Trac, S., Yuan, X., Zaman, H., and Li, X. (2026). Project Manager Competency Requirements in Lean-Oriented Construction Delivery: Evidence from Job Advertisements in Canada. *Lean Construction Journal* 2026 Special Issue CRC-CSCE pp 114-138 https://doi.org/10.60164/8t940u4t4 (Submitted 10Jan2026; Accepted 10Sep2026)
www.leanconstructionjournal.org

Project Manager Competency Requirements in Lean-Oriented Construction Delivery: Evidence from Job Advertisements in Canada

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Abstract

Purpose: Project management is a key skill set in construction to support project design and delivery in accordance with contractual requirements. This paper examines competencies sought for construction project managers in Alberta and how these competencies vary and co-occur across contracting parties and industry sectors. This study uses Lean Construction as an analytical framework that treats competency configurations as system-level capabilities required by lean-oriented construction delivery to support flow, reliability, and cross-party coordination.

Research Method: A competency framework derived from existing literature was applied to analyze 220 job advertisements. Competency frequency and co-occurrence were examined across contracting parties (owner, consultant, contractor) and industry sectors (building, infrastructure, industrial), with statistical testing used to assess contextual dependency.

Findings: Technical, communication, and select managerial competencies were most frequently cited. Owner and consultant postings emphasized technical and communication competencies, whereas contractor postings emphasized communication and managerial competencies. Differences across industry sectors were limited, indicating that delivery role and service scope influence competency demand more strongly than project type. Competencies were commonly specified as role-based configurations that reflect the distinct system-level capabilities each contractual role requires to maintain flow and support planning reliability in lean-oriented construction.

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Limitations: The study is limited to job advertisements from a single Canadian province and reflects stated employer expectations.

Implications: The findings reveal role-differentiated capability configurations across owner, consultant, and contractor roles, reflecting what lean-oriented construction systems require at each delivery stage. A persistent gap is identified between these role-specific system requirements and the relatively uniform way competencies are currently articulated in recruitment practice. Selected competencies are further mapped to lean methods and operational logics, illustrating how each configuration contributes to flow stabilization, variability reduction, and planning reliability across delivery roles.

Value for practitioners: The results provide practitioners with market-informed insight into role-specific competency expectations, supporting targeted recruitment, professional development, and role alignment in construction project delivery.

Keywords: construction project management; competency framework; job advertisement analysis; contracting party; construction industry

Paper type: Full paper

Introduction

The construction industry is one of the main sectors of the economy and is continuously growing (Tsiga et al., 2016). In Canada, the construction sector plays a critical role in economic development and employment, making the successful delivery of construction projects essential for supporting economic growth, employment, and supply chain stability (Canadian Construction Association, 2024); (Sinesilassie et al., 2019). Because of the construction industry's dynamic nature, project complexity is high due to the numerous risks and issues that arise during project implementation (Ahmed et al., 2020). Project managers are engaged on construction projects to lead project development and delivery (RMIT University, 2023), and project management is a key skill set required to support the design and execution of projects in accordance with contractual requirements (Ahuja et al., 1994).

In response to increasing project complexity and performance uncertainty, construction project delivery has progressively shifted toward lean and integrated delivery approaches that emphasize value generation, flow efficiency, collaboration, and early stakeholder involvement (Mesa et al., 2016). Lean construction reconceptualizes project delivery as a production system in which value is generated through the transformation of inputs, the management of flow, and the elimination of waste (Ibrahim et al., 2025). Lean construction principles promote the alignment of project objectives across organizational boundaries and encourage coordination among multiple contractual parties throughout the project lifecycle (Ballard, 2005), (Bygballe et al., 2018). As a result, construction project delivery is no longer defined only by technical execution, but increasingly by the ability to manage interdependencies and support value-based decision-making across diverse delivery roles (Killen & Kjaer, 2012). From this perspective, project manager competencies are interpreted in this paper as role-embedded capabilities required by lean-oriented delivery systems to support flow, reliability, variability reduction, and cross-party coordination.

Traditional project management approaches emphasize delivery in accordance with schedule, budget, scope, and quality requirements (Kerzner, 2022). However, the technological, organizational, and engineering complexity inherent in construction projects has led to broader interpretations of project success, extending beyond short-term performance measures to include long-term outcomes such as stakeholder satisfaction, organizational learning, and future readiness (Flyvbjerg, 2007); (Philbin, 2008); (Ahmed & Mohamad, 2016). Accordingly, project management arrangements increasingly need to be tailored to specific project contexts and conditions (Mulenburg, 2008). Within lean-oriented and collaborative delivery environments, this tailoring extends beyond project characteristics to include the specific services and responsibilities assigned to different contractual parties. In accomplishing such objectives, project managers are responsible for defining project requirements, balancing competing demands related to scope, time, cost, and quality, adapting plans to stakeholder expectations, and managing uncertainty throughout the project lifecycle (Ahsan et al., 2013). The project manager's role is therefore widely recognized as one of the most challenging positions within organizations, requiring both broad technical understanding and strong interpersonal capabilities (Ahsan et al., 2013).

Given their involvement across multiple aspects of project delivery, project managers play a critical role in project success, leading to increasing interest in understanding project manager competence (Crawford, 2005). Competence is defined as the ability of an individual, team, or organization to mobilize and combine resources, including knowledge, skills, and attitudes to effectively perform activities within a given situation (Loufrani-Fedida & Missonier, 2015). In lean and integrated delivery contexts, competence extends beyond individual capability to encompass the ability to support coordination and value realization across organizational interfaces (Rashidian et al., 2023). Projects are inherently unique, and different project types require distinct management approaches, styles, and competency profiles (Müller & Turner, 2010). Selecting an appropriate project manager aligned with project type, context, and complexity is therefore essential for improving performance and project success (Müller & Turner, 2007). In lean-oriented delivery systems, however, this selection logic extends beyond individual qualification. The competency configuration of the project manager directly conditions the capacity of the production system to maintain workflow, absorb variability, and deliver value reliably across contractual boundaries. PM competencies are therefore a production-system requirement, as specific capabilities shape how coordination, commitments, and value delivery are enacted across different delivery roles.

