The Significance of Project Manager Competencies in Recruitment: A Means of Supporting Success in the Construction Industry

Suzana Trac, BSc.[1], Xinming (Sherry) Li, Ph.D., P. Eng. [2], and Hamid Zaman, Ph.D., P.Eng.[1]

[1] Dept. of Civil and Environmental Engineering, University of Alberta, 116 St and 85 Ave, Canada
[2] Dept. of Mechanical Engineering, University of Alberta, 116 St and 85 Ave, Canada

ABSTRACT: Given the dynamic nature of construction, evolving standards, principles, and methodologies introduce new considerations in the delivery of construction projects. A project manager plays a pivotal role in ensuring overall project success by effectively overseeing project execution in light of these potentially conflicting factors. As such, there is increasing interest in identifying and exploring project manager competencies that existing literature does not address specifically in the Canadian construction sector. The purpose of this paper is (1) to identify and analyze competencies desired for construction project managers, and (2) to understand the correlation between competencies, in addition to how contracting parties (owner, consultant, and contractor) and industries (building, infrastructure, and industrial) influence these competencies. A literature review was completed to develop a competency framework. 220 Albertan job advertisements were reviewed and competencies were recorded. The frequency and phi coefficient of each competency was calculated for all postings, then for postings specific to each contracting party and type of industry. The Fisher-Freeman Halton test was employed to determine dependency of competency frequency on contracting party and industry. Technical, communication, and select managerial and financial competencies were highly cited. Owner and consultant postings favoured technical and communication competencies while contractor postings included communication and select managerial competencies. There is less variation in competency citation frequency between industries and positive relationships were observed between oral and written communication competencies. Desired competencies are influenced by the services to be provided, the industry in which work will take place, and other competencies included in the postings.

1. INTRODUCTION

Project managers are engaged on construction projects to lead project delivery (RMIT University 2023) and there is increasing interest in project manager competence (Crawford 2005). Competence is the ability to mobilize and combine resources (i.e., knowledge, skills, and attitudes) to implement an activity in a situation (Loufrani-Fedida and Missonier 2015). With the ever-changing construction industry, project managers require different and potentially new competencies for better project performance, as well as to meet current and future project needs (Müller and Turner, 2007). There is also complexity and uncertainty associated with selecting project managers as candidates possess various characteristics that influence the way they comprehend and address issues (Wang et al. 2016). As such, establishing appropriate criteria from competencies based on project needs is critical for evaluation and selection of a successful project manager (Hadad et al. 2013). Existing literature primarily focuses on identifying key competencies for project managers, however, a limited number of papers highlight competencies based on contractual party and industry, specifically for the Canadian construction sector.

This study involves identification and classification of desired competencies for construction project managers, as evaluated from existing job advertisements. While the analysis focuses on job postings within Alberta, the framework can be broadly applied to other regions. The paper outcomes provide insight into competencies sought by organizations seeking construction project managers within the Alberta province and provides a comparison between desired competencies by industry and contracting party.

2. 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 et al. 2015). Various parties are also involved in the delivery of construction projects (Stiegler 2019). The owner is the public or private contracting party that is the client for all design and construction activities (Stiegler 2019). The contractor is the contracting party responsible for carrying out a portion of or the entirety of project construction (Stiegler 2019). Consultants are specialists providing technical support in construction (Stiegler 2019).

In the recruitment of project managers, organizations typically use the job advertisement; a recruitment tool employed to generate an initial applicant pool (Johnson et al., 2008). The job advertisement includes information on the job description, employer expectations, and desired competencies, which encourage potential candidates to apply to the posted position (Johnson et al., 2008). Qualified candidates are then invited to proceed further in the hiring process and may be selected as the preferred candidate for a job opportunity (DNV, 2024).

