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Identifying Critical Success Factors in Implementing Green Building, Case Study: Medium-sized Construction Companies in East Java, Indonesia

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ABSTRACT

The construction industry is a significant consumer of natural resources and a contributor to environmental issues and ecological instability. This has led to the emergence of sustainable programmes (green construction) which aim to minimise the impact of development projects. The objective of this study is to identify the critical success factor in implementing green construction and to the extent of familiarity among middle-sized companies in the province of East Java with the implementation of green construction projects and to ascertain the factors that affect the success of such projects. The case study subjects are four medium-sized construction companies in East Java that have experience in implementing green building projects. The data obtained will be analysed on mean using IBM SPSS software on each variable. The results will identify the top five critical success factors based on questionnaires distributed to respondents. The findings of critical success factors are as follows: Integrated planning and/or design, Adequate project funding sources (smooth payments), Classification/capabilities of implementing contractors, Effective communication among stakeholders, Competence and experience of the project manager, and last critical success factor is Applicable policies/regulations regarding green construction. These findings are expected that this research will contribute to a deeper understanding of the critical factors that influence success in implementing green construction projects.

Keywords: critical success factors; green construction; mean; medium-sized contractor; questionnaire.

INTRODUCTION

As observed by the United Kingdom Green Building Council and documented in Shan et al. (2020), at least 400 million tons of materials are utilized annually, a significant portion of which has a detrimental impact on the environment. Similarly, in the United States, the United States Environmental Protection Agency has reported that industrial construction generates 160 million tons of non-industrial waste annually, representing approximately 25% of the total non-industrial waste. In order to address this issue, experts have advocated for the implementation of green building-based development in recent years. In this context, green building (and sustainable building) is defined as a methodology for the efficient utilisation of resources throughout the entire lifecycle of a building(Shurrab et al., 2019; Singh & Singh, 2023). Green construction, in contrast, is more specific in that it concerns the question of how to deal with materials that have appropriate values and specifications (Liu et al., 2022).

The preceding research by Kumar and Tawalare (2021) on the implementation of green building in India provides a foundation for this study. The researchers were interested in the growing demand for residential buildings resulting from high levels of urbanisation. In this study, the researchers identified 20 significant factors influencing the implementation of green building in India. The top five ranking factors were: The following factors were identified as significant impediments to the implementation of green building in India: Lack of public awareness about green building technology, Unfamiliarity with green technology, Resistance to change from conventional construction methods, Conflict of interest among various stakeholders in adopting green technology, and Lack of government incentives.

A previous study conducted by Shan et al. (2020) focused on companies with limited market capitalisation and examined only the Singaporean context. In this journal, the results of the ten most significant determinants of success were obtained. These were: "workforce with experience in carrying out green building construction projects", "incentives/subsidies provided by the government", "senior management support", "return on investment", "committed to change behaviour", "effective communication between stakeholders on objectives for sustainable construction" "early contractor involvement", "involving experts with good knowledge of green building construction", "cost control" and "project manager competence". The results indicate that small contractors face significant challenges in terms of technical, cost, and human resources, which are likely to be more pronounced in larger companies.

In a similar vein, the Indonesian government responded to this by issuing a number of regulations. One such regulation was issued by the Ministry of Public Works and Housing in Ministerial Decree (Kementrian PUPR RI, 2015), which regulates all aspects of green building construction, including the definition, philosophy, objectives and implementation of such construction.

The researcher identified a gap in previous studies. Given the differing responses and outcomes observed across regions, this research aims to identify the critical success factors in implementing green construction, as perceived by respondents, namely large contractors in East Java. These contractors have previously been investigated regarding their experience in implementing green construction projects. The object of this current research is the large classification of contractor companies in the province of East Java, Indonesia, who are known to frequently undertake green construction/green building projects. The objective of this research is to enhance the understanding of the critical factors that impact the success of implementing green construction projects.

