p–ISSN: 2723 – 6609 e-ISSN: 2745-5254
Vol. 6, No. 1, January 2025 http://jist.publikasiindonesia.id/

Development of building assessment criteria framework for implementing the issuance certificate occupancy in Jakarta with Genetica Algoritm method

M. Fajar Prasetyo[1*], Ayomi Dita Rarasati[2], Henki Wibowo Ashadi[3]
Universitas Indonesia, Kampus UI Depok 16424, Indonesia
Email: m.fajarprasetyo88@gmail.com
*Correspondence

Keywords: quality and feasibility, genetika algorithm, certification occupancy.

ABSTRACT

A building is considered ready for use once it obtains a Certificate of Occupancy, which serves as a regulatory mechanism for overseeing building activities. To measure the quality level achieved in a completed building project, numerous assessment tools and methods have been developed globally to measure building performance. This study aims to create an evaluation system based on a scoring methodology. To develop the framework, seven prominent building assessment methods were analyzed, focusing on their application processes, primary criteria, and sub-criteria. Surveys were conducted involving construction experts and respondents familiar with quality and feasibility building assessment to incorporate their insights into the local construction context of Jakarta. The genetic algorithm method was used to analyze the survey data, leading to the identification of 12 criteria and 39 sub-criteria as the most suitable for assessing the implementation of the Certificate of Occupancy in Jakarta. These criteria include structural integrity (5%), fire safety (20%), mechanical, electrical, and plumbing (MEP) systems (8%), accessibility (8%), drainage systems and waste management (5%), functionality testing (8%), environmental quality (6%), sociocultural and functional aspects (8%), technical quality (8%), construction area quality (8%), energy consumption (8%), and health-related building requirements (8%).

Introduction

Buildings are expected to support the needs of human activities within them, designed to serve specific purposes. Jakarta, no longer the capital city of the Republic of Indonesia, aspires to become a global city capable of competing with other big cities worldwide. With a population reaching 10.5 million, Jakarta holds the title of the largest metropolitan city in Southeast Asia, lot of high-rise buildings for residential, office, and other purposes.

The implementation of the Certificate of Occupancy (SLF) for buildings began alongside the increasing in building construction, one main issue are high-rise buildings. The SLF is required to ensure that every building, once completed and ready for use, meets the standards of occupancy both administratively and technically. The assessment

of the functional quality of buildings using a scoring system has been introduced in various countries.

The assessment system using the scoring method is to address the challenges in ensuring that buildings that have been constructed and ready to use meet both technical and administrative requirements. Previously the buildings fitness assessment process was usually qualitative and not measureable making it difficult to achieve objective and consistent results in evaluating buildings. The scoring method was introduced as a solution to provide a more structured, transparent, and data-driven evaluation that can more accurately reflect the quality and feasibility of a building. With this method, various important criteria related to technical aspects, safety, comfort, and environmental impacts can be assessed with appropriate weights, resulting in a more comprehensive evaluation. In addition, the rapid development of high-rise buildings and infrastructure in major cities like Jakarta has increased the need for a system that can ensure buildings meet the standards set for their function and sustainability. Therefore, by using the scoring method, the SLF certification process can be more effective in measuring how well a building meets various fitness criteria and supports sustainable development goals.

In the process of determining criteria and sub-criteria, a review of literature from seven countries was conducted to identify criteria and sub-criteria that can represent and can be implementing for the assessment process of building functionality using a scoring method.

Previous studies have highlight that assessment methods created for one nation or region might not be applicable to others (Cole, 1999; Darus et al, 2009; reed, bilos, Wilkinson, and schulte, 2009) in auddition a number of environmental factors may prevent the transfer of currently available environmental assessment tools to toher nations (Mou, Lu, and Li, 2009; Suzer, 2015). An Anothers studies concern about the weighting criteria and subcriteria of specific function of building. However, new government polices encouraging international ivestment to improve private and national industry development have spurred commercial construction (Ameen, Mourshed, and Li, 2005) in Jakarta construction industry. As a result, these is an increasing deman for building nationwide. To ensure success in implementation this concept in the building sector, architects, contractors, environmental, engineers, clients and allied professionals should have a better understanding of and information about the relationship between the various aspects of the building assessment process for issuance certificates occupancy.

