An In-Depth Study Of Project Management In Construction Services Engineering: Focus On Hong Kong

1st Ren Ran, 2nd Aiman Al-Odaini

Abstract

With a specific focus on the impact of green building standards, this study presents an extensive assessment of project management in hong kong's construction services engineering industry. Distinctive issues with efficiency, sustainability, and quality arise in hong kong's construction sector due to the city's increased population density, rigid rules, and significant dependence on massive infrastructure projects. The purpose of this study was to specify how construction services engineering outputs are affected by project management methods especially by the incorporation of green building standards like beam plus. The study was performed using a quantitative approach and responses were gathered from different professional groups using stratified sampling. Using spss version 25, the researcher analysed 449 authentic responses. To ensure reliability and detect significant associations, the researcher used descriptive statistics, anova and factor analysis. The results showed that green building requirements were significantly associated with more profitable construction services engineering. Additionally, the implementation of green standards had the impact of enhancing collaboration across interdisciplinary teams which in turn led to a decrease in disputes and an improvement in adherence with rules. In spite of these benefits, there were a number of challenges that were noted including high costs, the demand for professional training, and resistance to organisational change. The majority of respondents believe that green building standards provide the groundwork for innovation, sustainability and the accomplishment of success in projects over the course of a longer period of time. Findings from the research highlight the significance of strong institutional backing, ongoing professional development and superior project management to accomplish complete integration of green standards within the construction services engineering industry of hong kong.

Keywords: green building standards; hong kong; construction services engineering; beam plus; project management.

1. Introduction

The construction sector drives development in many countries. It brings together several distinct but connected areas of study, such as the industrial and automotive industries and is therefore crucial to the development of other parts of the economy. Compared to other sectors, it depends more on physical work, which means it creates more employment and stimulates the economy. Most nations' major budgetary assessments have recognised their final position in contributing to gross domestic product (gdp) (vakhovych & demianenko, 2020). This sector can significantly influence global economic growth. Thus, it is essential that all ingredients, operations, and procedures be well managed. An efficient system of monitoring and evaluation can accomplish this by registering and assessing the project's development at each stage. For this reason, in modern times, determining a project's success or failure relies on project management as much as on technical processes. To ensure success at every stage of a project's life cycle, project management is essential in the construction services engineering sector, which is difficult and costly to manage. Over the years, hong kong businesses have earned recognition for their exceptional quality and rapidity in constructing residential buildings and office towers. With its inventive use of specialised techniques, such as design-and-build systems and water reclamation, hong kong has emerged as a leader in the region's construction industry. Hong kong's engineering industry is involved in the provision of amenities to its

neighbouring countries particularly mainland china. Engineering consulting, project management and construction are some of the most prevalent types of engineering services that are being provided to other countries at present (xu et al., 2020). To meet the growing need for construction workers and the growing population, big infrastructure, transportation and real estate projects are adopting new technologies and grade certifications including green building standards, building information modelling and many more. Due to rules and aspirations for digital transformation, innovative, eco-friendly and stable construction methods have also acquired an extensive amount of funding from both public and private sources.

2. Background of the study

The construction services engineering sector is an essential factor in the global economy because of the vital infrastructure it supplies, which in turn helps with urbanisation, industrialisation, and social advancement. Project management has become increasingly significant in this market due to the high volume of large-scale efforts. These initiatives usually include multiple stakeholders, substantial expenditures and complex technological needs. The hong kong design and construction sectors place a high value on punctuality. Consultant prices must be kept low for construction consultation companies to remain competitive and attract customers in the face of fierce and ongoing rivalries for fresh endeavours (anson et al., 2021). A problem whose long-term effects are opaque is hampering hong kong's building expansion. It is common for there to be misunderstandings about the building's structural, architectural and service designs. It could be difficult to fix this. It is common for the different construction systems to not be integrated and coordinated while the design process is commencing. Therefore, hong kong provides a distinctive framework in which to examine these shifts. Project managers working in the construction business in the city face a variety of challenges and possibilities as a result of the city's dense population, lack of usable land, and intense regulatory scrutiny. It is essential to have an adequate grasp of the project management practices of construction services engineering, especially in the hong kong region in light of the aforementioned features. As a profession that is experiencing fast change, engineers, legislators and contractors may find it helpful to have a better understanding of the positive and negative aspects of project management as well as the most current developments in the field.