RESEARCH METHODS

Materials

As previously stated, this research was conducted by way of a case study of a mid-sized construction company. This was done for the purpose of gaining insight into the perspective of green construction from the standpoint of middle-class contractors, with a particular focus on those in the East Java province. The selection of respondents was conducted using the purposive sampling method, which entails identifying and selecting specific individuals who have experience with green construction methods. Four middle-class construction companies were selected for inclusion in this study. The medium-sized contractors in the province of East Java, Indonesia in this research which are registered with GAPENSI (Indonesian National Construction Implementation Association) which are 37 companies. According to Article 11, paragraphs 1(e) and 1(f), and paragraphs 2(e) and 2(f) (Lembaga Pengadaan Jasa Konstruksi Nasional, 2013), a construction company can be classified as medium-sized if it has a net worth of Rp. 500,000,000 for medium-sized 1 or more than Rp. 10,000,000,000 for medium-sized 2, or if it has completed projects with a total cumulative value of more than Rp. 10,000,000,000 in the last 10 years (Lembaga Pengadaan Jasa Konstruksi Nasional, 2013).

Purposive sampling is a statistical technique that reduces the number of variables in a dataset by identifying and eliminating those that are correlated with each other. This process results in a new set of variables that are smaller and independent of each other (Bakkalbasioglu, 2020). In other words, purposive sampling is employed to select specific variables with the objective of maximizing the probability of obtaining the phenomenon or results in question (Serra et al., 2018). Following the acquisition of the number of respondents, the subsequent stage is the formulation of the critical success factor variables through the administration of a questionnaire, which is based on analogous preceding studies, and Table 1 presents the compiled variables.

Table 1. Critical Success Factors Variables

No.	Variabel	Source
A.	**The Details of The Project are a Critical Success Factor**	
A1.	Project Location	(Al-Hosani & Rashid, 2021)

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No.	Variabel	Source
A2.	Integrated planning and/or design	(Prameswari et al., 2021; Shan et al., 2020)
A3.	The project's level of achievement (goals) for green buildings are clear and realistic	(Al-Hosani & Rashid, 2021; Prameswari et al., 2021)
A4.	Clear and consistent green construction implementation contract specifications	(Prameswari et al., 2021)
A5.	Adequate project funding sources (smooth payments)	(Al-Hosani & Rashid, 2021; Prameswari et al., 2021)
A6.	Availability of green construction/green building pilots	(Al-Hosani & Rashid, 2021; Prameswari et al., 2021; Shan et al., 2020)
B.	**Procurement Capability is a Critical Success Factor**	
B1.	Procurement with an integrated and effective green concept	(Al-Hosani & Rashid, 2021; Prameswari et al., 2021; Shan et al., 2020)
B2.	Classification/capabilities of implementing contractors	(Prameswari et al., 2021)
B3.	Availability and accuracy in selecting environmentally friendly quality materials	(Al-Hosani & Rashid, 2021; Prameswari et al., 2021)
B4.	Competent provision and supply of innovative technologies	(Al-Hosani & Rashid, 2021; Prameswari et al., 2021)
B5.	The owner/client's ability to make decisions	(Prameswari et al., 2021; Shan et al., 2020)
C.	**The Project Management System is a Critical Success Factor**	
C1.	Effective communication among stakeholders	(AbuMoeilak et al., 2023; Al-Hosani & Rashid, 2021; Prameswari et al., 2021; Shan et al., 2020)
C2.	Effectiveness of scheduling and minimal changes	(Al-Hosani & Rashid, 2021; Prameswari et al., 2021)
C3.	Optimal cost management and allocation	(Prameswari et al., 2021; Shan et al., 2020)
C4.	Commitment to the success of green construction / green building by stakeholders	(Al-Hosani & Rashid, 2021; Shan et al., 2020)
C5.	Effective and optimal allocation of resources	(Al-Hosani & Rashid, 2021)
C6.	Effective risk management (disasters and waste).	(Al-Hosani & Rashid, 2021; Prameswari et al., 2021)
C7.	Top management/senior management support	(Prameswari et al., 2021; Shan et al., 2020)
C8.	Involvement of experts in evaluation and guidance during the green construction implementation stage	(Al-Hosani & Rashid, 2021; Prameswari et al., 2021; Shan et al., 2020)
D.	**Human Resource Competency is Critical Success Factor**	
D1.	Competence and experience of the project manager	(Prameswari et al., 2021; Shan et al., 2020)
D2.	Involve project staff in green building training (competency certification)	(Al-Hosani & Rashid, 2021; Prameswari et al., 2021; Shan et al., 2020)
D3.	Effective selection and coordination of subcontractors	(Al-Hosani & Rashid, 2021)
D4.	Effective monitoring and allocation of workforce	(Al-Hosani & Rashid, 2021)
D5.	Commitment to change workforce habits to support the implementation of green construction	(Prameswari et al., 2021)
D6.	Owner/client involvement and/or demands during the project	(Shan et al., 2020)
E.	**The External Factors Critical Success Factor**	

