Joint CSCE Construction Specialty & CRC Conference 2025
Conférence conjointe spécialisée en construction de la SCGC et CRC-2025

Montreal, Quebec
July 28-31, 2025 / *28-31 juillet 2025*

Digital transition in construction: comparative public policy insights from France and Quebec for BIM adoption

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ABSTRACT: Building Information Modeling (BIM) is a digital process that enables the creation, management, and sharing of structured data throughout the lifecycle of construction projects, fostering efficiency, collaboration, and sustainability. In recent years, several governments have implemented national action plans to support BIM adoption, but with different timelines and strategies. France launched first the Plan de Transformation Numérique du Bâtiment and then Plan BIM, while Quebec introduced its Feuille de route gouvernementale pour la modélisation des données des infrastructures (2021-2026). Although the literature has examined challenges related to BIM adoption, few studies have explored the impact of these policies and the diffusion dynamics they have generated. This study addresses this gap by comparing BIM policies in France and Quebec—two regions with different governance structures but strong institutional collaborations in construction and digital innovation. Through an in-depth review of recent literature and policy documents, we analyze the objectives, implementation strategies, and challenges associated with BIM policies. Our research focuses on four key questions: (1) the government's role in structuring digital transformation efforts; (2) how public policy influences BIM adoption at regional and national levels; (3) the role of standards in BIM policy development and dissemination; and (4) key features of policy frameworks supporting BIM implementation.
This study provides valuable insights into how policy frameworks shape digital transformation in the construction sector. By comparing two distinct yet interconnected contexts, it offers lessons for other regions seeking to enhance their construction industry's digital capabilities and overall efficiency.

Keyword: digital transformation, policy context, public construction industry, Building Information Modeling (BIM), France, Quebec, government roadmap

1. INTRODUCTION

The public construction sector is at a critical turning point in its digital transformation. As a key contributor to the global economy, the construction industry plays a significant role in GDP and employment generation. However, it continues to face persistent inefficiencies such as cost overruns, delays, material waste, and quality issues (Naji, Gunduz, Alhenzab, Al-Hababi, & Al-Qahtani, 2024). Many of these challenges arise from fragmented workflows, a lack of data integration, and traditional project management practices that hinder innovation. Digital transformation presents a potential solution to these issues by enhancing collaboration, optimizing resource utilization, and increasing overall productivity (Vial, 2019).

Among the key technologies driving this transformation, Building Information Modeling (BIM) plays a central role. BIM is a structured digital process that enables the creation, management, and exchange of construction project data across all stakeholders and project phases (Liu, Wang, Zhang, Liu, & Wang, 2017). BIM is more than just a technological tool—it also requires significant organizational and policy shifts. Its successful implementation depends on clear regulatory frameworks, standardized practices, and coordinated strategies from governments (Succar & Kassem, 2015).

In response to these challenges, several governments have implemented national strategies to promote BIM adoption. France launched first the *Plan de Transformation Numérique du Bâtiment* (Delcambre, 2014), and then the *Plan BIM 2022* (Ministère de la Cohésion des territoires et des Relations avec les collectivités locales, 2018), while Quebec introduced the *Feuille de route gouvernementale pour la modélisation des données des infrastructures (2021-2026)* (Société québécoise des infrastructures (SQI) & Ministère des Transports et de la Mobilité durable (MTMD), 2024). Although many studies focus on the barriers to BIM adoption, few have examined the real impact of public policies or how they influence the spread of digital practices in the construction sector. Understanding how public policies shape BIM adoption is essential to identifying the most effective policy levers for driving digital transformation.

This study seeks to bridge this gap by providing a comparative analysis of BIM policies in France and Quebec. These two regions present an interesting case for comparison: they share strong institutional collaborations in construction and digital innovation, yet their governance structures and policy approaches differ. The study aims to answer four key questions:

1. The role of governments in structuring digital transformation efforts;
2. The influence of public policies on BIM adoption at regional and national levels;
3. The role of standards in BIM policy development and dissemination;
4. The key features of policy frameworks supporting BIM implementation.