Despite extensive research identifying key competencies for project managers, the selection of suitable candidates remains complex and uncertain, as individuals possess diverse characteristics that influence how they perceive and respond to project challenges (Mohammadi et al., 2014); (Wang et al., 2016). Establishing appropriate competency-based criteria aligned with project needs is thus critical for the evaluation and selection of effective project managers (Hadad et al., 2013); (Meng & Boyd, 2017). This challenge is further amplified in lean-oriented delivery systems, where project managers are expected to fulfill role-specific responsibilities that vary across contractual arrangements and stages of project delivery.

While prior studies have examined project manager competencies, relatively few have investigated how these competencies vary across contractual parties or construction industries, particularly within the Canadian construction context, and relationships among different competency requirements have received limited empirical attention. Although lean construction emphasizes role differentiation, collaboration, and service integration, recruitment research continues to implicitly treat project manager competencies as relatively uniform across delivery roles (Moradi et al., 2020). Accordingly, the primary objective of this study is to identify the key competencies sought by organizations for construction project managers in Alberta, based on job posting requirements and qualifications. The study further examines how competency requirements differ by contractual role and industry sector, and explores co-occurrence patterns among competencies to better understand how inclusion or exclusion of certain competencies is associated with others in practice.

To address these gaps, this study focuses on the identification and classification of competencies sought for construction project managers in Alberta, using job advertisements as empirical evidence of organizational requirements. The study examines (1) the most frequently cited competencies, (2) differences in competency requirements across contractual parties (owners, consultants, and contractors), (3) differences across construction industries (building, infrastructure, and industrial), and (4) co-occurrence patterns among competencies. By situating competency analysis within a lean-oriented and role-differentiated delivery context, the study provides insight into how project manager competencies are structured and articulated in recruitment practice within the Canadian construction industry.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature on project manager competencies. Section 3 outlines the research methodology, including competency framework development, data collection, and analysis methods. Section 4 presents the results of the competency frequency, group differences, and co-occurrence analyses. Section 5 discusses the findings in relation to contractual parties, industries, and correlation patterns, and highlights implications for practitioners. Finally, Section 6 concludes the paper and outlines directions for future research.

Literature Review

Construction projects can be categorized into building (residential, commercial, or institutional), industrial (process-based), or infrastructure (system operations) projects, or a combination of the three (Safa, 2015). In addition to project type, construction project delivery typically involves multiple contractual parties, including owners, contractors, and consultants, each of whom performs different roles and assumes varying responsibilities throughout the project lifecycle (Brekoulakis & Thomas, 2019). Within lean and integrated delivery environments, these differences in project context and contractual role are closely associated with how value is created, coordinated, and delivered across organizational boundaries (Mesa et al., 2019). These differences suggest that expectations placed on construction project managers may not be uniform across industries or contracting parties.

Project management professionals possess and apply various competencies to ensure effective management of construction projects (Project Management Institute, 2017a). Across all industries and contractual parties, Ahsan et al., (2013) identified communication, technical capabilities, stakeholder management, cost management, time management, educational background, planning, leadership, team building and management, and certification as top competencies for engineering and construction project managers in Australia and New Zealand. These findings are in alignment with Yap & Chow, (2020), who concluded competency of the project manager and team, leadership, effective planning and control, in addition to realistic cost and time estimates as the leading indicators for successful construction delivery in Malaysia. Mouchi et al., (2011) results were also consistent with the above findings and noted that planning, risk management, communication and people competencies, in addition to technical competencies and experience, were imperative for project managers. Additionally, Hartono et al., (2019) determined that resource and team management are competencies generally required for superior project performance in construction. Pieterse et al., (2022) employed t-tests and concluded that compliance with regulations and procedures, safety management, decision-making, time management, and organizational competency were highly ranked competencies. Collectively, these studies indicate strong convergence around core competency clusters related to communication, planning and control, technical capability, and people management across construction contexts.

Beyond identifying commonly cited competencies, several studies have examined the relationship between specific competencies and project performance outcomes. For example, Ahmed & Anantatmula, (2017) reported positive associations between communication competencies and project success, while Abdelmasseh et al., (2022) identified budgeting and risk management competencies as influential factors affecting cost and schedule performance. These findings suggest that competencies do not operate in isolation, but rather interact and reinforce one another in supporting effective project delivery, highlighting the importance of examining competency configurations alongside individual attributes.

Research has also explored differences in competency requirements across construction industries. Abdelmasseh et al., (2022) concluded that although certain competencies, such as teamwork, quality management, scheduling, and procurement, are consistently important across building, industrial, and infrastructure projects, variations exist in the emphasis placed on technical and managerial competencies depending on project type. Infrastructure and industrial projects, in particular, have been associated with greater technical complexity, which may necessitate stronger technical and regulatory competencies compared to building projects (Safa, 2015). From a lean delivery perspective, these differences reflect variations in process complexity, uncertainty, and coordination intensity across industries, which in turn shape the competency emphasis required to support reliable project delivery (Nanda et al., 2017).

Differences in competency requirements across contractual parties have received comparatively less attention. Yap & Chow, (2020) reported that owners, consultants, and contractors share common expectations regarding leadership and team competency, while also exhibiting role-specific preferences. Owners emphasized effective communication and contractor selection, consultants valued cost and time estimating capabilities, and contractors prioritized subcontractor and supplier performance. These findings suggest that competency expectations are closely linked to the specific services and responsibilities project managers are expected to perform within a contractual arrangement.

Several competency frameworks have been proposed to structure and classify project manager competencies. The Project Management Institute's Project Manager Competency Development Framework (PMCDF) categorizes competencies into knowledge, performance, and personal dimensions (Project Management Institute, 2017a); (Project Management Institute, 2017b), while the International Project Management Association's Individual Competence Baseline (ICB) organizes competencies into people, practice, and perspective domains (International Project Management Association, 2024). In the construction domain, Edum-Fotwe & McCaffer, (2000) developed a comprehensive framework encompassing technical, managerial, financial, legal, communication, and general competencies. While these frameworks provide a robust theoretical foundation for organizing competencies, they offer limited insight into how competency requirements are configured across delivery roles or articulated in recruitment contexts.

Recruitment practices offer a valuable lens for examining organizational expectations of project manager competencies. Job advertisements are commonly used by organizations to communicate role requirements, desired qualifications, and competency expectations to potential candidates (Johnson et al., 2008). Prior studies have demonstrated that job advertisements reflect organizational priorities and can influence both applicant behavior and selection outcomes (McEntire et al., 2006); (Ahsan et al., 2013). In lean-oriented and project-based environments, recruitment advertisements serve as signals of delivery expectations and role-specific competency configurations (Ahsan et al., 2013). For construction project managers, where work is project-based and context-dependent, recruitment advertisements provide empirical evidence of how competency requirements are operationalized in practice.