No.	Variabel	Source
E1.	Economic, social, political and cultural stability of the country	(Al-Hosani & Rashid, 2021)
E2.	Applicable policies/regulations regarding green construction	(Nwogu & Emedosi, 2024; Prameswari et al., 2021; Shan et al., 2020)
E3.	Assistance in the form of subsidies from the government	(Shan et al., 2020)
E4.	Public awareness of green construction/green building projects	(Shan et al., 2020)

Methods

This research is classified as quantitative research, employing medium-sized contractors in East Java as respondents. The objective is to identify the critical success factors in implementing green construction in green building projects that have been carried out. According to Sarmanu (2017) a quantitative research study is an investigation designed to evaluate the veracity or falsity of a previously validated theoretical framework. In contrast, quantitative research is defined as a method of inquiry that employs statistical analysis and hypothesis testing to analyze data obtained from survey results, as outlined by another source (Prof. dr. Sugiyono, 2011). Given the limited number of middle-class contracting companies with experience in implementing green construction projects, the analysis method employed is a straightforward approach, namely mean value analysis.

The mean, also referred to as the average, represents the most commonly utilized statistical analysis technique to ascertain the central tendency of the results derived from a data set. The mean is calculated by summing the values observed in a data set and then dividing this total by the number of data points (Ghozali, 2016). The results of the mean analysis will be selected according to the magnitude of the mean value obtained for each critical success factors variable, with the highest ranking given to the factor with the highest mean value and the lowest ranking given to the factor with the lowest mean value.

Data Analysis

In light of the preceding discussion on literacy, the numerical data obtained from the questionnaires will be analysed using the following equation:

$$\chi = \frac{\sum_{i=1}^{n} x_i}{n}$$

However, in this study, the mean value will be calculated using IBM SPSS software.

RESULT AND DISCUSSION

As previously outlined, the aim of this study is to identify the critical success factors involved in the implementation of green construction projects. To this end, a case study of middle-class contractors in East Java province will serve as the research respondents. In actual numbers, according to the membership of GAPENSI, which is the National Construction Services Association of Indonesia, the registered number of medium-sized contractors in 2022 amounted to a total 37 companies were initially contacted, however, many were unable to be contacted and many had no experience of implementing green construction projects. Based on some respondents who have met the author, this is because there is still a lack of knowledge about what and how green construction is, and it is still a common belief that green construction causes reduced profit value, one of which is due to the lack of cost support from the government (Kumar & Tawalare, 2021).

Due to the limited number of respondents obtained in the study (n = 4), the analysis was conducted using the mean technique. Data was collected by distributing questionnaires to respondents (see Table 1). The assessment employed a Likert scale with a value of 1–5, where 1 represents a low level of criticality and 5 represents a high level of criticality. The Likert scale is the psychometric scale that is the most commonly and widely employed in research that utilises survey methodology with questionnaires (Taluke et al., 2019).

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Following the collection of the questionnaire data from respondents, it proceeded to be analysed via IBM SPSS software, utilising the mean function. The resulting outcomes are presented in Table 2 below.

