

Achieving Sustainable Green Buildings Through The Use Of LEED Certification Indices

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Abstract– The increasing concern of global warming has brought with it the need for innovation in strategies for reducing global greenhouse gas emissions. One such strategy involves optimizing efficient energy usage through green building design and operations. Leadership in Energy and Environmental Design (LEED) certification provides a framework for healthy, highly efficient, and cost-saving green buildings, which offer environmental, social, and governance benefits. Green buildings, specifically LEED-certified buildings, claim to provide a better work environment for their end users. This study investigated the claim that LEED-certified buildings do provide a higher level of occupant satisfaction than their non-certified counterparts. Within the context of Small Island Developing States (SIDS), seven Indoor Environmental Qualities (IEQs) were compared for office buildings located in Trinidad and Tobago. Primary data on these qualities were collected using targeted questionnaires and interviews with working professionals who were occupants of LEED-certified and non-certified green buildings. The results showed that only one IEQ, thermal comfort, had a lower mean score, while in general, LEED buildings had a higher level of satisfaction than non-certified buildings. The study recommended areas of improvement, such as thermal comfort and post-occupancy evaluations, to optimize both energy efficiencies and occupancy comfort levels while reducing the output of greenhouse gas emissions.

Keywords– Green Buildings, Indoor Environmental Quality, LEED certification, SIDS, Thermal Comfort.

I. INTRODUCTION

The pressing issue of global warming necessitates innovative strategies to reduce greenhouse gas emissions, with a focus on energy efficiency. Buildings in the Caribbean account for nearly 40% of total energy use and 38% of carbon emissions, particularly during the construction and operation phases [1]. Trinidad and Tobago (T&T) is a major producer of oil and gas and is responsible for less than 1% of global greenhouse gas emissions [2]. As such, the government of T&T emphasizes renewable energy, clean energy production, and energy efficiency as key pillars of sustainable development [3]. Green buildings, also known as smart buildings, play a pivotal role in this effort by integrating sustainable design and operation practices that lower energy and water consumption while enhancing efficiency, reducing environmental impact, and increasing cost savings [4, 5].

Globally, green building movements have established standards such as the United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) certification. The LEED certification was launched in 2000, and its most recent version (v4.1) emphasizes performance metrics like energy, water, indoor air quality, and occupant satisfaction [6]. Trinidad and Tobago's green building initiatives are championed by the Trinidad and Tobago Green Building Council, established in 2010. Notable milestones include Savannah East, a six-story office building as shown in Fig. 1, which acquired LEED Silver certification in 2016 [7]. Additionally, the National Insurance Board of T&T building obtained LEED Gold certification in 2017. The NIBTT structure incorporated features like water conservation, energy efficiency, and improved indoor air quality [8]. The credits earned for each building are shown in Table I.



Fig. 1 Savannah East Building Trinidad and Tobago [7]

TABLE I CREDITS EARNED FOR LEED-CERTIFIED BUILDINGS

Certification Categories	Score			
	Savannah East (Silver)		NIBTT (Gold)	
LEED 2009	Core & Shell Points	Credits Earned	New Construction Points	Credits Earned
Sustainable Sites	28	17	26	19
Water Efficiency	10	8	10	10
Energy and Atmosphere	37	16	35	11
Materials and Resources	13	2	14	4
Indoor Environmental Quality	12	6	15	9
Innovation in Design	6	3	6	6
Regional Priority	4	4	4	4
Total Score	110	56	110	63

User benefits, such as better indoor ventilation, lead to a healthy and more productive work environment. Furthermore, green buildings promote public awareness regarding sustainability [9]. The creation of green buildings integrates processes that are environmentally responsible and resource-efficient throughout the life cycle of a building, from site selection, design, construction, operation, maintenance, renovation, and deconstruction. The construction sector is a major contributor to greenhouse gases as a result of quarrying activities and cement production, which consumes large quantities of energy and contributes to the depletion of natural resources [10]. The implementation of green building construction and enhancement through LEED certification can combat the issue of increased energy consumption, reduce material depletion, and carbon dioxide emissions [11].