Project management professionals possess and apply various competencies to ensure effective management of construction projects (Project Management Institute 2017). Across all industries and contractual parties in various regions around the world, studies demonstrated alignment in the top competencies identified. Within Australia, New Zealand, and Malaysia, Ahsan et al. (2013) and Yap and Chow (2020) identified communication, technical capabilities, stakeholder management, cost management, time management, educational background, planning, leadership, team building and management, and effective planning and control as the leading indicators for successful engineering and construction project managers. Mouchi et al. (2012) and Hartono et al.'s (2019) results are also consistent with the above findings and noted that risk management, people competencies, experience, and resource management are competencies generally required for superior project performance in construction. Pieterse et al. (2024) employed t-tests and concluded that in addition to the above, safety management and decision-making are highly ranked competencies.

Abdelmasseh et al. (2022) determined key competencies for construction project managers in Egypt based on industry. Between the commercial/residential, industrial, and infrastructure projects, the top competencies are generally common across all industries, with teamwork, quality management, contract administration, scheduling, budgeting, and procurement management being important competencies (Abdelmasseh et al. 2022). Pearson's correlation analysis was also conducted, yielding budgeting and risk as competencies affecting project cost and schedule performance (Abdelmasseh et al. 2022).

Comparing contractual parties, Yap and Chow (2020) determined that the top competencies perceived by owners, consultants, and contractors include team competency and leadership (Yap and Chow 2020). Top competencies specific to owners include tendering to the right designers/contractors and effective communication (Yap and Chow 2020). The top competencies for consultants and contractors both include effective planning and control, while consultants value cost and time estimating capabilities, and contractors place importance on subcontractor/supplier performance (Yap and Chow 2020).

Regarding statistical analysis, Fisher's exact test is used to assess the null hypothesis of independence via hypergeometric distribution of numbers (Kim 2017). The test is valid for all sample sizes, and using the Freeman-Halton extension permits calculation of an exact p value from 2×3 contingency tables (Hazra and Gogtay 2016). The phi coefficient is a measure for the strength of an association between two binary

variables (Akoglu 2018). It is a symmetrical statistic, in which the interpretation ranges from -1 to 1, where 0 is no relationship, 1 is a perfect positive relationship, and -1 is a perfect negative relationship (Yule 1912).

3. PROBLEM STATEMENT

While previous research has addressed project manager competencies, a limited number of papers analyze the differences in key competencies between contract parties and industries, with none identifying correlation between competencies. As such, the primary goal of this paper is to identify the top competencies desired by organizations for Albertan construction project managers based on job posting requirements and qualifications, as well as to understand how these competencies differ based on construction contract role (owner, consultant, contractor) and industry (building, infrastructure, and industrial). Additionally, this study will look to identify correlation between competencies to gain an understanding of relationships between inclusion/exclusion of certain competencies in construction project manager job advertisements.

4. STUDY 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 Figure 1 below.
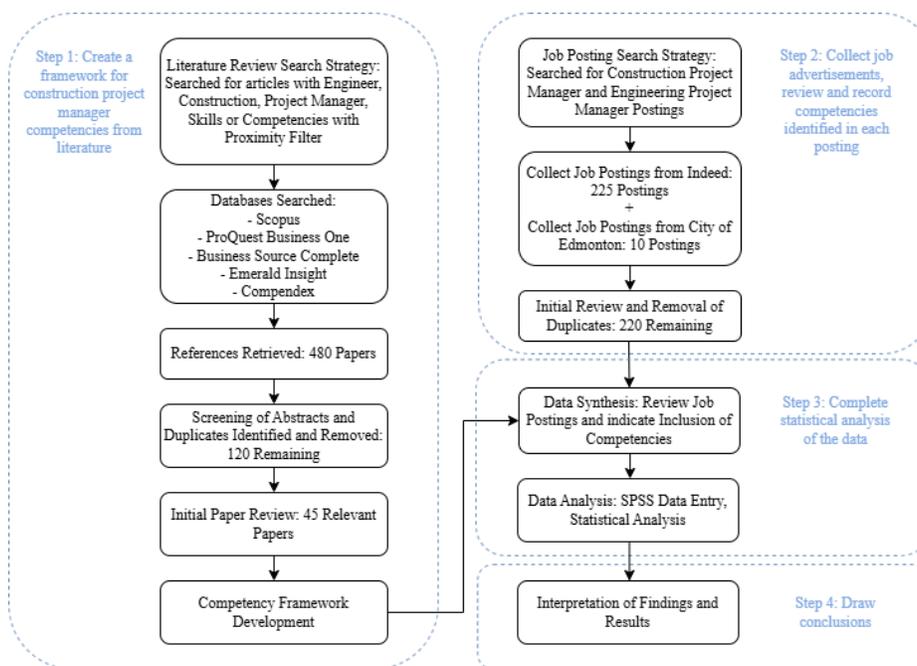

Figure 1: Study methodology flowchart

4.1   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 and McCaffer (2000), supplemented by additional information

from other literature. 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			

4.2   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 were removed, with 220 postings remaining for analysis.