3. The piano, as a popular and all-ages musical instrument,
4. Is particularly important in the future development of art teaching in colleges and universities. The
5. The introduction of multimedia technology into piano teaching in colleges and universities is an important
6. Means to meet the needs of art teaching in the current era
7. The piano, as a popular and all-ages musical instrument,
8. Is particularly important in the future development of art teaching in colleges and universities. The
9. The introduction of multimedia technology into piano teaching in colleges and universities is an important
10. Means to meet the needs of art teaching in the current era

3. Purpose of the research

This study aims to perform a detailed examination of project management within the domain of construction services engineering in the hong kong region. Due to its rigid regulations and intense competition, the construction industry encounters distinctive economic and quality challenges. This research sought to define the optimal project management strategies for addressing these requirements. The research also aimed to investigate many distinctive features

of the hong kong construction sector. Research indicated that the industry was heavily controlled by stringent construction rules, operated in a context influenced by population increase, and relied particularly on large-scale infrastructure projects. Additionally, the study evaluated the advantages and disadvantages of the existing methods, pinpointing potential areas for enhancing innovation and sustainability. The research aims to present understandings that might help to improve project results by assessing the strengths and limits of current approaches. The research was developed to assist decision-makers, project managers, and specialists in the field in designing projects that include best practices more effectively and have more streamlined processes. The study's overarching goal was to promote more efficient, environmentally friendly, and quality-driven project management procedures in the hong kong construction industry.

4. Literature review

According to the findings of the study, sustainability is now one of the most important issues of those who oversee building projects. Within the scope of a systematic examination that discovered sustainability evaluation, sustainable project management, and sustainable construction drivers, the importance of lifespan perspectives and ongoing assessment was brought to light. The literature highlights the growing impact of complexity management and new technologies on construction services engineering in hong kong (bao et al., 2020). More recent investigations have examined the use of robotic cybersecurity systems, artificial intelligence and machine learning for project monitoring, cost prediction, and risk detection. These technologies can only reach their maximum potential when they are included in specified project management systems. Green building standards are becoming increasingly important for hong kong's construction services engineers because they establish guidelines for how much energy is used, how the interior of a building ought to appear, and how to design a system that is useful for the environment. The beam plus grading method is the most common way to rate both new and ancient buildings. Research demonstrates that these standards have a direct effect on how engineers design and run the hvac, lighting, plumbing, and other systems in a building (li et al., 2021). A study on the subject discovered that the procedure was hard since it cost a lot to add green features and it was hard to use them on developing services. Even though many developers recognised the benefits of utilising beam plus implementing it was difficult. Another study that used the analytical structural approach found that the most significant barriers to success were a lack of stable government backing and the fact that service engineering technology was not up to par. Even though the government offered incentives to get people to accept it, this was the situation (huang et al., 2021). Furthermore, the government must take the initiative in establishing a framework that ensures the ongoing maintenance of sustainability standards following development. Regarding the huge number of government-owned properties, it is clear that the government wields considerable influence over the construction industry and can impose its will on facilities under its purview. Public buildings include locations for learning and healthcare, as well as housing, government offices and other community centres (wang et al., 2024).

5. Research questions

What is the impact of green building standards on construction services engineering in hong kong?

6. Research methodology

6.1 Research design

This study examined aspects of construction services engineering project management using a quantitative research technique. In order to analyse the data, spss version 25 was used. We employed descriptive statistics to summarise demographic and project-related characteristics. Probability ratios with 95% confidence intervals and other inferential statistics were used to determine the direction and intensity of the associations. Statistics was deemed significant when $p < 0.05$. The researcher used analysis of variance (anova) and factor analysis to confirm the findings and identify statistically significant differences between the groups.