Despite the extensive body of literature on construction project manager competencies, several gaps remain. First, few studies have examined how competency requirements differ across contractual parties and construction industries within a single regional context, particularly in lean and collaborative delivery perspective. Second, limited attention has been given to the Canadian construction industry, despite its economic significance and distinct regulatory environment. Third, while prior research has linked competencies to project performance, the co-occurrence of competency requirements in recruitment advertisements remains underexplored.

Methodology

The project study was conducted per the following steps: (1) create a framework for construction project manager competencies from literature, (2) collect job advertisements, review and record competencies identified in each posting, (3) complete statistical analysis of the data, then (4) draw conclusions. A summary of this process is shown in the figure below.

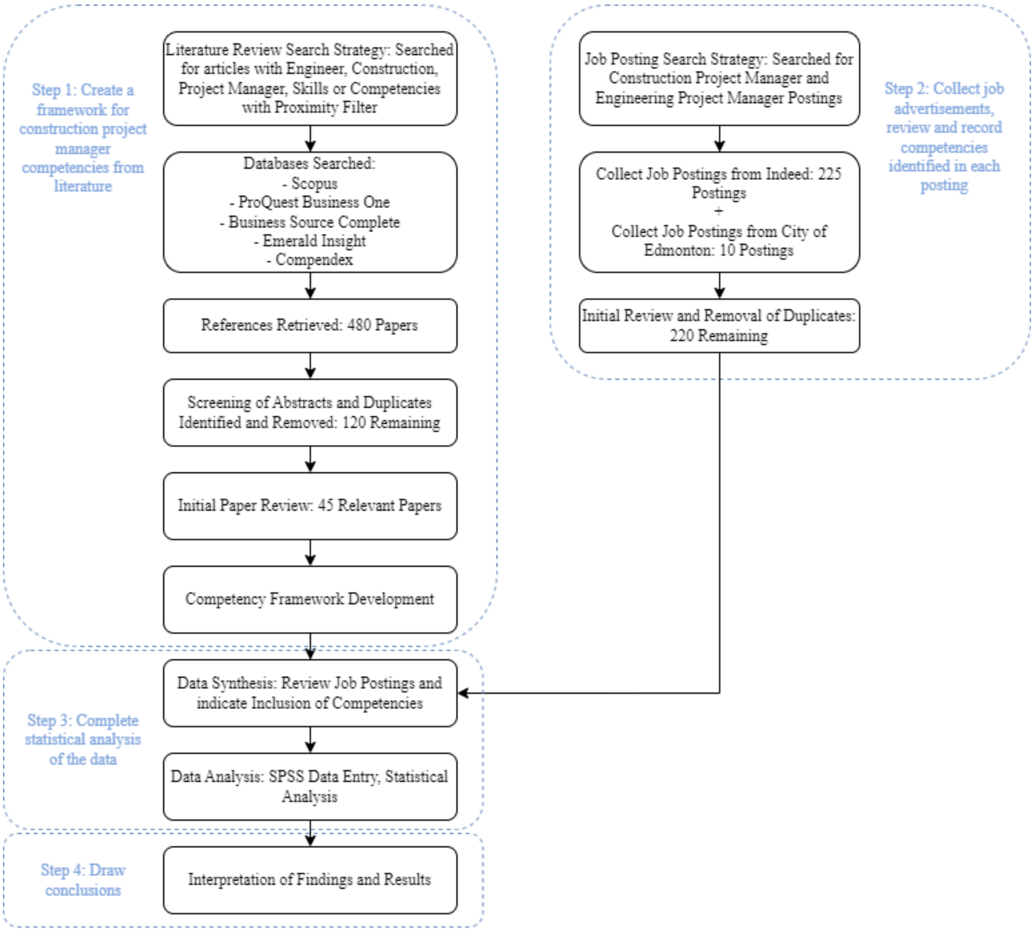

Figure 1. Study methodology flowchart

Competency Framework Development

A literature review was conducted searching for articles including engineer, construction, project manager, skills, or competencies with a proximity filter to relate skills or competencies to the project manager term. Upon screening, a total of 45 papers were deemed relevant to this study. While multiple competency frameworks exist for construction project management, the framework employed in this study is based on the breakdown provided by Edum-Fotwe & McCaffer (2000), supplemented by additional information from other literature.

This framework was selected not as a prescriptive model of ideal competencies, but as an analytical lens to support the systematic identification and comparison of competency requirements across different delivery roles and organizational contexts. It provides a structured representation of construction project manager competencies, enabling consistent identification and comparison of competency requirements across job advertisements (Chipulu et al., 2013). Its comprehensive and cross-functional structure enables competencies to be examined both individually and in combination, which is particularly relevant for analyzing how competency expectations are configured across contracting parties within lean-oriented and collaborative delivery environments (Mesa et al., 2019). A total of 17 technical, 16 managerial, 3 financial, 4 computer, 3 legal, and 2 communication competencies were identified and are summarized in Table 1 below.

Table 1: Competency framework

Technical Competencies				
T1: Job experience in the required field	T2: Educational background	T3: Local site-based knowledge	T4: Certification and other training	T5: Work planning, scheduling, and resource management
T6: Design management activities	T7: Construction management activities	T8: Health, safety, and environmental (HSE) management	T9: Basic technical knowledge	T10: Project management knowledge
T11: Project controls	T12: Quality management	T13: Estimating / quotation preparation	T14: Procurement / tendering	T15: Reviewing and understanding drawings, specifications, and plans
T16: Design activities and background	T17: Valid driver's license			
Managerial Competencies				
M1: Understanding of the organization, vision	M2: Leadership	M3: Integration management	M4: Delegation	M5: Decision-making and judgement
M6: Motivation and taking initiative	M7: Working independently	M8: Flexibility and adaptability	M9: Teamwork	M10: Time management and organization
M11: Scope management	M12: Ethics	M13: Conflict management and negotiation	M14: Risk and issue management	M15: Stakeholder management
M16: Strategic perspective				
Financial Competencies				
F1: Establishing and managing budgets	F2: Payment processing and support	F3: Forecasting and establishing cash flows		
Computer Competencies				
C1: Construction and project management software	C2: Familiarity with Microsoft and Google suites	C3: Design software	C4: Estimating software	
Legal Competencies				
L1: Drafting contracts and tender documents	L2: Contract interpretation and administration	L3: Claim preparation and management		
Communication Competencies				
CO1: Oral communication	CO2: Written communication			

Job Advertisement Collection

A total of 225 job advertisements were collated from Indeed, as well as 10 from the City of Edmonton repository between 2023-2024 for engineering project and program managers. Indeed is the largest job site in the world (Indeed, 2024). Advertisements provided in response to search phrases for “construction project manager” and “engineering project manager” were downloaded from May 4, 2024 to May 16, 2024 within the Alberta province. Duplicate advertisements, in which a posting’s content is identical to that of another posting published by the same organization, were removed, with 220 postings remaining for analysis.