By examining these aspects, this research contributes to a better understanding of how public policies drive digital transformation in the construction sector and offers insights that can inform future policy developments in other regions.

2. METHODOLOGY

To establish a strong foundation for this research, a literature review was conducted on the digital transformation of the construction sector and the role of public policies in BIM adoption. This analysis explored key theoretical frameworks, government interventions through financial incentives and regulatory measures, and challenges such as interoperability, workforce training, and industry acceptance. Case studies of digital transformation initiatives further informed the identification of best practices and barriers to policy implementation.

This study adopts a qualitative research methodology based on a comparative analysis of public policies supporting BIM adoption in France and Quebec. These two regions were selected for their structured yet distinct governance systems, providing an opportunity to assess how digital policy frameworks evolve under different political and institutional contexts. While France operates under a multi-tiered governance model with national strategies adapted at regional levels, Quebec follows a more centralized provincial framework that coordinates efforts across multiple agencies. The comparison is

relevant as both regions actively collaborate in the fields of construction and digital innovation, despite Quebec being part of a federal state and France being a unitary state. This contrast allows for a deeper understanding of how governance structures influence BIM adoption.

After the literature review, to achieve this, the research follows a three-step methodological approach, described in figure 1.

1. Application of theoretical models

The study employs established models find during the literature review to frame the analysis of public policies:

- *The Policy Actions Matrix* (Succar & Kassem, 2015), which categorizes government interventions into passive, active, and assertive strategies, was used to assess the roles of communication, engagement, and oversight in both regions.
- *The Theme-Instrument-Evaluation framework* (Zhang et al., 2023) helped identify key policy themes, the instruments used to implement them, and evaluation mechanisms measuring their impact.

2. Qualitative analysis of policy documents

The research incorporates a critical reading of official government documents, including strategic plans, reports, and regulatory guidelines. Key data sources include:

- France: Plan BIM 2022, PTNB (Plan de Transition Numérique du Bâtiment), AFNOR standards, and reports on regional BIM adoption (PTNB, 2018), (Ministère de la Cohésion des territoires et des Relations avec les collectivités locales, 2018), (Delcambre, 2014).
- Quebec: The Feuille de route gouvernementale pour la modélisation des données des infrastructures (2021-2026), Société Québécoise des Infrastructures (SQI) guidelines, and provincial pilot projects (Société québécoise des infrastructures (SQI) & Ministère des Transports et de la Mobilité durable (MTMD), 2024), (Comité directeur de la feuille de route gouvernementale, 2023).

3. Content analysis and structured comparison

A content analysis framework was applied to classify policy measures according to their objectives (e.g., financial incentives, regulatory mandates, training programs), their impact on stakeholders, and their alignment with international standards based on *The BIM Knowledge Content taxonomy – Mind Map* (Kassem, Succar, & Dawood, 2015). This allowed for a structured comparison of policy approaches in France and Quebec, highlighting commonalities and divergences in terms of policy instruments, implementation challenges, and governance strategies.

This methodological approach follows a sequential logic, where the theoretical models structured the initial analysis, which was then applied to policy documents, leading to a comparative assessment based on content analysis. The study also incorporates secondary sources, including academic literature and industry reports, to contextualize policy developments and assess their effectiveness in practice.