6.2 Sampling

According to raosoft's sample size calculation, 435 people should be included in the study. 600 surveys were distributed evenly throughout different strata in order to decrease the rate of non-response. There were 482 responses in all. Since 34 replies were either missing information or were deemed invalid, the final valid sample size was 449 respondents.

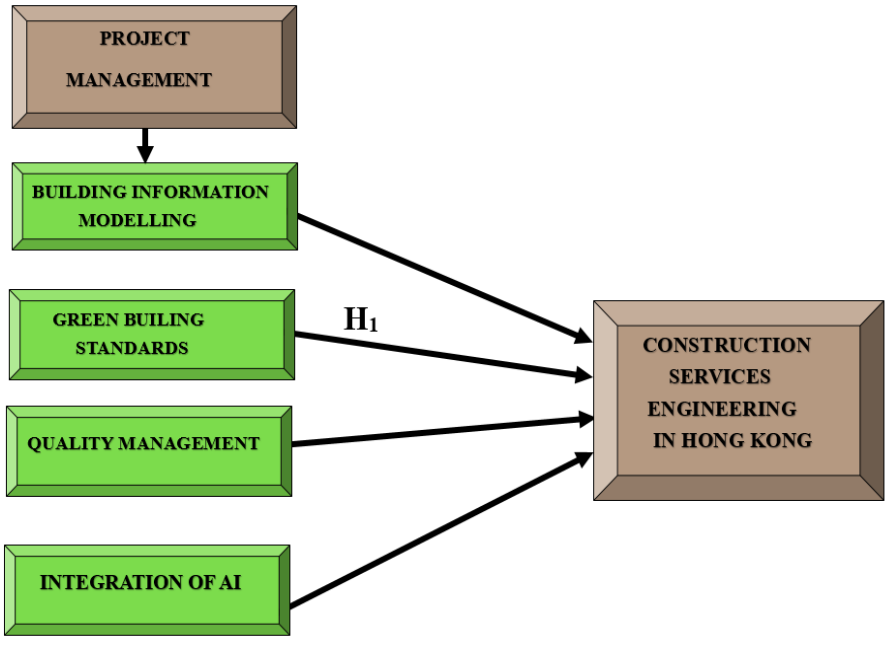
6.3 Data and measurement:

Surveys using pre-designed questions were the main tool for data collection. (a) respondents were requested to provide basic personal and occupational information, and (b) their opinions on several project management features were gauged using a five-point likert scale. Using stratified sampling, we were able to ensure that every project type and job function was represented. The secondary material required to complete the inquiry was sourced from academic journals, corporate reports, and online sources.

6.4 statistical software: the statistical analysis was performed using spss 25 and microsoft excel.

6.5 statistical tools: the researcher used descriptive analysis to characterise demographic and project-related factors across strata. Analysis of variance (anova) for stratum comparison, odds ratios with 95% confidence intervals (cis), and factor analysis for measurement reliability and concept validation were all inferential statistical approaches used.

7. Conceptual framework



8. Result

- **Factor analysis**

To ensure the accuracy of a measurement set's latent component structure, factor analysis is often used. Latent factors can influence the outcomes of quantifiable variables. A test of the accuracy of the model using financial models (fa). It lays forth the chain of events that led to the observed outcomes, including the hidden causes and measurement errors. Predicting whether data is suitable for factor analysis is the job of the kaiser-meyer-olkin (kmo) test. In order to ensure accurate sampling, the model and all of its variables are examined. Multiple variables' shared variance may be quantified using statistics. When working with smaller percentages, factor analysis yields the best results. There is a 0–1 range that kmo produces. A kmo score between 0.8 and 1 indicates that the sample is sufficiently representative. The sample is inadequate and steps must be taken to rectify the situation if the kmo result is less than 0.6. Some writers choose 0.5. Meyer-kaiser-olkin co. When compared to partial correlations, overall correlations with a value near to 0 are weak. Component analysis is made more difficult by significant correlations. Kaiser's requirements for approval: the acceptability limits set by kaiser are between 0.050 and 0.059. Low quality: 0.60 to 0.69; average quality: 0.70 to 0.79. Value of quality points: 0.80 to around 0.89. Notable values will fall between the range of 0.90 and 1.00.