Content Analysis and Competency Coding

Content analysis was employed to identify project manager competencies from the collected job advertisements. Content analysis is a recognized research technique that combines qualitative interpretation with quantitative aggregation to enable systematic examination of textual data in context (Holzmann & Spiegler, 2011);(Krippendorff, 2019). This approach has been widely applied in project management research, including prior studies that identified construction project manager competencies through job advertisement analysis (Ahsan et al., 2013).

A manual review of posting content was conducted, and information on competencies included (per the aforementioned framework) was recorded, in addition to the industry associated with the position and the contracting party the organization would assume in a traditional construction contract. Manual coding was adopted to ensure accurate interpretation of competency terminology and contextual meaning within job advertisements.

Statistical Analysis

Recorded data were coded into the International Business Machines (IBM) Statistical Package for the Social Sciences (SPSS) version 29 to undertake descriptive statistical analyses. These analyses identified the frequency of cited competencies, as well as patterns of competency co-occurrence using phi coefficients across all postings and for postings related to each industry sector and contracting party.

The phi coefficient was used to assess the strength and direction of associations between pairs of binary competency variables. It is a symmetrical statistic, with values ranging from −1 to 1, where 0 indicates no relationship, 1 indicates a perfect positive relationship, and −1 indicates a perfect negative relationship (Akoglu, 2018).

Differences in competency inclusion across contracting parties and industries were examined using the Fisher Freeman–Halton test. This test assesses the null hypothesis of independence and is appropriate for categorical data with unbalanced sample sizes, supporting exact significance testing for multi-category contingency tables (Kim, 2017);(Hazra & Gogtay, 2016). Significance was set at $p < 0.05$ for both the phi coefficient and Fisher Freeman–Halton test (Njuka & Phiri, 2021).

Postings that included work across multiple industries had their competency information duplicated for each applicable sector when industry-specific analysis was conducted.

Results

Sample Characteristics

The total number of postings collected was 220, with 23 owner, 61 consultant, and 136 contractor postings. Contractor postings represent the largest share of the dataset (136 of 220 postings). As postings associated with multiple industries were counted once for each relevant industry, 108 postings were included for both building and infrastructure projects, while 76 postings were included for industrial projects.

A summary of the experience and education requirements is provided in Table 2. A total of 194 postings included requirements for prior related experience, with 26 not specifying requirements. Specifically, 57, 98, and 39 postings required a minimum experience of 0-4, 5–9, and 10+ years, respectively. With regard to education requirements, 3 postings required a diploma, 78 postings requested a degree, and 79 postings requested a diploma or a degree. Other postings did not specify the level of education, or required either a trade certificate, degree, or diploma. Overall, the majority of job advertisements request 5–9 years of experience, with most recruiters requiring a degree or diploma.

Table 2: Experience and Education Requirements of All Postings

Minimum Experience (Years)	Number of Postings	Level of Education Required	Number of Postings
0-4	57	High School Diploma	3
5-9	98	Trade Certificate	1
10+	39	Diploma	3
None Specified	26	Degree	78
		Diploma/Degree	79
		Degree/Diploma/Trade Certificate	6
		Degree/Trade Certificate	1
		None Specified	49

Frequency of Competencies

The figures below illustrate the citation frequency of identified competencies from the collected job postings, including overall frequency and frequency stratified by contractual party and industry.

Figure 2 presents the overall frequency of competencies cited across all postings. Prior job experience (93.18%) is the most cited competency, followed by written communication (92.73%), work planning, scheduling, and resource management (90.45%), oral communication (87.73%), teamwork (84.09%), stakeholder management (84.09%), establishing/managing budgets (79.55%), educational background (78.18%), basic technical knowledge (74.55%), and quality management (71.36%). Competencies less frequently included across all postings are ones related to managerial traits and personal qualities (delegation, decision-making, motivation, independent worker, flexibility, ethics). Only 40.00% of total postings ask for project management knowledge. No owner or consultant postings included the estimating software competency. Figure 3 shows the frequency of competencies cited in postings per contractual party. Figure 4 shows the frequency of competencies cited in postings per industry.