4.3   Competency Review and Recording

A manual review of posting content was conducted, and information on competencies included (per the aforementioned framework) was recorded, in addition to the industry the position is associated with, as well as the contracting party the organization would assume in a traditional construction contract. Recorded data was coded into International Business Machines (IBM) Statistical Package for the Social Sciences 29

(IBM 2024) to undertake descriptive statistical analyses to identify the frequency of cited competencies, in addition to determining the phi coefficients between recorded competencies across all postings, and for postings related to each industry sector and contracting party. The Fisher Freeman-Halton test was used to test for significant differences among three variables (the parties and the industries). Significance was set at p less than 0.05 (Njuka and Phiri 2021) for the phi coefficient and Fisher Freeman-Halton test. Postings that include work across multiple industries had their competency information duplicated for each applicable sector when industry-specific analysis was conducted.

5. RESULTS AND DISCUSSION

The total number of postings collected was 220, with 23 owner, 61 consultant, and 136 contractor postings. As postings for multiple industries are counted as one posting for each industry for analysis, the total number of postings considered as part of each industry is 108 each for building and infrastructure projects, and 76 for industrial projects.

194 postings included requirements for prior related experience, with 26 not specifying requirements. 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. Figures 2, 3, and 4 illustrates the citation frequency of identified competencies from all collected job postings, as well as the citation frequency based on contractual party and industry, respectively.
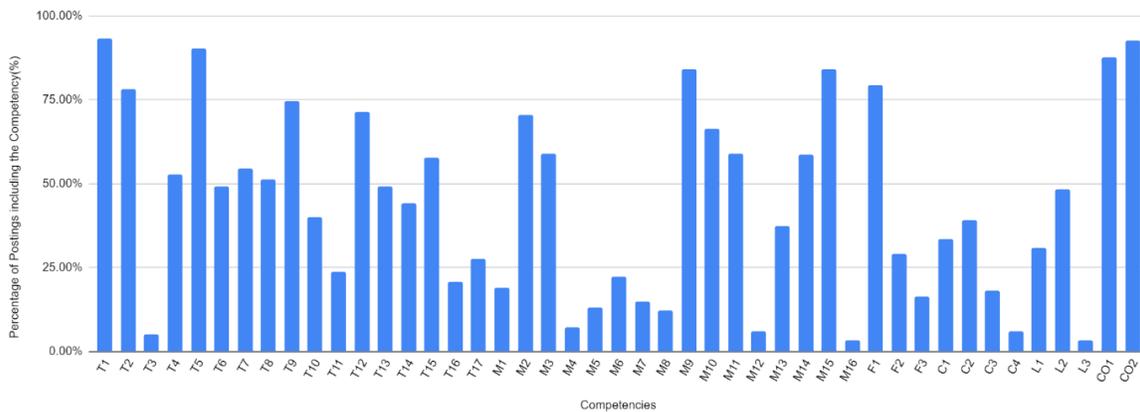