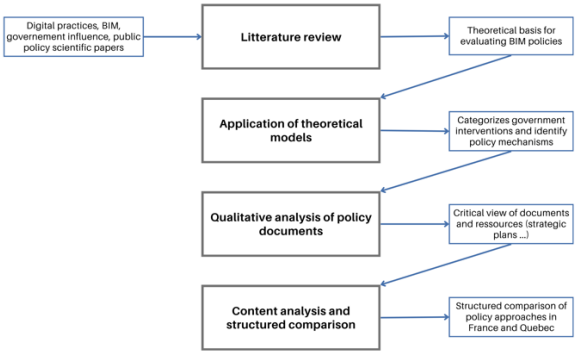

Figure 1 : Methodology Framework - BIM Policy Analysis

By examining the contrasting governance structures—France's multi-tiered governance system with national strategies adapted regionally versus Quebec's centralized provincial coordination—this study provides a nuanced perspective on how public policies drive digital transformation in the construction sector. Additionally, considering France's involvement in European BIM standardization efforts and Quebec's integration within Canada's federal context, the research also raises questions about policy scaling across different administrative levels, from national to international.

3. FINDINGS AND DISCUSSION

Before delving into the specific findings of this research, it is essential to outline the structure and rationale behind this section. The analysis of public policies supporting BIM adoption in France and Quebec follows a structured approach, building upon theoretical insights and empirical data. While no single model entirely dictates the structure of this discussion, the Policy Action Model (Succar & Kassem, 2015) serves as a key reference, helping to classify government interventions along three core dimensions: communication, engagement, and monitoring. This model is adapted to position France and Quebec within different policy action patterns, offering a comparative perspective rather than a strict replication of theoretical frameworks. Furthermore, an effort has been made to contextualize the financial investments and regulatory measures in each region, recognizing that simple budgetary comparisons can be misleading without considering factors such as the number of enterprises affected, the scale of infrastructure projects, and overall industry structure. These contextual elements provide a deeper understanding of how digital transformation policies unfold in distinct governance environments.

The policy development timeline (Figure 2) visually represents the key milestones in the evolution of BIM-related public policies in both France and Quebec. This chronological perspective helps illustrate how each government has structured its approach to digital transformation and how policy instruments have evolved over time.

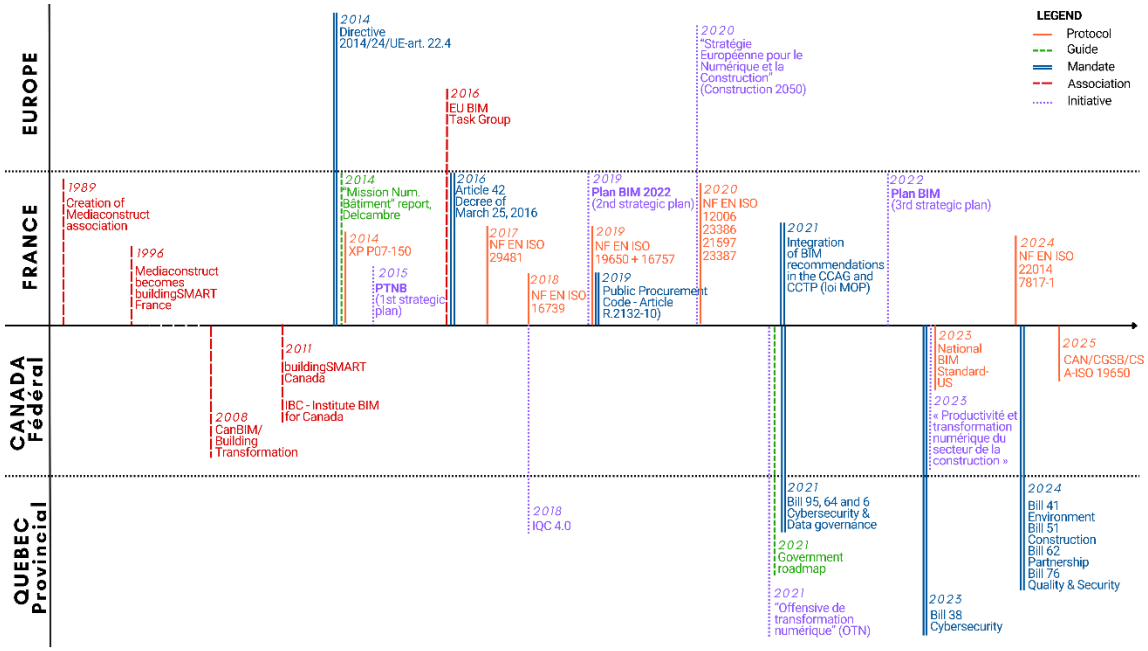

Figure 2: Timeline of the development of the policy framework around the digital transformation of the construction industry in France and Quebec