Most of building assessment tools are similar in som of their criteria, which typicaly focus on site protection energy, water consumption, indoor environment quality, building material, minimum earthquake, waste, pollution, transportation and innovation (Forsberg and Von malmborg, 2004; Dirlich, 2011; Kajikawa, Inoue and Goh, 2011). These criteria are regarded as facets of the interation between buildings and their environment (Reinders and Van Roekel, 1999). However, (Dixon et al, 2007) believe that this common agreement between different assessment scheme indicates negligence of the economic and sosial aspects of sustainability, which could lead to aloss of balance among sustainability dimensions, therbymissing the real goals of sustainable development (Goh

and Rowlinson, 2013). Furthermore, these tools were developed for a certain geographic context largely without considering regional variation in environment, economics and culture (cole, 1998; Ding, 2008). Hence, adapting an assessment tool requires significant adjustments of its criteria, priorities, weighting coefficients and scoring benchmarks (Attia, 2013; Darus et al.,2009; Kajikawa et al., 2011). (Happio and viitaniemi, 2008) concluded that in addition to environmental factors, existing building assessment tools should incorporate economic and cultural aspects to effitively transform into sustainable assessment tools. Moreover, inflexibility, complexisty and lack of consideration of weighting sustems are identified as major barriers to the acceptance of any assessment method (Ding, 2008).

Almost all building assessment schemes, including CONQUAS, DGNB, USGBC and etc, share some common criteria such as fire safety, structural, MEP and may more for assessing building performance or level quality achieved (lee, Chau, Yik, Burnett, and Tse, 2002) however the severit of these factors can vary across regions, depending on local factors such as climate materials and building stock (Ding, 2008; Kajikawa et al., 2011; Rahardjati, Khamidi, and idrus, 2010). In these studies, suggested that a weighting system can provide opportunities to enhance environmental assessment scales thorough accommodation these regional variations.

According to (Lee et al., 2002) weighting system could be regarded as the heart of building assessment schemes, as the govern the overall performance score of the building. Nevertheless, no consensus based on approach or statisfactory method exist. The objective weighting method often ovelooks decision makers concerns and experts experience which is considered as a disadvantage (Yang, Li, and Yao, 2010) Furthermore (Wang et al., 2009) concluded that subjective weighting is superior to objective weighting in clarifying evaluations.

Considering the need for a quality and feasibility building assessment tool, this study has developt as et of assessment criteria. In this study for weighting methods for assessment criteria using likert scale based on importance level criteria, subcriteria and process by delphi genetica algorithm has been adopted to assess the weight of the crietria for quality and feasibility building assessment in Jakarta.

Method

The study was designed to first develop assessment criteria for quality and feasibility buildings din Jakarta through qualitative research methods. The resultant criteria were then used to develop priorities and weight through quantitative research methods (Fig. 1) research data was drawn from three main sources: literature, semi structured interviews and survey questionare. The research was devided into three main stages: establishing, refining and weighting the assessment crietria, as shown in Fig.1. to establish initial criteria for assessing quality and feasibility building projects, a combination of existing assessment tools, academic research and policy product from minestry or Jakarta government were reviewed in the first stage of this research.

The main objective of the second stage was to refine the list of assessment criteria derived in the first stage. The second stage discussed the local context of Jakarta construction industry. To understand the practical issues for operationalisisng these core concepts, a scoping study was carried out and unstructured interviews were conducted with a number of construction professionals. After this the criteria will be sparated into two categories first category is scoring criteria dan second category is mandatory criteria. Last in the stage two giving point level important of criteria were in scoring criteria. Questionnaire by likert scale to defined importance level of criteria as expert data. The questionnaires were also conducted for general respondents to obtain importance values of criteria as population data.