Figure 2: Frequency of competencies cited in all job postings
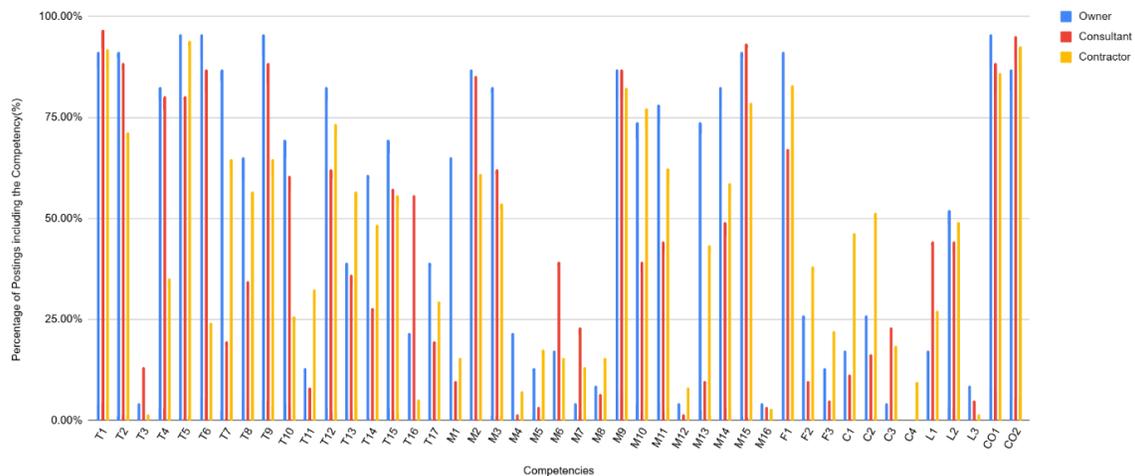

Figure 3: Frequency of competencies cited in postings per contractual party
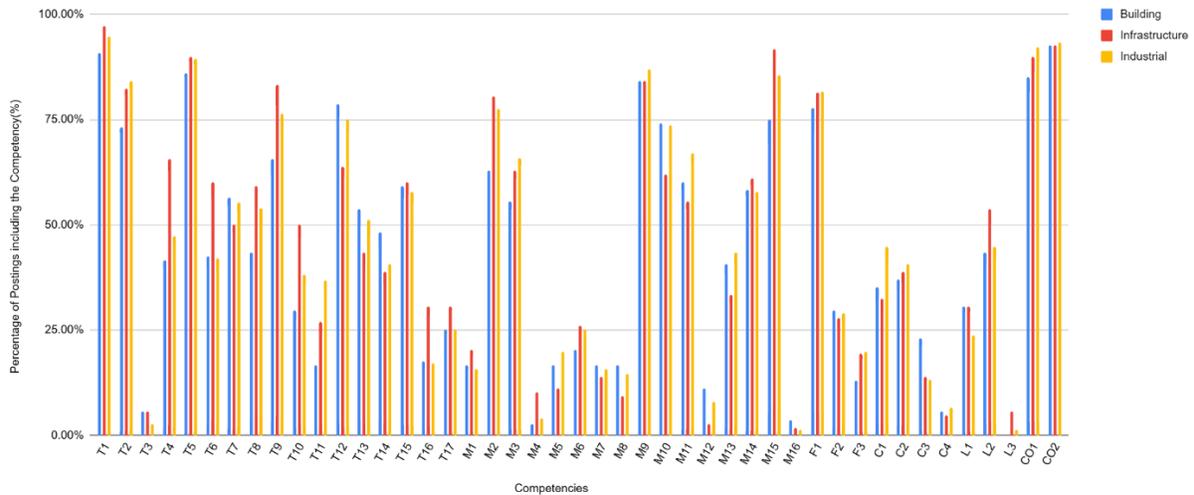
Figure 4: Frequency of competencies cited in postings per industry

Select results of the Fisher Freeman-Halton test are available in Table 2 below for analysis between the 3 contracting parties and industry groups.

Table 2: Select Fisher Freeman-Halton test values and significance to determine differences between contracting parties and industries

Competency	Contracting Party		Industry	
	Value	Exact Sig (2-sided)	Value	Exact Sig (2-sided)
T1	1.771	0.477	4.005	0.127
T7	47.024	<0.001*	1.008	0.609
T12	4.006	0.133	6.147	0.045*
T16	61.87	<0.001*	6.510	0.039*
M1	28.258	<0.001*	0.766	0.732
M9	0.659	0.757	0.292	0.895
M10	26.528	<0.001*	4.408	0.118
C2	24.511	<0.001*	0.285	0.886

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

Select phi coefficient values and significance across the various parties and industries are displayed in Table 3 and 4 below.