3.1 The role of government in digital transformation

Governments play a central role in driving the digital transformation of the construction sector, particularly by fostering the adoption of BIM. This involvement spans three fundamental dimensions: communication, engagement, and monitoring (Succar & Kassem, 2015). Each dimension contributes uniquely to shaping the implementation and acceptance of digital transformation policies within the industry.

First, effective communication helps raise awareness about the benefits of BIM and fosters alignment among industry players. In France, for example, the Plan BIM 2022 included targeted awareness campaigns and provided free tools such as KROQI to help small and medium-sized enterprises (SMEs) overcome initial adoption barriers. In Quebec, public agencies like the Société Québécoise des Infrastructures (SQI) used pilot projects to demonstrate, in a tangible way, how BIM can improve efficiency and project outcomes. These efforts help create a shared understanding of digital transformation and reduce resistance to change by highlighting real-world benefits.

Beyond communication, government support is crucial in helping stakeholders adopt digital practices. This support often comes in the form of financial assistance, pilot initiatives, and collaborative frameworks. France, for instance, dedicated €30 million to initiatives under Plan BIM 2022, aimed at funding tools and training. Similarly, Quebec invested $20 million in its Construction 4.0 program, benefiting over 1,000 businesses and improving both digital infrastructure and workforce skills. These investments lower the cost barrier for SMEs and make it easier for them to implement innovative solutions. Pilot projects, like France's "BIM and Digital Models" initiative or Quebec's provincial trials, serve as practical examples that test and refine new methods while showcasing the value of BIM. At the same time, collaborative structures established by governments help public and private actors work together more effectively. These frameworks promote standardization, encourage knowledge exchange, and create a more unified approach to digital transformation across the industry.

Finally, governments ensure the long-term success of these efforts by implementing monitoring mechanisms that enforce compliance, track progress, and allow for policy adjustments. In France, BIM has been made mandatory for large public projects, with oversight systems designed to maintain consistency across regions. Quebec, on the other hand, relies on audits and official guidelines to ensure public infrastructure projects meet required standards. While France operates under a multi-tiered governance model involving national, regional, and departmental coordination, Quebec's structure gives more autonomy to provincial agencies. This difference highlights the need to tailor government interventions to local governance models – as described in the Figure 3. Overall, effective digital transformation requires a balance between top-down directives and bottom-up engagement, with oversight systems adapted to industry capabilities. Through these concrete and strategic actions, governments not only facilitate the adoption of BIM but also lay the foundation for ongoing innovation and long-term modernization in the construction sector.