The last stage in this study was to formulate a rating criteria framework for assessing quality and feasibility building based on the finddings of the research will be calculated with delphi. Finally, this research proposes a framework for developing assessment criteria for quality and feasibility building in Jakarta.

Non-probability sampling techniques was selected to identify the qualified participants for this research (saunders, Lewis & Thornhill, 2009). final data form questionare of are 90 respondents. The results of the questioners were analysed using consistency and reliability analysis (Saaty & Sodenkamp, 2010) the outcomes of this analysis 90 questionnaires are consistent, and they were including from research.

Results and Discussion

The results of the quality and feasibility form expert judgments and genetic algorithm are presented in table. 10 and shows that fire safety criteria represent the highest priority criteria for quality and feasibility Jakarta building assessment at 15% for expert and 20% for genetica algorithm. meanwhile the lowest criteria form expert is waste and drainage management system and environment quality with weighting 6%, for genetica algorithm is structural safety and waste and drainage management system with weighting 5%. Table 12 illustrates weighting associated with each criteria and subcriteria for genetica algorithm calculation included in the assessment. Fire resistance material the highest subcriteria value 14% and is this considered the most important subcriteria with quality and feasibility building assessment framework. The subcriteria emergency lamp weighted at 6% ranks as the second most important.

This studi created a weighting framework for quality and feasibility building assessment criteria for new buildings in jakarta. Genetica algorithms methods was used to establish the relative weight for strong relantionship between certificate occupancy and quality and feasibility assessment methods has been reported in the literature. (Ding, 2008, Reed et al., 2009; Chandratilake & Dias, 2013) this relationship is comprised of varios factors such as environment, economy, social and cultural and integrity of buildings, which have been considered in this study.

In this study the weighting results determined the priority wich each safety aspect in Jakarta. In addition, the results categorise the criteria based on their calculated weighting, which reveal that fire safety is the highest priority criteria. For second level of hierarchy, a number of subcriteria within each criteria were assigned higher weights. As shown in table 11 fire resistance material is the highest subcriteria weight for makesure safety even the building has fire disaster. (Venkatarama & Jagadish, 2003) Furthermore

for the materials fire resistance was place on the use of regional materials such as concrete, bircks and stone are common resistant materials can integrate relationship between materials selection fire resistance and socialculture and function quality and economics sector too. (Ding, 2008) suggest that financial considerations can be as important as environmental factor in assessing environmental concentration with the respect for sustainable construction. Despite this fact, environment quality and waste management criteria received less weight relative to the MEP and socialcultural and function quality, site quality criteria. It should be to attention is to made price minimum for operational building. Clearly for Jakarta quality and feasibility building assessment the building operation phase is the key why the quality more weight than environment its same with economic perspective. It can be the purposed of expert to giving point for high level importance criteria has relationship with resiliency building aspect to reduce minimum cost when building into operation phase and building service.

Energy and health compliance are second important criteria because the energy in Jakarta is expensive value for building operations. To reduce the cost operations, need to adption of energy efficiency technologies, utilization of renewable energy, green building ceretifications and for stakeholders can make a reward for energy awareness campaigns. Positive impacts of energy efficiency are reduced opratioanal cost, improved environmental health and global competitiveness for eco friendly building in Jakarta. To health compliance will be straight after covid 19 deasess many technologies used to reduce infections are high efficiency air filtration, air sterilization technologies, termal imaging camera, crowd monitoring system to enforce social distancing. So, Health aspects in buildings are influenced by two factors: internal and external factors of the building. These factors can occur in buildings because of the planning process or the operational and maintenance processes of the building. Internal factors in buildings are not only determined by the building system itself but can also be influenced by the behavior of the building's occupants (Widianto, 2015).

Finally, the overall criteria weight was calculated based algorithms genetica that reflect the current expert understanding of quality and feasibility building assessment in Jakarta.