Table 3: 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 4: 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

The majority of job advertisements request 5-9 years of experience, with most recruiters requiring a degree or diploma. Contractor postings make up the majority of collected advertisements (136 out of the 220), which is reasonable given the number of established contracting companies compared to consultants and owners in Canada (Government of Canada, 2023). Regarding the different industries, building and infrastructure projects have the same number of postings used for analysis (108), though there are fewer industrial postings (76). This observation aligns with the Albertan industry market as the majority of construction employment is within the building and infrastructure sectors (BuildForce Canada, 2021).

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%), and stakeholder management (84.09%). This aligns with previous studies across different regions in the world, in which communications and planning, technical capabilities, team building, and stakeholder engagement are higher ranked competencies (Ahsan et al., 2013; Yap and Chow, 2020).

Competencies less frequently included across all postings are ones related to managerial traits and personal qualities (delegation, decision-making, motivation, independent worker, flexibility, ethics). The collected postings appear to focus on competencies directly related to tasks being executed, as opposed to traits that may facilitate performance of these activities. Most postings request candidates possess leadership (70.45%) and teamwork (84.09%) competencies, which aligns with the literature review as the role of a project manager is to lead and oversee teams in the achievement of objectives (Ahmed et al., 2021). Only 40.00% of total postings ask for project management knowledge. Postings tend to prioritize job experience, which would include prior exposure to project management work.

In general, competency citation frequency remains consistent considering different years of work experience. However, there is an increase in postings requiring legal competencies, particularly tender document drafting and contract interpretation, with increasing job experience. This is reasonable given the time required to gain familiarity with legal technicalities, as the majority of project managers possess a non-legal background. Time management and organization is more frequently cited with fewer years of experience, indicating the recruitment of newer project managers place higher importance in their ability to organize and prioritize activities.

Correlation analysis across all postings generally support findings from previous literature. There are a few competency pairings with strong relationships, typically within the same category, with the majority of statistically significant results indicating weak or no correlation. This result appears contradictory to what is observed in practice, whereby managerial, communication, and financial skills facilitate the execution of technical activities to ensure projects are planned for completion within specified timelines, cost, and quality requirements, while adhering to owner needs (Project Management Institute 2017). Results with higher statistical significance are expected between competency categories. There is a moderate positive relationship between oral and written communication competencies (phi = 0.338, p = <0.001). This is reasonable as most postings include requirements for both strong verbal and written communication competencies together (DNV, 2024). Postings from all other parties and industries also exhibit moderate to strong positive relationships for these two competencies. It is observed that leadership and teamwork has

no relationship across all job postings (phi = 0.154, p = 0.022). With the exception of infrastructure and owner postings, which has a weak positive relationship, building, industrial, consultant, and contractor postings also have no relationship. This is contradictory to existing literature, which indicates leadership of team members is a key responsibility for project management professionals (Ahmed et al., 2021).

Although there are many recent research studies on advanced topics such as Building Information Modelling (BIM) and Artificial Intelligence (AI) in construction, this study found only one posting specifically mentioning these competency requirements. This indicates that wide application of these technologies in construction is still in its infancy.

5.1   Results and Discussion by Contractual Party

Referring to Figures 2-4 above, owner postings require more competencies than other contracting parties, with technical and communication competencies most frequently referenced in job advertisements. This greater proportion of technical and managerial competencies requested is reasonable since the owner manages both contractor and consultant scopes of work (Forcada Matheu, 2005). Consultant job postings 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 in the provision of technical consultation services to meet client needs (Forcada Matheu, 2005). Contractor postings tend to also include select technical and managerial competencies, in addition to communication competencies. Given the number of sub-trades a contractor project manager is coordinating at one time, people management is key (Scalisi and Davis, 2024). The contractor's top competencies do not include the construction management competency (64.71%). Most of these postings highlight resource management, communication, stakeholder, budget, and quality competencies, which reflect the importance of managerial and communication competencies in meeting technical requirements related to project timeline, cost, and overall expectations. In lieu of citing a general requirement for construction management or contractor/sub-contractor management, postings tend to refer to specific activities undertaken by a contractor project manager that may facilitate planning, execution, and monitoring of construction activities.