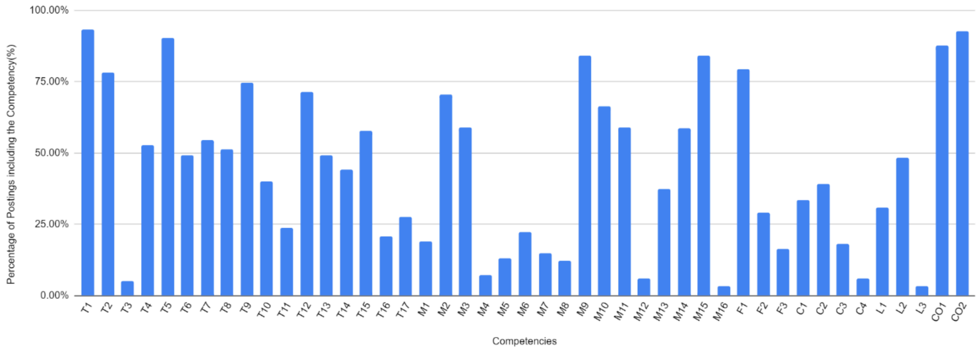

Figure 2. Frequency of Competencies Cited in All Job Postings

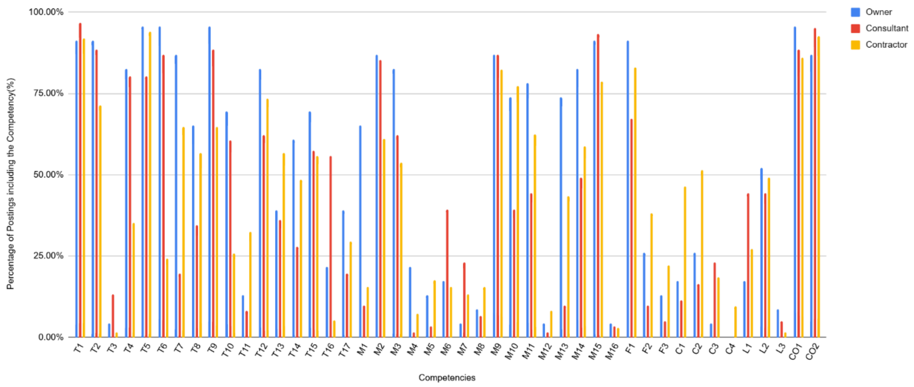

Figure 3. Frequency of Competencies Cited in Postings per Contractual Party

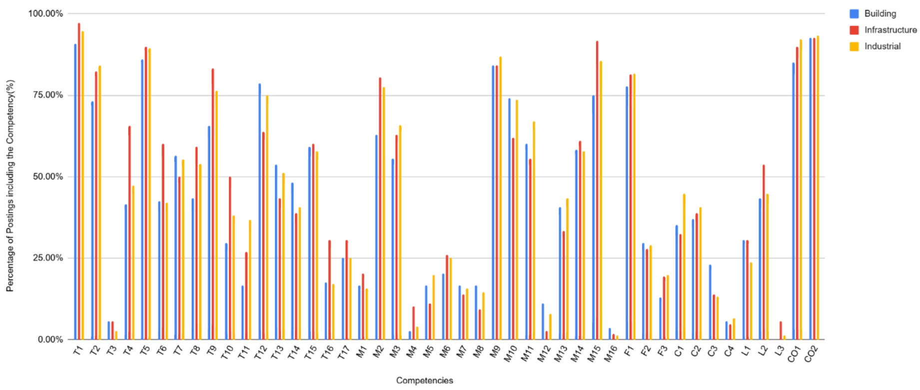

Figure 4. Frequency of Competencies Cited in Postings per Industry

Differences Across Groups

To examine whether the inclusion of competencies differed across contracting parties and industries, the Fisher Freeman–Halton test was applied. Table 3 reports the test statistics and exact two-sided significance values for comparisons across contracting parties and across industries.

Table 3: Fisher Freeman-Halton Test Values and Significance to determine Differences Between Contracting Parties and Industries

Competency	Contracting Party		Industry		Competency	Contracting Party		Industry	
	Value	Exact Sig (2-sided)	Value	Exact Sig (2-sided)		Value	Exact Sig (2-sided)	Value	Exact Sig (2-sided)
T1	1.771	0.477	4.005	0.127	M7	5.02	0.087	0.362	0.877
T2	9.776	0.007*	4.069	0.129	M8	3.118	0.188	2.735	0.264
T3	10.673	0.002*	1.014	0.579	M9	0.659	0.757	0.292	0.895
T4	44.955	<0.001*	13.504	0.001*	M10	26.528	<0.001*	4.408	0.118
T5	8.642	0.01*	0.817	0.717	M11	9.566	0.008*	2.475	0.291
T6	95.863	<0.001*	8.598	0.014*	M12	3.009	0.179	5.922	0.050
T7	47.024	<0.001*	1.008	0.609	M13	37.751	<0.001*	2.232	0.332
T8	10.229	0.006*	5.526	0.063	M14	7.866	0.02*	0.266	0.899
T9	19.535	<0.001*	8.913	0.012*	M15	7.768	0.018*	11.134	0.004*
T10	30.652	<0.001*	9.412	0.009*	M16	0.635	0.853	1.122	0.704
T11	15.93	<0.001*	9.637	0.008*	F1	8.063	0.017*	0.590	0.778
T12	4.006	0.133	6.147	0.045*	F2	18.03	<0.001*	0.110	0.959
T13	8.101	0.017*	2.403	0.296	F3	9.909	0.005*	2.171	0.351
T14	10.319	0.005*	2.049	0.369	C1	27.402	<0.001*	3.042	0.210
T15	1.469	0.476	0.113	0.942	C2	24.511	<0.001*	0.285	0.886
T16	61.87	<0.001*	6.510	0.039*	C3	3.978	0.14	3.990	0.138
T17	3.712	0.152	1.044	0.619	C4	8.304	0.011*	0.436	0.856
M1	28.258	<0.001*	0.766	0.732	L1	7.596	0.021*	1.293	0.518
M2	15.44	<0.001*	9.221	0.010*	L2	0.607	0.758	2.573	0.276
M3	7.313	0.024*	2.223	0.333	L3	4.488	0.068	6.690	0.018*
M4	8.651	0.012*	5.440	0.069	CO1	1.407	0.503	2.202	0.348
M5	8.443	0.013*	2.827	0.244	CO2	1.871	0.409	0.129	1.000
M6	13.194	0.001*	1.060	0.584					

*p value less than 0.05, indicating significant differences between groups

Co-occurrence of Competencies

Select phi coefficient values were calculated to examine co-occurrence patterns among competencies. Table 4 presents select phi coefficient values considering all postings. Table 5 presents select comparisons between contracting parties, and Table 6 presents select comparisons between industries.