The LEED rating system, established by the USGBC, is the most recognized green building certification system globally and was founded by Robert K. Watson, a scientist who was an active advocate for sustainable buildings and circular economy [12]. Apart from this renowned certification system, various green building certification systems exist worldwide. These include the Green Standard for Energy and Environmental Design (G-SEED) in Korea, Green Star in Australia, and the Comprehensive Assessment System for Built Environment Efficiency (CASBEE) in Japan. Furthermore, the oldest certification system, BREEAM (British Building Research Establishment Environmental Assessment Method), was introduced in the UK in 1990 and features five certification levels: Pass, Good, Very Good, Excellent, and Outstanding [13]. In Malaysia, the Green Building Index (GBI) offers certification levels similar to those of LEED [12].

To achieve LEED certification, a building must meet specific prerequisites and earn credits/points based on its design and construction. There are four certification levels: Certified, Silver, Gold, and Platinum,

as shown in Table II. From its early stages, flaws were identified in the LEED rating system. Research by the University of Michigan's Center for Sustainable Systems found that LEED was not entirely effective as a comprehensive method for assessing environmental impacts [14].

TABLE II LEED CERTIFICATION LEVELS

Rating	Earned Points (v1.0)	Earned Points (v4)
Certified	26-32	40-49
Silver	33-38	50-59
Gold	39-51	60-79
Platinum	53-69	80+

LEED has undergone multiple updates since its inception to address its initial limitations. LEED version 1.0 was initially designed for new construction (NC) projects, followed by updates to versions NC v2.0 and NC v2.2. LEED v3 became the most widely adopted version, expanding its scope to include rating systems for the design, construction, and operation of various building types. The latest version, LEED v4, was released in 2013, introducing adjustments to point allocation and credit weighting across categories [15].

Originally, LEED featured six categories: Sustainable Sites (SS), Energy and Atmosphere (EA), Water Efficiency (WE), Indoor Environment Quality (IEQ), Materials and Resources (MR), and Innovation (ID). Between 2009 and 2013, three additional categories were added: Regional Priority (RP), Location and Transportation (LT), and Integrative Process (IP). LEED v3 and v4 emphasized key priorities, such as reducing energy use and carbon dioxide emissions, while addressing broader environmental concerns like climate change and optimizing energy and water consumption [16]. LEED v4 incorporates seven categories: Climate Change, Human Health, Water Resources, Biodiversity, Material Resources, Greener Economy, and Community Quality of Life. LEED v4.1 is the newest certification system, with the inclusion of Location and Transportation, Materials and Resources, and Indoor Environmental Quality. The updated version 5, however, is expected to be launched in 2025 [17].

LEED certification is awarded based on meeting specific criteria aimed at improving energy efficiency, sustainability, and environmental impact. Energy efficiency is achieved through renewable energy use, heat and water conservation, and reducing energy consumption for heating and cooling. Since 40% of global energy is used for heating and cooling buildings, optimizing HVAC (Heating, Ventilation, and Air Conditioning) systems while maintaining indoor comfort is crucial [18]. Techniques such as air barrier installation, alternative roofing materials, and efficient landscaping practices are also encouraged.

Additional LEED points can be earned for projects near public facilities and transportation, for using previously contaminated land with proper containment, and for employing low-flow toilets and water-saving landscaping. The use of regionally sourced, recycled materials and prioritizing renovation over demolition further contribute to certification. Holistic planning from the project's inception results in better integration of LEED principles [17]. The credit ratings for the respective LEED categories are shown in Table III.

TABLE III CREDIT RATINGS FOR LEED CATEGORIES.