Looking at the various parties, the Fisher Freeman-Halton values indicate that inclusion is dependent on contractual parties, and thus, the service being provided. Competencies that are not dependent on contractual parties are important for overall project management, including prior job experience, quality management, teamwork, and communication. Competencies included in owner postings possess phi coefficient values with larger magnitudes compared to that of consultants and contractors. This relates to the previous observation that owner postings include a greater number of competencies. However, due to the relatively small number of postings and the greater number of competencies, there are more instances in which phi coefficient values obtained for certain competencies indicate statistical significance that appears contradictory or cannot be easily explained. For example, having a valid driver's license exhibits strong significant relationships with HSE compliance (Phi = 0.586, p = 0.005) and estimating/quotation preparation (Phi = -0.460, p = 0.027), where one would not anticipate there being any relationship.

5.2   Results and Discussion by Industry

There is significant overlap between the top 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. Given the lack of significant differences, it can be inferred that competencies are generally transferable between industries, though application, and the knowledge type, 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 compared to building postings. All industries show significant positive relationships between both risk and issue management and various technical competencies (i.e. HSE, quality management). This is reasonable given the number of technical risks managed on construction projects (Ahmed et al., 2021).

6. CONCLUSION

The results provide project managers with an understanding of the competency profile sought by recruiters within the Canadian construction industry. In light of the construction industry's dynamic nature, this study confirmed that most postings do not seek knowledge or skill on novel technologies and computer systems at this time. Competency dimensions developed by previous researchers continue to be relevant and can be used in current assessment and selection of construction project managers. It can also be concluded that there is variation in competencies sought by recruiters seeking project managers to provide different services, though there is less of a difference in competencies required between industries. The latter indicates competencies are transferrable between construction fields. Moreover, relationships exist that influence the inclusion/exclusion of one competency in a posting based on the inclusion/exclusion of other competencies. These relationships can also differ based on contracting party and industry.

The top rated competencies listed in job advertisements are job experience, oral and written communication, work planning and scheduling/resource management, and stakeholder management. Competencies related to personal qualities are cited the least. In general, owner postings require more competencies compared to consultants and contractors. Technical and communication competencies are most cited for consultants, with select managerial and communication competencies most cited for contractors. Compared to competencies between contractual parties, there are considerably fewer instances where the competency citation frequency is dependent on construction industry.

Generally, correlation analysis results are in alignment with other findings from this paper, in addition to results from the literature review. Oral and verbal communication competencies are positively correlated for all postings, and across the different parties and industries. Postings for all industry breakdowns indicate positive relationships between risk and issue management and various technical competencies, supporting the significance of technical risk management in project delivery. Calculation of the phi coefficients also yielded values that are unexpected or are in conflict with literature findings.

Study results provide the opportunity for alignment of professional development goals with competency improvement to increase the attractiveness of project managers when seeking new opportunities. Findings can also be expanded to inform gaps between educational curriculum and industry requirements, as well as to understand changes in trends related to construction project manager competencies. Future research may analyze how competencies change between various stages of the recruitment process and may also address how modern advancements including BIM and AI impact future competency requirements. Additionally, future work may confirm the results and applications of this study in other regions with different economic and industrial conditions.

ACKNOWLEDGMENTS

REFERENCES

Abdelmasseh, R.M., Bassioni, H.A., Gaid, E.F., 2022. Project Manager Skills affecting Construction Projects in Egypt. *IOP Conference Series Earth and Environmental Science*, Cairo, Egypt, 1056: 012038.

Ahmed, R., Philbin, S.P., Cheema, F.A., 2021. Systematic literature review of project manager's leadership competencies. *Engineering, Construction and Architectural Management*, 28: 1–30.

Ahsan, K., Ho, M., Khan, S., 2013. Recruiting Project Managers: A Comparative Analysis of Competencies and Recruitment Signals from Job Advertisements. *Project Management Journal*, 44: 36–54

Akoglu, H., 2018. User's guide to correlation coefficients. *Turkish Journal of Emergency Medicine*, 18: 91–93.