Table 2. Result of Mean Analysis

No.	Variabel	n	$\sum_{i=1}^{n}$	x_i
A.	**The Details of The Project are a Critical Success Factor**			
A1.	Project Location	4	19	4,75
A2.	Integrated planning and/or design	4	20	5,00
A3.	The project's level of achievement (goals) for green buildings are clear and realistic	4	17	4,25
A4.	Clear and consistent green construction implementation contract specifications	4	19	4,75
A5.	Adequate project funding sources (smooth payments)	4	20	5,00
A6.	Availability of green construction/green building pilots	4	15	3,75
B.	**Procurement Capability is a Critical Success Factor**			
B1.	Procurement with an integrated and effective green concept	4	16	4,00
B2.	Classification/capabilities of implementing contractors	4	19	4,75
B3.	Availability and accuracy in selecting environmentally friendly quality materials	4	16	4,00
B4.	Competent provision and supply of innovative technologies	4	16	4,00
B5.	The owner/client's ability to make decisions	4	16	4,00
C.	**The Project Management System is a Critical Success Factor**			
C1.	Effective communication among stakeholders	4	19	4,75
C2.	Effectiveness of scheduling and minimal changes	4	17	4,25
C3.	Optimal cost management and allocation	4	20	5,00
C4.	Commitment to the success of green construction / green building by stakeholders	4	14	3,50
C5.	Effective and optimal allocation of resources	4	18	4,50
C6.	Effective risk management (disasters and waste).	4	16	4,00
C7.	Top management/senior management support	4	14	3,50
C8.	Involvement of experts in evaluation and guidance during the green construction implementation stage	4	16	4,00
D.	**Human Resource Competency is Critical Success Factor**			
D1.	Competence and experience of the project manager	4	18	4,50
D2.	Involve project staff in green building training (competency certification)	4	14	3,50
D3.	Effective selection and coordination of subcontractors	4	16	4,00
D4.	Effective monitoring and allocation of workforce	4	16	4,00
D5.	Commitment to change workforce habits to support the implementation of green construction	4	14	3,50
D6.	Owner/client involvement and/or demands during the project	4	17	4,25
E.	**The External Factors Critical Success Factor**			
E1.	Economic, social, political and cultural stability of the country	4	10	2,50
E2.	Applicable policies/regulations regarding green construction	4	17	4,25
E3.	Assistance in the form of subsidies from the government	4	11	2,75

No.	Variabel	n	$\sum_{i=1}^{n}$	x_i
E4.	Public awareness of green construction/green building projects	4	15	3,75

As previously stated, the highest value of each critical success factor will be selected based on the results of the table of analysis above. If a critical success factor has more than one sub-variable, this is due to the same mean value.

In the first factor variable, namely The Details of The Project, the sub-variables with the highest value are : A2 Integrated planning and/or design, this was one of the factors investigated in the previous study (Shan et al., 2020), but the results of this study indicate that this factor is one of the critical success factors in green construction implementation, according to the respondents of this study. A5 Adequate project funding sources (smooth payments), this is in accordance with the researcher's expectations and is appropriate given that smooth project funding is one of the critical factors that can affect the outcome of a project. These results are in line with the results of previous research which states that this factor is in quadrant 1, indicating that it is a critical issue in the successful implementation of green construction (Prameswari et al., 2021).

The next critical factor variable, namely Procurement Capability, obtained one sub-variable factor B2 Classification/capabilities of implementing contractors. In previous studies, this factor was in quadrant 4, which indicates a low critical level (Prameswari et al., 2021). However, in this study, it received the highest score, indicating that differences in respondents and locations have a strong influence.