Table 4: Comparison of Phi Coefficient Values and significance for competence of All Postings

Competencies Analyzed	Results	Competencies Analyzed	Results
T6 and T7	Phi = -0.473, p = <0.001	T8 and C1	Phi = 0.366, p = <0.001
T4 and T6	Phi = 0.420, p = <0.001	T14 and L1	Phi = 0.139, p = 0.039
T4 and T10	Phi = 0.327, p = <0.001	CO1 and CO2	Phi = 0.338, p = <0.001
T4 and T16	Phi = 0.241, p = <0.001	M1 and M4	Phi = 0.309, p = <0.001
M2 and M9	Phi = 0.154, p = 0.022		

Table 5: Comparison of phi coefficient values and significance for competencies between contracting parties

Competencies Analyzed	Results for Owner Postings	Results for Consultant Postings	Results for Contractor Postings
CO1 and CO2	Phi = 0.550, p = 0.008	Phi = 0.394, p = 0.002	Phi = 0.319, p = <0.001
M2 and M9	Phi = 0.233, p = 0.263	Phi = -0.025, p = 0.847	Phi = 0.184, p = 0.032

Table 6: Comparison of Phi Coefficient Values and significance for competence between industries

Competencies Analyzed	Results for Building Postings	Results for Infrastructure Postings	Results for Industrial Postings
M2 and M9	Phi = 0.195, p = 0.043	Phi = 0.237, p = 0.014	Phi = 0.071, p = 0.534
M14 and T8	Phi = 0.401, p = <0.001	Phi = 0.305, p = 0.002	Phi = 0.335, p = 0.004
M14 and T12	Phi = 0.294, p = 0.002	Phi = 0.231, p = 0.017	Phi = 0.308, p = 0.007
CO1 and CO2	Phi = 0.479, p = <0.001	Phi = 0.408, p = <0.001	Phi = 0.316, p = 0.006

Discussion

Main Findings and Interpretation

This study provides a comprehensive overview of the competency profile sought by recruiters for construction project managers in Canada. Overall, the findings indicate that recruiters continue to prioritize traditional project management competencies, with limited emphasis placed on emerging digital or technology-specific skills.

Across all postings, prior job experience emerged as the most frequently cited competency, followed by written and oral communication, work planning and scheduling, teamwork, and stakeholder management. These findings are consistent with previous studies that identified communication, planning, technical capabilities, team building, and stakeholder engagement as core competencies for construction project managers(Yap & Chow, 2020).

Taken together, these results suggest that recruitment practices remain strongly oriented toward operational and execution-focused capabilities, with limited explicit emphasis on advanced digital or emerging technology-related competencies. Although there are many recent research studies on advanced topics such as Building Information Management and Artificial Intelligence in construction, only one posting specifically mentioning these competency requirements. This finding suggests that the widespread integration of advanced digital technologies into construction project management practice remains limited at present.

Discussion by Contractual Party

For most competencies reviewed, the Fisher Freeman-Halton values in Table 3 indicate that competency inclusion is dependent on contractual party, reflecting differences in the services project managers are expected to provide. In contrast, competencies such as prior job experience, quality management, teamwork, and communication appear consistently important across all parties, suggesting their role as foundational project management requirements.

In general, owner postings require a broader range of competencies than those for consultants and contractors, with technical and communication competencies most frequently referenced. Compared to consultant and contractor postings, the greater emphasis on technical and managerial competencies is reasonable given that owners are responsible for overall project oversight and must manage both contractor and consultant scopes of work (Forcada Matheu & Casals Casanova, 2005); (Brekoulakis & Thomas, 2019). Accordingly, owner postings are significantly more likely to include competencies related to understanding organizational objectives and vision. This reflects the role of owner project managers in representing organizational interests, whereas consultants and contractors primarily deliver services on behalf of a client (Bailey, 2021). Lean-oriented delivery therefore requires owner-role project managers to embody broad integration and oversight capabilities that support system-level coordination across the full project scope.

Consultant job advertisements also frequently include technical and communication competencies, with the exception of construction management as that may not be a part of their scope of work (Forcada Matheu & Casals Casanova, 2005). This aligns with the consultant role of providing technical expertise and design-related services, which requires planning, pricing, and managing service delivery rather than direct construction oversight (Brekoulakis & Thomas, 2019). Consistent with this role distinction, consultants are the only contractual party for which certification appears among the top-ranked competencies, reflecting the importance of formal technical credentials. The production system in lean-oriented delivery depends on the consultant role to stabilize information flow into the construction phase, making technical precision and design coordination capabilities system-level requirements at this stage.

Contractor postings prioritize communication and selected managerial competencies, particularly stakeholder management and teamwork. Given the number of subcontractors coordinated by contractor project managers, people management emerges as a critical capability (Harshil & Brain, 2025). In addition, contractor postings more frequently reference project management software requirements than those for owners or consultants, reflecting the use of software tools to support scheduling, resource coordination, and documentation. These results align with Yap and Chow's (2020) findings between different parties. The execution-stage competency configuration observed in contractor postings reflects what the production system requires to maintain reliable workflow and absorb variability across subcontractor interfaces in lean construction.

Educational requirements also differ across contractual parties. While degrees and diplomas are commonly required across postings, contractor advertisements demonstrate greater flexibility in accepting trade certificates or, in some cases, high school diplomas accompanied by relevant experience. The Fisher Freeman-Halton results support this observation, as statistically significant differences were observed between contractual parties for educational background and certification competencies.

Differences in co-occurrence patterns further reinforce these role distinctions. Competencies included in owner postings exhibit larger phi coefficient magnitudes than those observed for consultants and contractors, consistent with the broader competency profiles required of owner representatives. For quality and scope management, no significant relationships are observed for owner postings, whereas consultant postings show strong positive relationships and contractor postings exhibit weaker positive relationships. This pattern aligns with prior literature suggesting that quality requirements are defined within project scope but are often delegated to external vendors for execution (Ahmed & Anantatmula, 2017); (Forcada Matheu & Casals Casanova, 2005).

A similar pattern is observed for work planning, scheduling, resource management, and budget management competencies. Owner postings do not show significant co-occurrence relationships among these competencies, while consultant postings demonstrate moderate positive relationships and contractor postings exhibit strong positive relationships. This suggests that consultants and contractors are expected to manage detailed cost and resource interactions more directly, whereas owners focus on higher-level schedule and cost oversight (Forcada Matheu & Casals Casanova, 2005).

Discussion by Industry

There is significant overlap between the top 10 competencies for each industry, namely communication, job experience, planning, teamwork, and stakeholder management. This agrees with findings from Abdelmasseh et al., (2022), where top competencies are common across the construction industries evaluated. The observed overlap suggests that fundamental project management competencies are largely transferable across construction industries, even though their application and required depth of knowledge may differ.

The Fisher Freeman-Halton results indicate a lack of substantial differences in competencies between industries. In general, postings for industrial and infrastructure industries include more technical competencies (i.e. for certification, design management, technical and project management knowledge) compared to building postings. As per Table 3, statistically significant variations between industries were observed primarily for technical competencies. This pattern is consistent with the greater technical complexity and design uniqueness often associated with infrastructure and industrial projects (Safa, 2015), which may also explain why claim preparation and management competencies did not appear in building-sector postings. Accordingly, these project types may warrant project managers with stronger technical backgrounds to manage uncertainty and complexity.