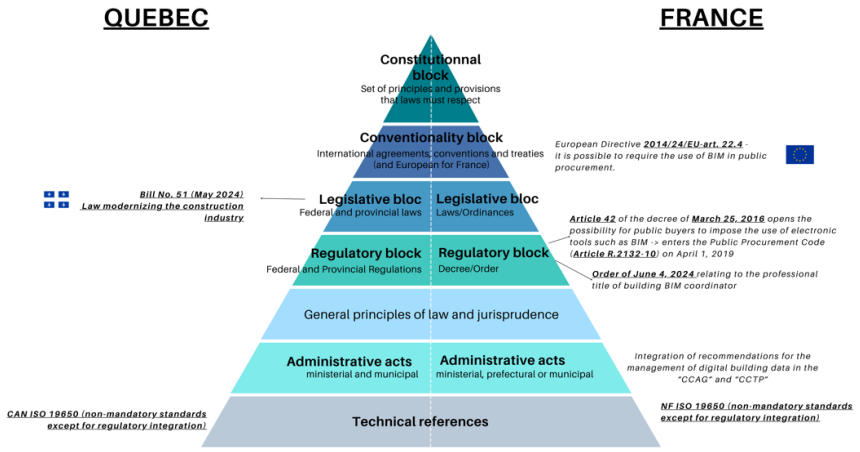

Figure 3: Regulatory and legal framework for BIM adoption in Quebec and France

3.2 Public policies supporting the digital transformation and BIM

While governmental leadership sets the tone for digital transformation, specific policy instruments are essential to translating strategic visions into concrete action. The next section examines the range of public policy tools deployed in France and Quebec to encourage BIM adoption across the construction industry. Governments employ a wide range of public policy instruments to stimulate the adoption of digital technologies, particularly BIM, in the construction sector. These instruments encompass financial investments, strategic roadmaps, public procurement reforms, and pilot projects, all aimed at creating a favorable environment for digital transformation.

Public investments form the backbone of many digital transformation initiatives, enabling governments to reduce financial barriers for businesses and ensure broad access to necessary tools and training. The French government allocated €20 million to the Plan de Transition Numérique dans le Bâtiment (PTNB) and an additional €10 million to the Plan BIM 2022 (Ministère de la Cohésion des territoires et des Relations avec les collectivités locales, 2018). These funds supported tool development, such as the KROQI collaborative platform, and subsidized training programs for small and medium-sized enterprises (SMEs). In Quebec, the provincial government earmarked $20 million for the Initiative Québécoise pour la Construction 4.0, targeting over 1,000 enterprises. This investment also included funding for infrastructure modernization and the development of a provincial BIM roadmap (Société québécoise des infrastructures (SQI) & Ministère des Transports et de la Mobilité durable (MTMD), 2024). Such investments reflect governments' recognition of their dual role as facilitators and regulators (Poirier, Staub-French, Whitel, Shahi, & Dadmehr, 2022). They enable private actors to experiment with and adopt digital tools without bearing the full financial burden.

Strategic roadmaps provide a structured framework for guiding digital transformation over time. These documents outline clear goals, timelines, and action plans, ensuring that all stakeholders work toward a shared vision. The French Plan BIM 2022 articulated specific objectives, such as the generalization of BIM use in public procurement and the establishment of regional ecosystems to support digitalization. This roadmap also emphasized training initiatives and collaboration between public and private actors. The Quebec government’s BIM roadmap (2021-2026) focuses on a phased implementation strategy, promoting gradual adoption across public infrastructure projects. The roadmap integrates performance measurement as a key pillar, enabling the evaluation of BIM’s return on investment at various scales. Strategic roadmaps are critical for ensuring that policy measures are not only ambitious but also achievable, particularly in sectors with varying levels of technological maturity (Zhang et al., 2023).

Public procurement is a powerful lever for driving BIM adoption. By integrating BIM requirements into procurement processes, governments create a structured demand for digital tools, encouraging private contractors to invest in their own digitalization (Godager, Mohn, Merschbrock, Klakegg, & Huang, 2022). Public procurement guidelines in France include BIM mandates for specific types of projects, particularly those exceeding certain budget thresholds. For example, large-scale projects funded by the French state must comply with BIM requirements, fostering consistency in the industry. The provincial government of Quebec has implemented similar reforms, requiring BIM use in public projects managed by agencies such as the Société Québécoise des Infrastructures (SQI). These mandates are accompanied by guidelines to ensure clarity in expectations and deliverables. Such reforms not only standardize practices but also incentivize the private sector to align with public sector expectations, creating a ripple effect throughout the industry (Atkinson, Amoako-Attah, & B-Jahromi, 2014).