Twelve criteria and 39 subcriteria were developed in this study for inclusion as the most appropriate assessment criteria for quality and feasibility building construction in Jakarta. These criteria include structural safety, fire safety, mechanical electrical plumumbing, accessibility, drainage and waste management system, final test, enviroment quality, socialcultural and function quality, technical quality, site quality, energy, health compliance. It was observed that these identified criteria clossly those international tools such as DGNB, LEED but differed somewhat in their priorities due to their consideration of Jakarta context.

The result show that the safety factor are the most important aspect of quality and feasibility building assessment in Jakarta followed by MEP, Accessbility, Technical, energy and health compliance. The cost building operation perspective made these criteria be second importance than environment and structure criteria. Finally, the result show that the difference in criteria priorities environment relationship and technical relationship. The assessment toll cannot to be as sustainable building assessment.

Table 1
Weighting Comparison expert and GA

No	Criteria	Weighting (%)	
		Experts	GA
1	Structural safety	7	5
2	Fire safety	15	20
3	Mechanical Electrical Plumbing	8	8
4	Accessibility	8	8
5	Drainage and waste management system	6	5
6	Final test	8	8
7	Enviroment quality	6	6
8	Socialcultural and function quality	8	8
9	Technical quality	8	8
10	Site quality	8	8
11	Energy	8	8
12	Health compliance	10	8

Table 2
Criteria and subcriteria scoring category for quality and feasibility assessment building

No	Scoring Criteria Category	Subcriteria	Subcriteria (%)
1	Structural safety (5%)	Compliance with Building standart	2
		load bearing capacity	3
2	Fire safety (20%)	Fire resistant material	14
		Emergency lamp	6
3	Mechanical Electrical Plumbing (8%)	Installation method of MEP pre-fitting	1
		Electrical System	2
		Plumbing System	2
		Mechanical system	2
		Gas system	1
4	Accessibility (8%)	Door	2
		Accessbility standard	2
		Parking and disability ways	1
		Free way	1
		Vertical transport requirements	2
5	Drainage and waste management system (5%)	Disposal Site	1
		Waste management	1
		Drainage	1
		Rainwater management	2
6	Final test (8%)	HVAC system	3
		Wet area durability test	5
7	Enviroment quality (6%)	Building architecture	3
		Landscape architecture	5

8	Socialcultural and function quality (8%)	Temperature in the building	2
		Air quality in the building	2
		Soundproofing of the building	1
		Security and safety	2
		Total building user capacity	1
9	Technical quality (8%)	Integrated building technology	3
		Ease of building cleaning	2
		Easy recovery and recycling of buildings	3
10	Site quality (8%)	Project environment area	4
		Project transportation access	4
11	Energy (8%)	Insulation standard	3
		Energy efficiency system	2
		Renewable energy integration	3
12	Health compliance (8%)	Sanitation	2
		Building materials	2
		Lighting	2
		waste disposal facilities	2

To expand the assessment method proposed in this study the next phase of this work could involve conducting a broader survey boh in terms of category and number of participants. Including the building occupants will bring further insight into analyse the robustness of the proposed assessment approach. In addition, further analysis of the feed back received from occupants can be used to extedn the scope of the criteria and make it ready to be implement as a tailor made certification designed particularly for the Jakarta construction industry.

Conclusion

This study successfully developed a quality and feasibility building assessment framework for the issuance of the Certificate of Occupancy (SLF) in Jakarta using the genetic algorithm method. The framework consists of 12 main criteria and 39 sub-criteria derived from international literature reviews and adapted to Jakarta's local context through expert surveys and interviews. The analysis results show that fire safety is the top priority in assessing building feasibility, followed by mechanical, electrical, and plumbing (MEP) systems, accessibility, technical quality, energy, and health compliance. This scoring-based assessment method provides a more objective and measurable approach compared to the previous qualitative methods. The developed criteria cover not only technical and environmental aspects but also consider social, cultural, and economic factors, making the framework more comprehensive and relevant for Jakarta's context.