Table1: kmo and bartlett's test

Testing for kmo and bartlett's

Sampling adequacy measured by kaiser-meyer-olkin .891

The results of bartlett's test of sphericity are as follows:

Approx. Chi-square = 3252.968

Df = 190

Sig =.000

Table 1: KMO and Bartlett's

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.891
Bartlett's Test of Sphericity	**Approx. Chi-Square**	3252.968
	df	190
	Sig.	.000

In particular, this permits claims to be made in order to facilitate sampling. The significance of the correlation matrices was examined by using bartlett's test of sphericity. At 0.891, the kaiser-meyer-olkin test indicates that the sample is sufficient. The p-value from bartlett's sphericity test is 0.00. With a positive result from bartlett's sphericity test, the correlation matrix cannot be considered an identity matrix.

❖ **Independent variable**

- **Project management:**

Measurement and evaluation of project performance is an important component of project management's responsibilities. Successful construction projects need a careful evaluation and quantification of all appropriate activities, resources and processes. In the construction sector, project management is defined as the procedure of planning and executing a project in a way that maximises performance, efficiency, grade, and commitment to budget. One must have project management in place for several reasons. The main benefit is that it keeps projects on track and on budget while also making them work better overall. Project supervisors may make sure that everything goes well throughout a project by carefully planning, carrying out, and considering how to find and eliminate any risks (gunduz & almuajebh, 2020). Construction project management is the term used to explain the operation of managing construction endeavours. What sets mission-based projects apart from all other types of projects is the concept of construction project management itself. When the construction of a project is complete, the planning phase ends. Construction project management may engage with a wide range of disciplines during a project's lifespan, including design, engineering, government work, city planning and much more. Construction project management combines the expertise of a standard project manager with the skill and speed of the construction sector. Therefore, building project managers need multiple skills to handle various teams, several stakeholders, mountains of paperwork, and demanding deadlines.

❖ **Factor**

- **Green building standards:**

Buildings have significant effects on the environment, both directly and indirectly. Buildings use energy, water, and natural resources, create waste, and release potentially harmful air pollutants at each phase of their life cycle, from construction to occupancy, remodelling, reuse, and deconstruction. To deal with these facts, green building standards, certifications, and rating systems were created to make sure that buildings do not negatively impact the environment as much as they do when they are being built. Sustainable, efficient building enterprises can find aid in the market's plentiful grading and certification programmes as well as standards to direct, showcase and record their progress (sapuan et al., 2022). Numerous green product certifications are in use across the globe and this trend shows no indications of slowing down. Additionally, there are rating programmes for green buildings in use worldwide. These programmes vary in their policy. Some furnish prerequisites and optional credits; others are more prescriptive and yet others propose performance-based conditions that can be met in various ways for various products and project types. Green building codes are continually being established and adopted around the globe to raise the benchmark for sustainable and efficient building practices. There are two main types of codes: prescriptive and performance. The latest kind of code that is growing more popular is called outcome-based. When it comes to following the rules, the cautious, quick, and definitive prescriptive path is the sole one that matters. There are specific quantities of materials and tools that must be satisfied. Performance-based codes are not limited to looking at the needs of individual parts as they try to achieve bigger goals. For example, outcome-based codes ensure that the completed structure consumes energy at a predetermined level by establishing a target and requiring that energy use be measured and reported.