Similarly, in the subsequent factor variable, The Project Management System, only one sub-variable is obtained, namely C1 Effective communication among stakeholders, which is consistent with several previous studies. According to (Prameswari et al., 2021), this sub-variable is situated in quadrant 2, indicating that even with a high level of performance, it is still a critical level of success. In (Al-Hosani & Rashid, 2021) research, this sub-variable is included in the framework of project success factors. In other studies, this sub-variable is considered to be of great importance in the successful implementation of green construction projects (Shan et al., 2020), indeed, the results of the research indicated that this was the most critical success factor (AbuMoeilak et al., 2023).

Moreover, the only sub-variable with a high mean value is D1 Competence and experience of the project manager in the Human Resource Competency variable, which has the same results as the two studies from which it is sourced. In (Prameswari et al., 2021) research, this factor sub-variable is only in quadrant 4, which indicates a low level of importance. In line with (Shan et al., 2020) research, this sub-variable is in the last position of the top 10 critical success factors.

The same two research sources and the same sub-variables are used in both cases. In the External Factors variable, the sub-variable with the highest mean value is E2 Applicable policies/regulations regarding green construction. This sub-variabledisplays both similarities and differences. The similarities can be observed in the paper of (Prameswari et al., 2021) the sub-variable is situated in quadrant 2, which is a critical success factor with a high level of importance. Consequently, this sub-variable can also be regarded as a recommendation from previous source research which asserts the significance of encouraging the willingness of stakeholders in the implementation of green construction (Nwogu & Emedosi, 2024). In contrast, the paper of (Shan et al., 2020) does not appear in the top 10 critical success factors in the results, despite its importance.

The results of the above analysis indicate that there are both similarities and differences with previous studies. It can be concluded that the critical success factors in the implementation of green construction projects are strongly influenced by the experience and location of the respondents or the project itself (Natalia et al., 2017).

CONCLUSION

The aim of this research is to identify the critical success factors in implementing green construction, as perceived by medium-sized contractors in East Java. These contractors have previously been investigated regarding their experience in implementing green construction projects. The findings reported here shed new light on that based on the top rankings of each critical success factors variable has been obtained. Which are (1) "Integrated planning and/or design", (2) "Adequate project funding sources (smooth payments)", (3) "Classification/capabilities of implementing contractors", (4) "Effective communication among stakeholders", (5) "Competence and experience of the project manager", and last critical success factor is (6) "Applicable policies/regulations regarding green construction". The limitations of this research are that this research does not include the obstacles experienced by the respondents during the implementation of green building projects, and the scope of this research is limited in terms of the research area and the classification of the respondents, which is only conducted on medium-sized contractors in East Java. Further research is required to identify critical barriers to the success of green construction implementation in regions or contractor classifications other than those already studied. This will enable the development of more up-to-date variations in further research. This information can be employed to develop interventions that are specifically designed to enhance the knowledge and comprehension of the significance of green construction, in particular, and green buildings, in general, among those who are responsible for planning, implementing, or delivering such projects. Such measures include modifying material quality standards, increasing the supply, and identifying methods and supporting technologies that are environmentally friendly. Consequently, all critical success factors in implementing green construction/green buildings can be readily achieved without significant obstacles.

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REFERENCES

AbuMoeilak, L., AlQuraidi, A., AlZarooni, A., & Beheiry, S. (2023). Critical Success Factors for Building Information Modeling Implementation as a Sustainable Construction Practice in the UAE. *Buildings*, *13*(6). https://doi.org/10.3390/buildings13061406

Al-Hosani, A. E. Y., & Rashid, N. B. A. (2021). Conceptual framework of the critical success factors of green building towards sustainable construction in United Arab Emirates. *Proceedings of the International Conference on Industrial Engineering and Operations Management*, 4455–4463.

Bakkalbasioglu, E. (2020). How to access elites when textbook methods fail: Challenges of purposive sampling and advantages of using interviewees as "fixers." *Qualitative Report*, *25*(3), 688–699. https://doi.org/10.46743/2160-3715/2020.3976

Ghozali, I. (2016). *Aplikasi Analisis Multivariete Dengan Program IBM SPSS 23* (8th ed.). Badan Penerbit UNDIP.