Differences across industries are more apparent when examining co-occurrence patterns, as opposed to simple citation frequency. While similar competencies are required across industries, the manner in which competencies are combined and specified varies by project context, suggesting that industry influences how competencies are operationalized rather than which competencies are required.

Competencies Implications for Production Flow and Planning Reliability

These role-differentiated competency patterns can be further interpreted through a lean delivery lens. Competencies in this context are viewed more as capabilities that enable specific operational practices and service functions across contractual roles. They therefore reflect the functional demands that lean-oriented delivery places on each contractual role, revealing how different roles contribute to maintaining workflow continuity, reducing variability, and supporting planning reliability across the delivery system.

Table 7 provides illustrative links between selected competencies and commonly recognized lean methods, practices, and tools in construction, along with their implications for flow, variability, and planning reliability. For example, competencies related to work planning, scheduling, and resource management (T5) align closely with pull planning and the Last Planner System, which are central to workflow coordination and reliability in lean delivery. Similarly, quality management (T12) and HSE management (T8) correspond to lean principles such as built-in quality, standard work, and built-in safety, which emphasize error prevention and proactive control.

Owner project managers are required to maintain oversight across multiple contractual scopes simultaneously. The broader competency profiles observed in owner postings serve as system-level stabilizers that reduce interface variability between contractual parties and support value definition at the project level. These capabilities address what Lean Construction identifies as essential conditions for preventing upstream disruptions from propagating through the production system (Ballard, 2005).

Consultant project managers operate primarily in the design and technical advisory phase, where planning reliability and coordination of specialist inputs are critical. The emphasis on technical competencies, certification, and scope management in consultant postings reflects the need to control variability in design outputs and maintain the quality of information flowing into the construction phase. Unreliable or incomplete design information is a primary source of downstream flow interruption in lean delivery, and the competency emphasis in consultant roles directly addresses this source of variability.

Contractor project managers are responsible for translating plans into reliable production at the site level. The strong emphasis on work planning and scheduling, project management software, stakeholder management, and people management in contractor postings reflects the operational demands of maintaining workflow at the execution stage. These capabilities support the conditions required for reliable commitment management in lean delivery and shielding of production from variability. The co-occurrence patterns observed in contractor postings, particularly the strong relationships among planning, resource management, and budget management competencies, indicate that these capabilities function as an integrated set of production control requirements.

Table 7: Links Between Selected Competencies and Lean Principles

Competency	Competency focus in recruitment context	Associated lean methods, practices, and tools (VanDenBerg, 2021), (Salonitis	Impact on Flow, Variability, and Reliability

	& Tsinopoulos, 2016), (Agrawal et al., 2024)		
T5: Work planning, scheduling, and resource management	Planning, scheduling, and coordination of labor and resources (Müller & Turner, 2010)	▪ Pull planning ▪ Last Planner System (LPS) ▪ Workflow reliability	Reduces task-sequencing variability; shields downstream activities from upstream disruptions
T8: Health, safety, and environmental (HSE) management	Safety compliance, hazard control, site-level HSE practices (Moradi et al., 2020)	▪ Standard work ▪ 5S workplace organization ▪ Built-in safety	Reduces unplanned stoppages; standardized practices support predictable production rates
T11: Project controls	Project controls, including productivity, performance tracking and cost control (Edum-Fotwe & McCaffer, 2000)	▪ Visual control (Andon) ▪ Plan-Do-Check-Act (PDCA) ▪ A3-based problem solving	Early detection of flow deviations; feedback loops improve planning reliability
T12: Quality management	Quality assurance, compliance, and defect prevention (Edum-Fotwe & McCaffer, 2000)	▪ Built-in quality ▪ Poka-yoke (mistake-proofing) ▪ Standard work	Prevents rework-driven flow disruption; reduces variability at source
T14: Procurement / tendering	Procurement processes, supplier selection, and tender management (Edum-Fotwe & McCaffer, 2000)	▪ Lean supply chain management ▪ Early supplier involvement ▪ Just-in-Time (JIT) principles	Reduces material delivery variability; supports predictable site flow
M3: Integration management	Coordination across disciplines, project phases, and contractual parties (Hanna et al., 2018)	▪ Integrated planning ▪ Big Room / Obeya collaboration ▪ Value stream perspective	Reduces interface variability; ensures flow continuity across organizational boundaries
M15: Stakeholder management	Stakeholder coordination and expectation alignment (Pieterse et al., 2022)	▪ Customer value definition ▪ Voice of the customer	Stabilizes value definition; reduces mid-stream scope variability

F1: Establishing and managing budgets	Budget development, cost control, financial oversight (Edum-Fotwe & McCaffer, 2000)	▪ Waste elimination (waiting, rework, overprocessing) ▪ Value-based decision-making	Reduces resource flow variability; eliminates non-value-adding expenditure

The stronger emphasis on integration management (M3), stakeholder management (M15), and budget management (F1) observed in consultant and contractor postings reflects the increasing importance of coordination, value definition, and waste elimination in service-oriented and execution-focused roles. These mappings highlight how recruitment requirements align with lean operational priorities within role-differentiated delivery contexts. It also confirms that the capabilities emphasized across contractual roles are functional requirements of the production system. Each contributes to stabilizing flow, reducing variability, or improving planning reliability in ways that are specific to the operational demands of each contractual role.

Correlation Patterns and Interpretation

Correlation analysis across all postings generally supports findings from previous literature. While a small number of competency pairings exhibit strong relationships, the majority of statistically significant results indicate weak or no correlation, suggesting that many competencies are specified independently in job advertisements, and are not presented as bundled requirements. The certification competency displayed weak to strong positive correlations with multiple technical competencies, including design management, project management knowledge, and design activities. This pattern is reasonable, as professional certifications are commonly used to demonstrate technical competence and domain-specific knowledge (Project Management Institute, 2017b).

A notable negative correlation is observed between design management activities and construction management competencies across all postings. This pattern reflects role differentiation, as design-oriented competencies are more prevalent in consultant postings, while construction management competencies are emphasized in contractor postings. Accordingly, negative associations among these competencies indicate differentiated service expectations rather than mutually exclusive capability requirements.