Pilot projects serve as experimental platforms for validating BIM implementation strategies and showcasing the benefits of digital practices. France’s BIM et Maquette Numérique initiative and Quebec’s pilot programs have provided valuable insights into improving collaboration, reducing errors, and optimizing project efficiency. These projects not only highlight the tangible benefits of BIM but also inform future policy frameworks by identifying and addressing technical, organizational, and contractual challenges (Atkinson et al., 2014).

Ultimately, these public policy measures highlight the importance of a holistic and adaptive approach. By integrating financial, strategic, and regulatory instruments, governments not only accelerate digital

transformation but also foster a culture of innovation and collaboration that is crucial for the sustainable modernization of the construction sector.

3.3 Standards as a pillar of public BIM policies

In parallel with financial investments and regulatory frameworks, standards play a foundational role in enabling digital collaboration. To ensure interoperability and consistency across diverse actors and technologies, public strategies increasingly emphasize standardization. This is explored in detail in the following section. Standards are essential for fostering interoperability, consistency, and collaboration in BIM processes. By establishing a common language and methodology, standards enable stakeholders to work together seamlessly, regardless of their technological platforms or geographical locations.

International standards, such as ISO 19650, provide a universal framework for managing information in construction projects. France has incorporated ISO 19650 into its national policies, ensuring alignment with global best practices. National bodies like AFNOR also develop localized standards that address the specific needs of the French construction sector. While ISO 19650 is gaining recognition in Quebec, its adoption remains limited. Instead, provincial agencies like SQI rely on internally developed guidelines tailored to local projects. The integration of global and national standards is critical for ensuring interoperability in increasingly internationalized construction markets (Zhang et al., 2023).

The adoption of standards is not without challenges, particularly for small and medium-sized enterprises (SMEs). These organizations often face resource constraints that make compliance with complex regulatory frameworks difficult. In France, the centralized nature of standard development ensures broad dissemination but can overwhelm SMEs with limited technical capacity. In contrast, the decentralized approach in Quebec leads to variability in requirements across different agencies, creating potential fragmentation for contractors navigating multiple standards (Poirier et al., 2022).
To overcome these challenges, targeted government support is essential. This includes training programs to build technical expertise and the creation of simplified guidelines tailored to the specific needs of smaller organizations (EU BIM Task Group, 2018). These initiatives ensure that all actors, regardless of size, can contribute to and benefit from standardized BIM practices.

Standards are more than regulatory tools; they are vital enablers of collaboration and trust. By ensuring that stakeholders adopt compatible formats and methodologies, standards minimize inefficiencies and promote confidence in shared data systems (Godager et al., 2022). Both France and Quebec are investing in Common Data Environments (CDEs) as a component of their BIM strategies, reflecting the critical importance of transparent and accessible information sharing. The use of CDEs reinforces the role of standards in creating ecosystems where data interoperability is not just a technical requirement but a collaborative advantage.

The United Kingdom exemplifies how standardization can drive digital transformation in the construction sector. From the early stages of its BIM strategy, the UK government integrated standardization as a fundamental pillar, ensuring consistency and interoperability across projects. The adoption of ISO 19650 and the BIM Level 2 mandate established a unified framework for information management, facilitating seamless collaboration between stakeholders. This approach clearly illustrates how standardized practices can improve data reliability, increase project efficiency, and support international collaboration in construction. France and Quebec could benefit from deepening their efforts in this direction to reinforce their digital strategies.

Standards serve as the backbone of public BIM policies, providing a framework for integrating advanced digital practices into the construction sector. By addressing the unique challenges of adoption through training, simplified guidelines, and robust regulatory frameworks, governments can maximize the effectiveness of these standards. In doing so, they not only ensure consistency and interoperability but also create a more inclusive and collaborative construction ecosystem.

