aligned with project objectives (Commonwealth of Australia, 2006). IPD fosters flexibility and adaptability in managing risk through its emphasis on team integration and collaborative practices. Early involvement of contractors and specialty trades during the design phase enables proactive risk identification and mitigation, while colocation and joint goal-setting support continuous communication and dynamic decision-making (Franz et al., 2017).

3.5 Comparative Summary

As discussed in the previous sections, PDB, IPD, and PA offer distinct approaches to managing risks throughout a project lifecycle. While each model emphasizes cooperation and transparency, their strategies for risk allocation, sharing, mitigation, and ownership vary in some instances. Table 1 serves as a summary to provide a clear and concise reference point that captures the distinctive risk management features of each delivery model as identified in the reviewed literature.

Table 1: Comparative Review of Risk Management in PDB, IPD and PA

Criterion	PDB	IPD	PA
Risk Allocation	 <p>Risks are more phased. Risks are partially shared in the early phases but ultimately rest with specific parties as the project progresses.</p>	 <p>Risks are distributed among all parties based on contract terms and performance.</p>	 <p>Risks are fully shared across all participants under a "no blame, no dispute" model. All parties jointly manage and mitigate risks as a unified team, with outcomes tied to the project's overall success.</p>
References	(Shang & Migliaccio, 2020) (D. Gransberg et al., 2022; D. D. Gransberg & Molenaar, 2019)	(Kent et al., 2010; Ling et al., 2020; Pishdad-Bozorgi & Beliveau, 2016)	(Walker et al., 2022) (Department of Infrastructure and Transport, 2011)
Risk Mitigation	Risk mitigation is focused on the iterative development of the design, with opportunities to address risks incrementally before full project execution.	Collaboration and early involvement of all stakeholders reduce risks through integrated decision-making, Big Room and use of BIM.	Relies on open-book accounting, transparency, and mutual trust to collaboratively identify, assess, and mitigate risks throughout the project lifecycle.
References	(D. D. Gransberg & Molenaar, 2019) (Shang & Migliaccio, 2020)	(Lahdenperä, 2012) (Franz et al., 2017; Ling et al., 2020)	(Department of Infrastructure and Transport, 2011)
Risk Sharing and Incentives	Risks and rewards are linked to clearly defined deliverables at each phase. Rewards are tied to performance in meeting cost, schedule, and quality benchmarks, often with less emphasis on collective sharing compared to IPD or PA.	Uses a financial risk/reward sharing mechanism. The rewards are performance based. Parties can earn or lose money separately based on individual performance	Costs, risks, and rewards are fully shared. The success or failure of the project affects all participants based on an agreed-upon formula (proportional to each party's profit).
References	(Woodhead et al., 2023) (Jiang, 2022)	(Ashcraft Howard et al., 2013; Kent et al., 2010; Pishdad-Bozorgi & Beliveau, 2016)	(Australian Government & Department of Infrastructure and Regional Development, 2015; Department of Infrastructure and Transport, 2011; Infrastructure Australia, 2021)
Flexibility/adaptability in managing risk	The phased approach allows more flexibility in risk management, as the owner retains greater	The structured nature of IPD contracts provides a clear framework for risk management but may	Offers the most flexible and adaptive risk management approach, as the model inherently

	control in the early stages and decisions are progressively made based on evolving project conditions.	offer less flexibility in responding to unforeseen risks compared to PA.	promotes continuous reassessment and collective decision-making.
References	(D. Gransberg et al., 2022; Jiang, 2022; Woodhead et al., 2023)	(Ghassemi & Becerik-Gerber, 2011; D. Gransberg et al., 2022; Poirier et al., 2022; Rached & Hamzeh, 2014)	(Australian Government & Department of Infrastructure and Regional Development, 2015; D. Gransberg et al., 2022)

4. APPLICATIONS IN THE CANADIAN INDUSTRY

Building on the insights from the literature review, the second part of this paper shifts focus from theoretical frameworks to practical application. It presents a preliminary survey of Canadian projects delivered using PDB, IPD or PA. The objective of this phase is to develop a foundational database and gain initial insights into the adoption trends, regional distribution, and sectoral application of these collaborative delivery models across Canada. These findings will inform future research aimed at exploring how specific risk management characteristics may influence or correlate with the adoption and performance of these models in practice. Data was extracted from multiple publicly available sources, including project and company websites, governmental reports and procurement portals (procurement portals from all Canadian provinces were surveyed), industry reports, company-published articles, and blog posts by project stakeholders. In addition, websites of Integrated Project Delivery Alliance (IPDA) and Canadian Design-Build Institute (CDBI) were used as potential sources. Academic articles were also consulted for project but there was very limited information available on Canadian projects.

The project survey findings indicate that the transportation sector overwhelmingly favors PDB and PA contracts, as illustrated in Figure 2. Large-scale transit projects, such as the Scarborough Subway Extension, Fraser River Tunnel Project, and East Harbour Transit Hub, leverage PDB and PA models. In contrast, IPD is more prevalent in healthcare, educational, and community-focused projects, reflecting its emphasis on collaboration, early stakeholder involvement, and shared risk/reward mechanisms. Healthcare emerges as a common sector for all three methods, with notable projects like the Cariboo Memorial Hospital (PDB), Royal Columbian Hospital Redevelopment (IPD), and Cowichan District Hospital Replacement (Alliance). This demonstrates the suitability of collaborative delivery methods for addressing the specialized requirements and long-term operational considerations of healthcare infrastructure.