HSE management and compliance has a moderate positive relationship with construction or project management software for all postings. This co-occurrence may reflect digital tools increasingly function as enablers of compliance, documentation, and reporting functions within construction projects.

Consistent with expectations, a moderate positive relationship between oral and written communication competencies is observed. This is reasonable, as job advertisements frequently specify verbal and written communication skills together within the same requirement (DNV, 2024). Similar patterns are observed across contracting parties and industries.

Across all postings, a moderate positive relationship between understanding an organization’s vision and delegation is identified. Although these competencies are not inherently linked, this pattern may indicate that organizations value effective delegation as a mechanism for translating strategic objectives into operational outcomes, particularly in contexts involving diverse project types (Safa, 2015).

Implications and value for practitioners

Estimating and project management software are widely used by contracting companies to support bidding, financial control, and documentation processes across project types (Abalone Construction, 2024). Rather than functioning as isolated technical skills, such tools appear closely embedded within broader financial and coordination competencies, highlighting their role in enabling operational performance.

All industries highlight the importance of using project management software to perform financial tasks. With the exception of industrial postings for the establishing/managing budgets competency, all other competencies in the financial category exhibit weak to strong positive relationships with the use of project management software for all posting combinations analyzed. For practitioners, this suggests that proficiency in project management software is no longer a supplementary skill, but a core enabler for financial control, resource allocation, and documentation across project types.

A total of 4 postings requested candidates be familiar with Leadership in Energy and Environmental Design principles. One posting also highlighted experience requirements related to the use of digital twins in project management. Although such competencies are cited infrequently, their presence indicates emerging expectations related to sustainability and digital innovation. Practitioners may therefore benefit from proactively developing foundational knowledge in these areas to remain competitive as industry practices continue to evolve.

The competency configurations identified across owner, consultant, and contractor postings carry practical implications for how lean-oriented construction systems are staffed and structured. Owners benefit from prioritizing integration and oversight capabilities in PM recruitment, as these stabilize cross-party coordination and prevent upstream disruptions from cascading through the system. In lean-oriented construction delivery, owner project managers serve as the primary integrators of the production system, and their capability to align contractual parties around shared objectives directly conditions whether flow can be maintained across organizational boundaries. Owner organizations should therefore emphasize competencies related to integration management, stakeholder coordination, and organizational vision when defining PM role requirements, as these capabilities underpin system-level reliability across the full project lifecycle.

Consultants and contractors, in turn, require PM roles that are specifically configured to address the variability sources most critical at their respective delivery stages, with information quality and design reliability being the priority for consultant roles, and commitment management and workflow control being the priority for contractor roles. For consultant organizations, the emphasis in PM recruitment should fall on technical precision, scope management, and design coordination capabilities, as incomplete or unreliable design outputs are a primary source of downstream flow disruption in lean delivery. Investing in these capabilities at the consultant stage reduces variability before it enters the construction phase, improving planning reliability across the whole system. For contractor organizations, the priority lies in PM capabilities that support reliable commitment management at the production stage, including work planning and scheduling, people management, and cross-party coordination. These capabilities directly support the conditions required for stable workflow and the absorption of variability across subcontractor interfaces, which are the execution-stage requirements most critical to lean delivery performance.

Conclusions

This study provides a clear overview of the competency profile sought by recruiters for construction project managers within the Canadian construction industry. Despite ongoing changes in construction delivery practices, this study confirms that most job advertisements continue to prioritize established project management competencies, with limited emphasis placed on emerging digital technologies and advanced computer-based systems at this time. Competency dimensions developed by previous researchers remain relevant and applicable for assessing and selecting construction project managers, indicating continued alignment between academic frameworks and established professional competency models.

The findings of this study contribute to Lean Construction thinking in ways that extend beyond descriptive documentation of competency requirements. Lean Construction literature has largely assumed that role definitions within delivery systems are relatively stable, treating the capabilities required across owner, consultant, and contractor roles as broadly comparable. This study provides empirical evidence that competency configurations vary structurally and systematically by contracting role, a pattern that has direct implications for understanding why Lean implementations succeed unevenly across projects and organizations. When the capabilities embedded in a given contractual role do not align with what the production system requires at that stage, flow disruptions, planning unreliability, and coordination failures become more likely. The observed structural variation in competency configurations therefore offers a production-system explanation for the inconsistency of Lean implementation outcomes that existing literature has noted but not fully accounted for.

This study further supports the position that Lean Construction is role-differentiated in its capability requirements, meaning that the system-level functions associated with different roles are distinct and cannot be addressed through a uniform competency model. This empirical grounding strengthens the theoretical case for role-differentiated approaches to Lean implementation, workforce development, and organizational design in construction project delivery.

At the empirical level, competency requirements are structured primarily around the services project managers are expected to provide within lean-oriented and collaborative delivery environments, with contractual role emerging as a more influential differentiator than construction industry type. The comparatively limited differences observed across industries suggest that core project management competencies are largely transferable across construction sectors, although their application may vary by project context. Co-occurrence patterns further indicate that competencies are configured in role-specific ways, and are not specified as uniform or tightly bundled requirements.

Owner postings generally require broader competency profiles, consultant postings emphasize technical and communication competencies, and contractor postings focus on managerial and coordination-related competencies associated with project execution. Compared to contractual parties, competency citation frequency shows considerably fewer dependencies on construction industry. Correlation analysis results are generally consistent with findings reported in the existing literature and support the role-differentiated patterns identified in this study, while also warranting cautious interpretation where relationships are weak or unexpected.

Overall, the findings highlight a persistent gap between the role-differentiated competency demands implied by lean construction principles and the relatively uniform way project manager competencies are articulated in recruitment practice. By illustrating how selected competencies align with lean principles, methods, and operational logics, this study provides an interpretive lens for understanding why certain competencies are emphasized across different contractual roles. The results support project managers in aligning professional development efforts with role-specific competency expectations and assist organizations and educators in reducing misalignment between industry recruitment practices and competency development pathways. This study also provides a foundation for future research examining longitudinal trends in construction project manager competency requirements and for studies incorporating broader datasets or alternative empirical sources to further validate and extend the observed patterns.

Acknowledgments

The authors would like to thank the City of Edmonton for sharing job advertisements to assist in data collection and dissemination.

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