BuildForce Canada, 2021. *Construction & Maintenance Looking Forward. 2021-2030 Highlights:*

Alberta. Ottawa.

DNV, 2024. *Associate Project Manager - Owners Engineering*. DNV Careers.

Edum-Fotwe, F.T., McCaffer, R., 2000. Developing project management competency: perspectives from the construction industry. *International Journal of Project Management*, 18, 111–124.

Forcada Matheu, N., 2005. *Life Cycle Document Management System for Construction (Doctoral Thesis)*. Universitat Politècnica de Catalunya, Barcelona.

Government of Canada, 2023. Summary - Canadian Industry Statistics: Construction. Ottawa.

Hadad, Y., Keren, B., Laslo, Z., 2013. A decision-making support system module for project manager selection according to past performance. *International Journal of Project Management*, 31: 532–541.

Hartono, B., Sulistyo, S., Umam, M., 2019. Leadership profiles of successful project managers in Indonesia. *Journal of Industrial Engineering and Management*, 12: 274

Hazra, A., Gogtay, N., 2016. Biostatistics series module 4: Comparing groups - categorical variables. *Indian Journal of Dermatology*, 61: 385

IBM, 2024. *IBM SPSS Software*. IBM Analytics.

Indeed, 2024. *About Indeed*. WWW Document.

Johnson, A., Winter, P.A., Reio, T.G., Thompson, H.L., Petrosko, J.M., 2008. Managerial recruitment: the influence of personality and ideal candidate characteristics. Journal of Management Development 27, 631–648.

Kim, H.Y., 2017. Statistical notes for clinical researchers: Chi-squared test and Fisher's exact test. *Restorative Dentistry & Endodontics*, 42: 152.

Loufrani-Fedida, S., Missonier, S., 2015. The project manager cannot be a hero anymore! Understanding critical competencies in project-based organizations from a multilevel approach. *International Journal of Project Management,* 33: 1220.

Mouchi, G., Rotimi, J.O., Ramachandra, T., 2012. The Skill Sets Required for Managing Complex Construction Projects. *Business Education & Administration,* 3: 89–100.

Müller, R., Turner, J.R., 2007. Matching the project manager's leadership style to project type. *International Journal of Project Management,* 25: 21–32.

Njuka, D.A., Phiri, J., 2021. Factors Influencing Social Media in Managing Corporate Reputation for a Christian Organisation in Developing Countries Based on the VT4 Model. *Technology and Investment*, 12: 66–81

Pieterse, B., Agyekum, K., Manu, P., Mohandes, S.R., Cheung, C., Yunusa-Kaltungo, A., 2024. Examining critical project management skills for successful delivery of major maintenance projects: insights from the United Kingdom energy sector. *Engineering, Construction and Architectural Management*, 31: 1556–1584.

Project Management Institute, 2017. *A Guide to the Project Management Body of Knowledge, 6th ed*. Project Management Institute, Newtown Square.

RMIT University, 2023. *The role of a project manager in construction*. WWW Document. RMIT University Blog.

Safa, M., Sabet, A., MacGillivray, S., Davidson, M., Kaczmarczyk, K., Haas, C.T., Gibson, G.E., Rayside, D., 2015. Classification of Construction Projects. *International Journal of Civil, Environmental, Structural, Construction and Architectural Engineering*, 9.

Scalisi, T., Davis, B., 2024. *Types of Subcontractors in Construction*. Procore Technologies Library.

Stiegler, S., 2019. *Parties to a Construction Contract, in: The Guide to Construction Arbitration – Third Edition*. Law Business Research.

Wang, C.M., Xu, B.B., Zhang, S.J., Chen, Y.Q., 2016. Influence of personality and risk propensity on risk perception of Chinese construction project managers. *International Journal of Project Management*, 34: 1294–1304.

Yap, J.B.H., Chow, I.N., 2020. Investigating the managerial '"nuts and bolts"' for the construction industry. *Built Environment Project and Asset Management,* 10: 331–348.

Yule, G.U., 1912. On the Methods of Measuring Association Between Two Attributes. *Journal of the Royal Statistical Society,* 75: 579