❖ **Dependent variable**

- **Construction services engineering in hong kong:**

Construction services engineering is centred around developing, installing, running, and maintaining systems that keep buildings and infrastructure safe, functional, productive, and

comfortable. It combines construction, project management, and technology to deliver construction services including water, power, air conditioning, fire alarms, lifts, and data networks. This comprises networks for healthcare, communication, and security; mechanical services like water supply, fire alarms, and lifts; and electrical infrastructure like power control, lighting, emergency backup, and smart management. With so many high-rises, massive infrastructure projects and rigorous rules in hong kong, construction services engineering's primary goal is to guarantee the safety, convenience and efficient operation of all involved. The construction industry in hong kong is characterised by a high degree of outsourcing, a small number of major local contractors and an abundance of enterprises that serve as both contractors and developers. Hong kong's construction industry cannot be considered very large with only about 11.5 employees per company on average (zhou et al., 2021). Typically, larger companies serve as public contractors while smaller ones are hired as subcontractors. They have the resources to take on complex projects that require a lot of money and machinery and several big construction firms are also growing their operations in the region. In addition to providing a technical foundation for building performance, construction service engineering is essential for the innovation, sustainability and longevity of hong kong's construction industry.

- **Relationship between green building standards and construction services engineering in hong kong:**

Buildings account for the majority of hong kong's energy, water, and material consumption. Annually, buildings account for around 60% of carbon dioxide emissions and 90% of the city's electricity consumption. To manage this, the city has placed forth beam plus, a rigid set of green certification standards created by the hong kong green building council (hkgbc) as part of the hong kong environment bureau's climate action plan 2030+. This plan's purpose is to reduce carbon emissions by 65–70% by 2030, compared to levels in 2005. More than 1,600 buildings and construction projects in hong kong have the highly desirable beam plus certification (ludovice et al., 2025). To attain this designation, builders have to satisfy strict performance standards that cover a wide range of sustainability issues, from the initial setup and planning to the ongoing function and maintenance of the building. This method evaluates a building's performance over its whole life which is both accurate and honest. Due to its extensive set of performance standards, the standard is both highly adaptable and effective as it calculates carbon emissions from buildings in ways that other green building standards overlook. In particular, the majority of carbon emissions from assimilation occur during construction and account for 30–40% of a building's total lifecycle emissions. All carbon emissions from incomplete buildings can be recognised and reduced (chau et al., 2024).

Based on the preceding discussion, the researcher developed the following hypothesis to examine the impact of green building standards on construction services engineering in hong kong:

- ***"h_{01}: there is no significant relationship between green building standards and construction services engineering in hong kong."***
- ***"h_1: there is a significant relationship between green building standards and construction services engineering in hong kong."***

Table 2: H_1 ANOVA Test

ANOVA					
Sum					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	38472.358	126	3115.206	997.185	0.000
Within Groups	987.235	322	3.124		
Total	39459.593	448			

Substantial findings are derived from this investigation. There is statistical significance below the.05 alpha level as indicated by the f value of 997.185 and the p-value of.000. This signifies that the ***"h_1: there is a significant relationship between green building standards and construction services engineering in hong kong"*** is accepted, and the null hypothesis is rejected.

9. Discussion

The research's findings demonstrate a positive relationship between engineering for construction services in hong kong and green building standards. The findings highlighted the significance of standards like beam plus in enhancing project results. Projects that conformed to these standards showed more elevated levels of compliance with regulations, greater environmental quality and enhanced energy efficiency. Green standards also helped construction services engineers improve hvac design, lighting, water systems, and waste management, which contributed to reduced waste, enhanced efficiency in the building, and minimised environmental impact. Additionally, standards facilitated communication and cooperation across various engineering teams which reduced disagreements throughout the planning and building processes. The study shows that there are still problems to solve even if attaining green certification is an admirable objective. When it comes to putting beam plus and similar standards into action, many people are worried about the expenses of advanced technology, system changes, and training personnel. Despite these challenges, the majority of respondents said that green building standards provide a regulated framework that encourages innovation, improves teamwork, and raises long-term success. With this framework in place, project teams can better follow strict regulations, which makes things safer and more comfortable and saves money in the long run.