3.4 Key characteristics of strategic frameworks and standards

Beyond individual standards, broader strategic frameworks provide the necessary coherence and direction for long-term digital transformation. The next section analyzes the structural characteristics of these frameworks and highlights how they support coordinated implementation efforts. Strategic frameworks and standards in the construction sector must balance rigor and flexibility to effectively meet the evolving demands of stakeholders while driving digital transformation. Below, the key characteristics of these frameworks and standards are outlined, referencing practices and insights drawn from the literature.

One of the fundamental features of effective strategic frameworks is the inclusion of clear mandates accompanied by specific timelines. These provide direction and establish accountability for stakeholders. For example, France's BIM mandates are supported by detailed implementation schedules, fostering a gradual and structured adoption of digital practices. Similarly, Quebec's roadmap employs a phased approach that incorporates iterative improvements, guided by continuous feedback from stakeholders. This clarity minimizes ambiguity, aligns stakeholder objectives, and ensures alignment with overarching digital transformation goals.

Standards and frameworks must remain adaptable to accommodate technological advancements and regional variations. The inclusion of ISO 19650 ensures that French standards align with global trends, but there is also room for localized adaptations to address specific industry needs. Quebec's reliance on collaborative frameworks allows for greater flexibility in integrating emerging technologies like AI and IoT into BIM processes (Nonirit, Poirier, & Forgues, 2022). Flexibility ensures that policies remain relevant and effective in a rapidly changing technological landscape.

The successful implementation of strategic frameworks relies on the active collaboration of all stakeholders, including public agencies, private contractors, and industry professionals. In France, national mandates are bolstered by regional initiatives that engage local governments and industry stakeholders, creating a shared responsibility for digital transformation. Quebec exemplifies collaborative governance through its regular consultations with public and private stakeholders, ensuring that the policies are both pragmatic and reflective of on-ground realities (Comité directeur de la feuille de route gouvernementale, 2023). This collaborative approach fosters ownership among stakeholders, mitigates resistance to change, and promotes a sustainable and inclusive digital transition.

These characteristics—clear mandates, adaptability, and stakeholder collaboration—form the cornerstone of robust strategic frameworks that support the digital transformation of the construction sector. By embedding these principles, both France and Quebec have set significant benchmarks for policy-driven digital advancement, emphasizing the importance of harmonized yet flexible approaches tailored to regional and technological contexts.

CATEGORY	FRANCE	QUEBEC
Role of Government in Digital Transformation	Strong national strategy with regional implementation. Plan BIM 2022 sets national objectives, but local adaptation varies.	Centralized provincial approach, guided by the Feuille de route BIM (2021-2026), with integration across agencies.
Communication: Awareness & Alignment	National awareness campaigns (Plan BIM 2022), free access to KROQI platform for SMEs.	Public agencies (SQI) rely on pilot projects to demonstrate BIM's benefits. Less emphasis on dedicated communication tools.
Engagement: Support & Adoption	€30M investment in BIM-related initiatives, focusing on subsidies, training, and tool development. Strong public-private partnerships.	$20M investment in Construction 4.0 program, supporting 1,000+ businesses with workforce training and digital infrastructure.
Monitoring: Compliance & Improvement	BIM mandatory for large public projects, regional variations in enforcement. Lack of continuous monitoring mechanisms.	Compliance ensured through audit processes and procurement guidelines. More uniform oversight across provincial agencies.
Public Policies Supporting Digital Transformation	Strong emphasis on financial incentives and public procurement requirements.	Emphasis on long-term roadmaps and gradual integration across sectors.
Financial Investments	PTNB (€20M) + Plan BIM 2022 (€10M) → Supporting BIM adoption via digital tools and training.	$20M Construction 4.0 Initiative → Focus on modernization and training for businesses.
Strategic Roadmaps	Plan BIM defines objectives but lacks post-2024 continuity. Relies on regional actors for implementation.	Feuille de route BIM (2021-2026) adopts a phased approach, integrating BIM progressively into public infrastructure.
Public Procurement Reforms	BIM can be asked as mandatory by client for large public projects. Some inconsistencies across regions.	Procurement reforms mandate BIM usage in public projects via SQI and infrastructure agencies.
Pilot Projects	"BIM et Maquette Numérique" initiative serves as a testing ground for national implementation.	Provincial pilot projects refine implementation strategies before large-scale deployment.
Standards & Interoperability	Adoption of ISO 19650 and development of AFNOR national standards. However, SMEs face challenges in implementation.	ISO 19650 adoption is limited, agencies rely on internal SQI guidelines, leading to less uniformity in standardization.
Challenges in Standard Adoption	Broad dissemination but high technical complexity for SMEs. Lack of training on international standards.	Fragmentation in standardization due to reliance on internal agency guidelines instead of national BIM standards.
Key Characteristics of Policy Frameworks	Top-down approach, strong initial investment but lacks continuity after 2022. Risk of regional disparities.	Phased, adaptive approach with stronger institutional coordination. Roadmap ensures continuous evaluation.