Category	Total Credits
Integrative Process	1
Location and Transportation	16
Sustainable Sites	10
Water Efficiency	11
Energy and Atmosphere	33
Materials and Resources	13
Indoor Environmental Quality	16
Innovation in Design	6
Regional Priority	4

Total	110
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Research revealed that 12 government buildings had energy consumption rates 25%-30% lower than average commercial buildings. The findings highlighted the advantages of incorporating LEED certification from the design through the construction phases. The research also suggested a potential link between LEED Energy Credits and Energy Star Scores, though it was limited to government-owned buildings [19]. Similarly, 121 LEED-certified buildings were analyzed and found they use 25%-30% less energy than the national average, delivering anticipated savings. The study used one year of measured energy data and Energy Star Ratings, showing an average score of 68 for LEED buildings, higher than the national median of 50. Notably, while half of the LEED buildings scored at least 75, a quarter fell below 50, possibly due to varying certification levels. Gold and Platinum LEED buildings had 45% better energy efficiency than non-LEED buildings, though they represent a small portion of total certified buildings [20]. Analysis of data from the New Building Institute (NBI) found that LEED buildings save 18-39% more energy compared to non-certified buildings. However, the study only focused on on-site energy, excluded other energy sources, and did not account for differences in building size or type [21].

Stemming from this study, public data from 953 buildings in New York City (NYC), focusing on energy consumption, greenhouse gas (GHG) emissions, and Energy Star Energy Performance Ratings (EPR), analyzed buildings of similar types, timeframes, and regions with 95% statistical significance. Of these, 21 office buildings allowed direct comparisons. It was found that some LEED buildings were less efficient, performing 3% worse, while others showed improved efficiency. The research concluded that, based on the limited data available, LEED certification, except at the Gold level, does not appear to contribute significantly to NYC's goal of achieving carbon neutrality [22].

Reference [23] also concluded contradictory findings after analyzing the electrical energy savings of 11 LEED-certified buildings compared to non-LEED buildings. Among these, only 7 buildings demonstrated energy savings, while the remaining 4 did not. Additionally, when comparing LEED-certified buildings to Commercial Buildings Energy Consumption Survey (CBECS) data, only a slight improvement in energy savings was observed. This study indicated that LEED certification alone does not guarantee energy efficiency in buildings. Other researchers were also in agreement with this statement [24, 25]. Nevertheless, it is recommended that the Life Cycle Assessment (LCA) of the building be included in the LEED rating system, which will better represent the overall degree of sustainability [26, 27].

LEED-certified green buildings are often praised for providing a better environment and improved occupant experience when compared to conventional buildings. However, there is a lack of post-occupancy evaluations (POEs) conducted to substantiate these claims. The authors in reference [28] emphasized that the success of a sustainable building ultimately depends on its indoor environmental quality (IEQ), which directly impacts occupants' quality of life, a fact often overlooked in current sustainable building research. Web-based questionnaires were used to assess seven IEQ categories in LEED-certified and non-LEED-certified buildings across the United States, Canada, and Finland, based on occupant feedback. The results showed that non-LEED-certified buildings were preferred for Office Layout, Lighting, and Acoustics. Conversely, LEED-certified buildings provided significantly higher satisfaction in categories such as Office Furnishing, Thermal Comfort, Indoor Air Quality, Cleanliness, and Maintenance [28, 29].

To promote sustainability on a larger scale, LEED introduced the Neighbourhood Development (LEED-ND) program in 2009, focusing on factors like walkability, compact design, access to transit, and environmental impact. However, challenges such as budget constraints, lack of awareness among developers, and short-term government priorities have hindered its adoption. Governments play a crucial role in overcoming these barriers by implementing policies like carbon taxes and financial incentives. Local governments have also used Tax Increment Financing Districts (TIFs) to support developers with infrastructure improvements [15]. LEED certification only accounts for less than 2% of the total overall project budget [30], and due to its rapid recognition globally, adapting its framework to regional priorities will be crucial for ensuring its continued relevance and effectiveness [31].

In the Caribbean between 2012 to 2021, there were 59 LEED-certified projects [32]; however, more new buildings are currently in the process of becoming certified, as shown in Table IV [33]. The Trinidad and Tobago Green Building Council has promoted

green building through seminars, education, and the introduction of LEED certification. However, the average Trinbagonian is not focused on environmental concerns. Hence, to adopt greener practices, the country needs a strong political will. Sustainable building can provide economic benefits, and governments should raise awareness through training programs to educate the public about the long-term financial and sustainable advantages.