The results of this study are expected to serve as a reference in the development of an effective building feasibility assessment system that supports sustainable urban development.

Bibliography

Ameen, Mourshed & Li (2015). A critical review of enviromental assessment tools for sustainable urban design.

Anirudhan B., V. Sri Santhya, M. Nithya, N. Saranya, (2023). Environmental Science Research. Integrated Publishers, New Delhi, India

Attia. (2013). LEED as a tool for enhancing affordable housing sustainability in saudy arabia: the case of al - Ghala project.

Chandratilake & Dias. (2013). Sustainability rating systems for buildings: comparisons and correlations.

Cole, R (1998). Emerging trendds in building enviromental assessment methods. Building Research&Ifnormation.

Cole, R (1999). Emerging trendds in building enviromental assessment methods. Clarifying intentions

Darus, Z. M., Hasim, N. A., Salleh, E., Haw, L. C., Rashid, A. K. A., & Manan, S. N. A. (2009). Development of rating system for sustainable building in Malaysia.

Ding. (2008). Sustainable construction - the role of enviroment asessment tools

Dixon et al. (2007). A green profession: an audit of sustainability tools, techniques and information for rics members.

Forsberg & Von Malmborg (2004). Tools for enviromental assessment of the built enviroment.

Goh & Rowlinson. (2013). The roles of sustainability asessmen systems in delivering sustainabel constrution.

Haapio & Viitaniemi. (2008). Acritical review of building enviromental assessment tools.

Jafarian, J. (2010). An Experiment to Study Wandering Salesman Applicability on Solving the Travelling Salesman Problem based on Genetic Algorithm. International Conference on Educational and Information Technology (ICEIT 2010) An, (Iceit), 1–7.

Kajikawa, Inouem, Goh. (2011). Analysis of building enviroment assessment framework and their implication for sustainability indicators.

Lee, Chau, Yik, Burnett & Tse. (2002). On the study of the credit - weighting scale in a building enviromental asessment scheme.

Mahmudy, W. F., Marian, R. M., & Luong, L. H.S. (2014). Hybrid genetic algorithms for part type selection and machine loading problems with alternative production plans problems with alternative production plans in flexible manufacturing system Hybrid Genetic Algorithms for Part Type Selection and Machine Loading Problems with Alternative Production Pl. ECTI

Mahmudy, WF, Marian, RM & Luong, LHS. (2013). 'Real coded genetic algorithms for solving flexible job-shop scheduling problem Part II: optimization', Advanced Materials Research, vol. 701, pp. 364-369.

Mao, Lu & LI, (2009). A coparison study of mainstream sustainable/green building rating tools in the world.

Rahardjati, Khamidi & Idrus (2010). The level of importance of criteria and subcrietria in green building index malaysia

Reed, R., Bilos, A., Wilkinson, S., & Schulte, K (2009). International comparison fo sustainable rating tools.

Reed, R., Bilos, A., Wilkinson, S., & Schulte, K (2011). International comparison fo sustainable rating tools - An update.

Reijnders & van Roekel. (1999). Comperhensiveness and adequacy of tools for the enviromental improvement of buildings.

Rosa & Haddad. (2013). Assessing the sustainability of existing buildings using the analytics hiererchy process.

Saaty & Sdenkamp. (2010) The analytic hierarrchy and analytic network measurement process: the measeurement of intabgibles.

Saunders, Lewis, Thornhill, & Dawsonera. (2009). Research methods for business students

Suzer, O. (2015). A comparative review of enviromental concern priortization: LEED vs other major certification systems.

venkatarama & Jagadish. (2003). Embodied energy of common and alternative building materials and technology.

Wang, Jing, Zhang & Zhai. (2009). Review on multi criteria decision analysis in sustainable energy decision making.

Widhianto. (2015). Kesehatan pada toilet umum berdasarkan sentuhan tangan.

Yang, Li & Yao. (2010). A method of identifying and weighting indicators of energy efficiency assessment in chinese resendtial buildings.