Kementrian PUPR RI. (2015). *Peraturan Menteri Pekerjaan Umum dan Perumahan Rakyat Nomor 02/PRT/M/2015 Tahun 2015 tentang Bangunan Gedung Hijau* (02/PRT/M/2015; p. 26). BN.2015/No.309, jdih.pu.go.id : 26 hlm.

Kumar, B. G., & Tawalare, A. (2021). Critical Success Factors for Implementation of Green Building in India. *IOP Conference Series: Materials Science and Engineering*, *1203*(3), 032061. https://doi.org/10.1088/1757-899x/1203/3/032061

Lembaga Pengadaan Jasa Konstruksi Nasional. (2013). *Peraturan LPJKN Nomor : 10 Tahun 2013 tentang Registrasi Usaha Jasa Pelaksana Konstruksi* (NOMOR : 10 TAHUN 2013; Issue 10, pp. 1–191).

Liu, Z. J., Snezhko, V., & Kurilova, A. (2022). International legal instruments for stimulating green building and construction business: Russian case study. *International Environmental Agreements: Politics, Law and Economics*, *22*(1), 157–175. https://doi.org/10.1007/s10784-021-09548-1

Natalia, M., Partawijaya, Y., Mukhlis, & Satwarnirat. (2017). Analisis Critical Success Factors Proyek Konstruksi Di Kota Padang. *Jurnal Fondasi*, *6*(2). https://doi.org/10.36055/jft.v6i2.2632

Nwogu, P., & Emedosi, A. (2024). Barriers to Green Building Project Implementation and Sustainability in the Nigerian Construction Industry 5 PUBLICATIONS 0 CITATIONS SEE PROFILE. *Article in International Journal of Progressive Research in Engineering Management and Science · INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN SCIENCE AND ENGINEERING*, *5*(2). www.ijprse.com

Prameswari, F. R., Rachamawati, F., Wiguna, I. P. A., & Rohman, M. A. (2021). Importance and Performance Ratings Analysis for Implementation of Green Construction on Building Project. *IOP Conference Series: Earth and Environmental Science*, *799*(1). https://doi.org/10.1088/1755-1315/799/1/012015

Prof. dr. Sugiyono. (2011). Metode Penelitian Kuantitatif Kualitatif dan R&D. In *Bandung Alfabeta* (10th ed.). CV. ALFABETA.

Sarmanu. (2017). *Dasar Metodologi Penelitian Kuantitatif, Kualitatif dan Statika* (1st ed.). Pusat Percetakan dan Penerbitan Universitas Airlangga (AUP).

Serra, M., Psarra, S., & O'Brien, J. (2018). Social and physical characterization of urban contexts: Techniques and methods for quantification, classification and purposive sampling. *Urban Planning*, *3*(1), 58–74. https://doi.org/10.17645/up.v3i1.1269

Shan, M., Liu, W. Q., Hwang, B. G., & Lye, J. M. (2020). Critical success factors for small contractors to conduct green building construction projects in Singapore: identification and comparison with large contractors. *Environmental Science and Pollution Research*, *27*(8), 8310–8322. https://doi.org/10.1007/s11356-019-06646-1

Shurrab, J., Hussain, M., & Khan, M. (2019). Green and sustainable practices in the construction industry: A confirmatory factor analysis approach. *Engineering, Construction and Architectural Management*, *26*(6), 1063–1086. https://doi.org/10.1108/ECAM-02-2018-0056

Singh, D., & Singh, A. (2023). Role of Building Automation Technology in Creating a Smart and Sustainable Built Environment. *Evergreen*, *10*(1), 412–420. https://doi.org/10.5109/6781101

Taluke, D., Lakat, R. S. M., Sembel, A., Mangrove, E., & Bahwa, M. (2019). Analisis Preferensi Masyarakat Dalam Pengelolaan Ekosistem Mangrove Di Pesisir Pantai Kecamatan Loloda Kabupaten Halmahera Barat. *Spasial*, *6*(2), 531–540.