Despite its benefits, LEED certification faces criticism regarding its effectiveness compared to conventional buildings. To assess its value, studies often compare LEED-certified buildings with similar structures, focusing on factors like Indoor Environment Quality (IEQ). This research examines end-user satisfaction in LEED-certified buildings versus non-certified buildings in Trinidad and Tobago, analyzing seven key criteria: office layout, furnishings, thermal comfort, indoor air quality, lighting, acoustics, and cleanliness/maintenance. This approach seeks to provide a comprehensive understanding of the benefits of green buildings and to outline recommendations for improvement.

TABLE IV PROJECTS WITHIN THE CARIBBEAN LISTED AS “CERTIFICATION IN PROGRESS”.

Country	Number of Projects
Trinidad and Tobago	5
Antigua and Barbuda	1
Aruba	5
Bahamas	8
Barbados	3
Cayman Islands	3
Belize	2
Costa Rica	3
Cuba	3
Curacao	1
Dominica Republic	18
Haiti	10
Jamaica	4
Puerto Rico	10
Saint Lucia	1

II. METHOD

This study utilized a quantitative approach, collecting data through questionnaires and interviews with professionals working in both LEED-certified and non-certified buildings in Trinidad and Tobago. It assessed end-user satisfaction in two LEED-certified office buildings: the National Insurance Board of T&T (99,778 ft², five stories with underground parking) and the Savannah East Building (88,265 ft², seven stories in Port of Spain). For comparison, similarly sized non-certified buildings included the EY Building, Prince’s Court, UDECOTT Headquarters, and ESG buildings. The study gathered responses from at least 150 voluntary participants.

TABLE V BREAKDOWN OF SECTIONS IN QUESTIONNAIRES.

Questions	Purpose
1-5	General information on interviewees
6-8	Time, location, and experience compared to other buildings
9-21	Addresses information to determine end-user satisfaction based on the 7 IEQs

The electronic questionnaire comprised a combination of 21 multiple-choice, Likert scale questions and was subdivided into three sections as shown in Table V. A detailed breakdown of the occupancy satisfaction questions (9-21) is shown in Table VI. The interviews, however, were conducted in person and virtually. Information from these interviews was used to gain further knowledge of the certification process of these buildings during the design and construction phases. The collected data was scrutinized, outliers were removed, and a search was conducted to identify missing data, such as incomplete questionnaires. For this research, the questionnaire options were designed specifically as worded questions, and the answers from each interviewee were assigned a number ranging from 1 to 5, as shown in Table VII.

TABLE VI BREAKDOWN OF OCCUPANCY SATISFACTION QUESTIONS.

Question	Main IEQ	Specific Quality
9	Thermal Comfort	How comfortable is the temperature
10		Control over temperature settings
11	Indoor Air Quality	User assumption of air quality
12	Acoustics	User perspective
13		Privacy when having conversations
14		Areas allocated for private conversations
15	Lighting	General opinion on lighting
16		Issues with lighting
17		Improvement required, if any
18	Office Layout	Areas of wellness and leisure
19		General office layout
20	Office Furnishings	General furnishings of the building
21	Cleanliness/Maintenance	Users' general feelings about the maintenance of the building

After removing outliers, descriptive statistics analysis was conducted to calculate the mean values for responses from occupants of both LEED-certified and non-certified buildings. These means were then visually represented for both building types. Once the Indoor Environmental Quality (IEQ) values were obtained, they were compared, and the hypothesis was tested. The final step involved statistical t-tests to determine whether the null hypothesis could be rejected. Furthermore, the p-value was also calculated using distributions, and the preset confidence interval for this study was 95%; therefore, to reject the null hypothesis, the p-value must be less than 0.05.

The hypotheses established for this research were:

- i. Null Hypothesis H_0 : LEED-certified buildings are equal in occupant satisfaction to non-certified buildings.
- ii. Alternative Hypothesis H_1 : LEED-certified buildings show higher occupant satisfaction than non-certified buildings.