10. Conclusion

The study discovered that green building standards have a big effect on how well and efficiently hong kong's construction businesses do their engineering work. Researchers discovered that when interdisciplinary teams used frameworks like beam plus along with other construction-related elements, they were better able to manage energy efficiency and environmental quality, enhance system design and work together. In today's highly regulated and competitive construction industry, project managers must follow these guidelines to enhance sustainability, meet strict compliance standards and create environments that are safer and healthier. Construction services engineering involves more than simply technical delivery. Because of green building requirements, it is now an increasing component of the process that promotes innovation, environmental responsibility, and long-term resilience. Standards like beam plus are beneficial in establishing clear requirements in areas like energy systems, indoor air quality, water management and reducing waste. Engineers and project managers can collaborate on equal terms by using these frameworks as a guide. Certification additionally makes sure that the construction process is consistent and that everyone is accountable by providing structured

feedback at each stage of a project. The study's results indicate that to fully incorporate these standards into daily practice, enhanced emphasis on training, technological advancement and organisational change is essential.

References

1. Anson, M., Chiang, Y. H., Lam, P. T., & Shen, J. (2021). 25 Years Of Hong Kong Construction Industry Progress 1995–2019. In *Construction Industry Advance And Change: Progress In Eight Asian Economies* (Pp. 19-41).
2. Bao, Z., Lee, W., & Lu, W. (2020). Implementing On-Site Construction Waste Recycling In Hong Kong: Barriers And Facilitators. *Science Of The Total Environment*, 141091.
3. Chau, K. W., Huo, D., & Liusman, E. (2024). Non-Institutional Factors That Contribute To The Green Building Premium. *Land*.
4. Gunduz, M., & Almuajebh, M. (2020). Critical Success Factors For Sustainable Construction Project Management. *Sustainability*, 1990.
5. Huang , B., Lei, J., Ren, F., Chen, Y., Zhao, Q., Li, S., & Lin, Y. (2021). Contribution And Obstacle Analysis Of Applying Bim In Promoting Green Buildings. *Journal Of Cleaner Production*, 123946.
6. Li, Y., Rong, Y., Ahmad, U., Wang, X., Zuo, J., & Mao, G. (2021). A Comprehensive Review On Green Buildings Research: Bibliometric Analysis During 1998–2018. *Environmental Science And Pollution Research*, 46196-46214.
7. Ludovice, N. P., Matus, K., Redonnet, S., Zeng, X., Zhang, Y., Loh, E., . . . Chow, J. (2025). Towards A Holistic And Reflexive Assessment Of Green Buildings And Technological Landscapes In Hong Kong. *Energy Research & Social Science*, 104235.
8. Sapuan, N., Faizah, H., Kumaran, V., & Saudi, N. M. (2022). Green Building Best Practices In Achieving Energy And Environmental Sustainability. *Environmental Management And Sustainable Development*, 74-92.
9. Vakhovych, I., & Demianenko, O. (2020). Factors Affecting The Cost Of Engineering Services In Construction. *Bulletin Of Vn Karazin Kharkiv National University Economic Series*, 97-107.
10. Wang, C., Che, Y., Xia, M., Lin, C., Chen, Y., Li, X., . . . Fan, G. (2024). The Evolution And Future Directions Of Green Buildings Research: A Scientometric Analysis3. *Buildings*, 345.
11. Xu, Z., Zayed, T., & Niu, Y. (2020). Comparative Analysis Of Modular Construction Practices In Mainland China, Hong Kong And Singapore. *Journal Of Cleaner Production*, 118861.
12. Zhou, J., Shen, G., Yoon, S., & Jin, X. (2021). Customization Of On-Site Assembly Services By Integrating The Internet Of Things And Bim Technologies In Modular Integrated Construction. *Automation In Construction*, 103663.