Figure 4 : Comparative Summary Table: France vs. Quebec on BIM Adoption Policies

The comparative summary table (Figure 4) highlights key differences between France and Quebec:

- France follows an "Active-to-Assertive" policy pattern, emphasizing strong government leadership, financial investments, and procurement mandates but facing challenges in regional coordination and SME integration.
- Quebec adopts a more "Active" policy pattern, favoring incentive-based adoption with gradual implementation but lacking strong mandates and struggling with standardization.

This positioning, based on Succar & Kassem's (2015) Policy Action Model, suggests that further analysis—potentially incorporating quantitative indicators (e.g., investment per enterprise, procurement impact, SME adoption rates)—could refine the classification. Understanding these policy structures provides valuable insights into best practices that could be adapted across governance contexts to optimize BIM adoption.

This refined positioning could serve as a valuable step toward better understanding how policy structures influence BIM adoption outcomes and identifying best practices that could be adapted across different governance contexts.

4. CONCLUSION

The comparative review of the digital transformation policies in the public construction sectors of France and Quebec highlights key approaches and challenges in fostering a technological paradigm shift in this traditionally conservative industry. Both regions demonstrate significant governmental involvement, with distinctive methodologies tailored to their socio-political and economic contexts.
In France, a centralized and assertive model has facilitated the rapid development of tools like KROQI and the deployment of strategic mandates, albeit with limited updates since 2022.
Conversely, Quebec's collaborative and progressive framework prioritizes stakeholder engagement and gradual systemic transformation, supported by initiatives like the Quebec Construction 4.0 program. Both approaches, while contextually adapted, emphasize the necessity of regulatory alignment, robust funding mechanisms, and extensive training initiatives to promote widespread adoption of BIM and other digital tools.
However, the analysis also reveals critical limitations, including uneven standardization, inadequate support for SMEs, and the absence of cohesive long-term monitoring strategies. These issues underscore the importance of harmonizing practices, improving interoperability through standards like ISO 19650, and fostering international collaboration to ensure scalability and efficiency. Additionally, incorporating sustainability goals and leveraging emergent technologies such as AI and digital twins remain pivotal in shaping the future policy landscape.
This study offers a robust foundation for understanding the interplay between governance structures and digital transformation policies. It underscores that while technological adoption requires a mix of assertive mandates and flexible incentives, achieving a balance between innovation and regulatory rigor is paramount for sustained transformation. However, this analysis represents only an initial step in a broader research agenda. To validate the observations and enrich the comparative insights, conducting structured interviews with key stakeholders—including public officials, industry representatives, and technical experts—would provide valuable complementary perspectives. Such qualitative data could help confirm policy impacts on the ground and shed light on overlooked challenges or opportunities within the current frameworks.

Future research should explore adaptive strategies to integrate digital transformation policies across varying administrative and cultural contexts, aiming for a global framework that enhances collaboration and innovation in the construction industry.

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