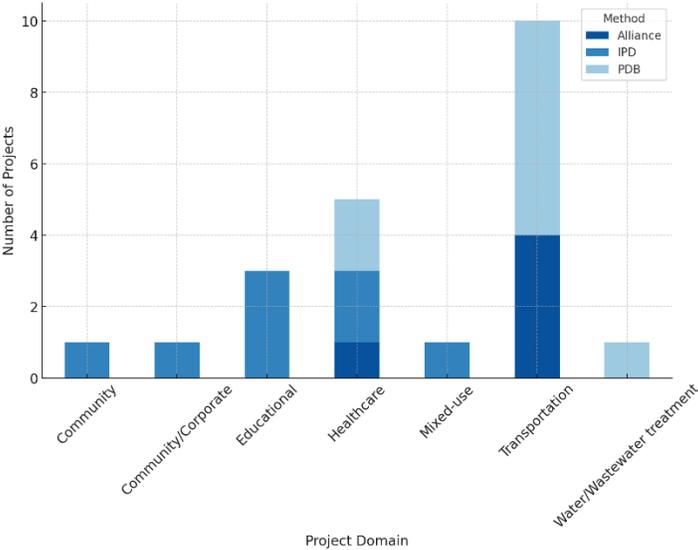


Figure 2: Comparison of Projects by Domain and Delivery Method

In terms of geographical distribution, Ontario and British Columbia lead in adopting PDB and PA contracts, primarily in large infrastructure and transit projects as shown in Figure 3. Key projects include the Ontario Line Elevated Guideway and Stations (PDB), BC Highway Reinstatement (Alliance), and Eglinton Crosstown West Extension (PDB) which highlight these provinces' commitment to collaborative delivery in transportation. Meanwhile, Saskatchewan and Alberta exhibit strong early adoption of IPD, with projects like the Five Hills Health Regional Hospital (Saskatchewan) and Mosaic Centre for Conscious Community and Commerce (Alberta). These projects underline IPD's alignment with sustainability goals and integrated service delivery. The Buffalo Pound Water Treatment Plant Renewal (PDB) in Saskatchewan stands as an exception, showcasing the potential for broader adoption of PDB beyond its transportation-heavy focus.

This suggests that while PDB is widely used in transit, it remains adaptable to other domains, including water infrastructure. The first Alliancing project in Canada was introduced in 2019 at Toronto's Union Station, marking a relatively recent entry into the market compared to PDB and IPD. However, the inclusion of the Cowichan District Hospital Replacement in British Columbia demonstrates its expanding versatility beyond transit projects. Overall, this survey highlights that while each model has distinct sectoral strengths, their shared focus on collaboration, risk-sharing, and efficiency is reshaping the landscape of project delivery in Canada. As adoption continues, the industry may see greater diversification in how these methods are applied across sectors and regions.

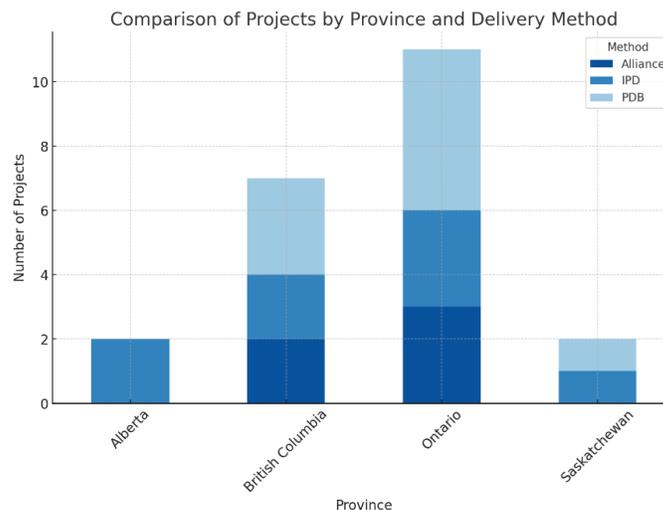


Figure 3: Comparison of Projects by Province and Delivery Method

5. DISCUSSION

This paper offers a comparative examination of risk management characteristics across three collaborative project delivery methods – PDB, IPD and PA – focusing on four key dimensions: risk allocation, mitigation, sharing and incentives, and flexibility in managing risk. The literature review highlights that while all three models emphasize collaboration and transparency, their contractual frameworks and underlying mechanisms for managing risk have differences. IPD and PA institutionalize shared risk and reward through multi-party agreements, aligning all stakeholders with project-wide performance goals. In contrast, PDB employs a two-phase structure with progressively negotiated terms, resulting in a more bilateral distribution of risk and reward. These distinctions influence how each model allocates and mitigates risk and fosters adaptable risk management.

The preliminary survey of Canadian projects reinforces these findings by illustrating how adoption patterns correspond to the models' risk-related features. IPD is primarily used in sectors like healthcare and education, where early stakeholder alignment and shared accountability are critical. PDB and PA, on the other hand, have gained traction in large-scale transit and infrastructure projects, where phased

development and joint governance enable more adaptable risk management. These observations suggest that risk management structures play a central role in influencing the selection and sectoral application of collaborative delivery models. The preliminary survey of Canadian projects provides a foundation for future research to explore how specific risk practices within each model contribute to project outcomes, and how these practices can be further refined to support broader adoption in the Canadian context.

6. CONCLUSIONS

This research makes several contributions to the body of knowledge on collaborative project delivery methods by providing a risk management–focused comparison of PDB, IPD and PA. To the authors' knowledge, this is the first study to examine these three methods side by side through a dedicated risk-focused lens. Second, it takes steps towards examining the extent of adoption of the three project delivery methods within the Canadian construction industry, an area that has received little attention to date, offering early insights into adoption trends and sectoral applications. This study lays the groundwork for future research on the role of risk-related factors in guiding the adoption and implementation of collaborative project delivery methods in the Canadian context.

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