Equation (1) is used to calculate the t value as follows:

$$t = \frac{x_1 - x_2}{\sqrt{s^2 \left[\frac{1}{n_1} + \frac{1}{n_2} \right]}} \quad (1)$$

Where;

t- t value

x_1 - means of group 1

x_2 - means of group 2

s^2 – pooled standard error of the two groups
 n_1 – number of observations in group 1
 n_2 – number of observations in group 2

TABLE VII LIST OF OPTIONS FOR QUESTIONNAIRE ANSWERS WITH ASSIGNED VALUE.

Questionnaire Answer Options			Assigned Value
Group 1	Group 2	Group 3	
Good	Yes	Comfortable	5
Somewhat Good	Somewhat Yes	Somewhat Cold	4
Neutral	Neutral	Somewhat Warm	3
Somewhat Bad	Somewhat No	Too Cold	2
Bad	No	Too Warm	1

III. RESULTS AND DISCUSSION

This research investigated whether occupants of LEED-certified buildings experience higher satisfaction compared to those in non-certified buildings by comparing seven indoor environmental quality (IEQ) factors. To achieve this, an online survey was conducted with 75 occupants from each building type. Usable responses were received from 61 LEED-certified and 66 non-certified building occupants. Indoor environmental quality forms one of the rating categories for LEED certification, although this category only accounts for 16 of the 110 possible points. It is one of the many categories that affect occupant satisfaction and focuses on 11 subsections, as shown in Table VIII.

TABLE VIII LEED POINTS ALLOCATION FOR IEQs.

Indoor Environmental Quality	Total Points (16)
Minimum Indoor Air Quality Performance	Prerequisite Required
Environmental Tobacco Smoke Control	Prerequisite Required
Enhanced Indoor Air Quality Strategies	2
Low-Emitting Materials	3
Construction Indoor Air Quality Management Plan	1
Indoor Air Quality Assessment	2
Thermal Comfort	1
Interior Lighting	2
Daylight	3
Quality Views	1
Acoustic Performance	1

Thermal comfort is a crucial factor in office buildings, influencing both worker productivity and comfort. In Trinidad and Tobago's warm climate, a properly functioning HVAC system is essential. Surprisingly, non-certified buildings reported higher thermal comfort than LEED-certified buildings. However, further analysis revealed that the primary issue in LEED buildings was that occupants felt “too cold,” indicating an adjustment problem rather than an HVAC efficiency issue. Despite this, a total of 49% of LEED building occupants indicated that the temperature was “comfortable” and “somewhat cold” which are generally preferred conditions as shown in Fig. 2. In non-certified buildings, 38% of occupants rated them as “comfortable” and 44% as “somewhat cold,” the highest-rated category. However, 2% of respondents felt the temperature was “too warm”.

A key challenge in both LEED and non-certified buildings is the occupants' inability to adjust the temperature to their preference. The study found that 92% of LEED building occupants and 82% of non-certified building occupants lacked control over the air conditioning settings. Fig. 3 illustrates the

distribution of temperature control among occupants. The average thermal comfort rating was 3.38 for LEED buildings and 4.17 for non-certified buildings, showing that non-certified buildings performed better in this IEQ category, as shown in Fig. 4. This may be partly due to one LEED-certified building not earning the thermal comfort controllability point, based on the certified scorecard.

Recent events like COVID-19 and the increasing presence of Saharan Dust in Trinidad and Tobago have heightened concerns about indoor air quality in office buildings. Saharan Dust frequently pushes air quality to "unhealthy" levels, prompting warnings from authorities, which advise precautions to mitigate health risks. Indoor air quality is a crucial IEQ factor as it directly impacts occupant health. In LEED-certified buildings, responses regarding air quality ranged from neutral to good, while non-certified buildings had a notable number of responses in the "somewhat bad" category (Fig. 5), showing a mix of positive and negative perceptions. The average air quality rating was 4.16 for LEED buildings and 3.77 for non-certified buildings, indicating that LEED-certified buildings performed significantly better. This may be attributed to the LEED certification system, which dedicates up to eight points to air quality-related factors.

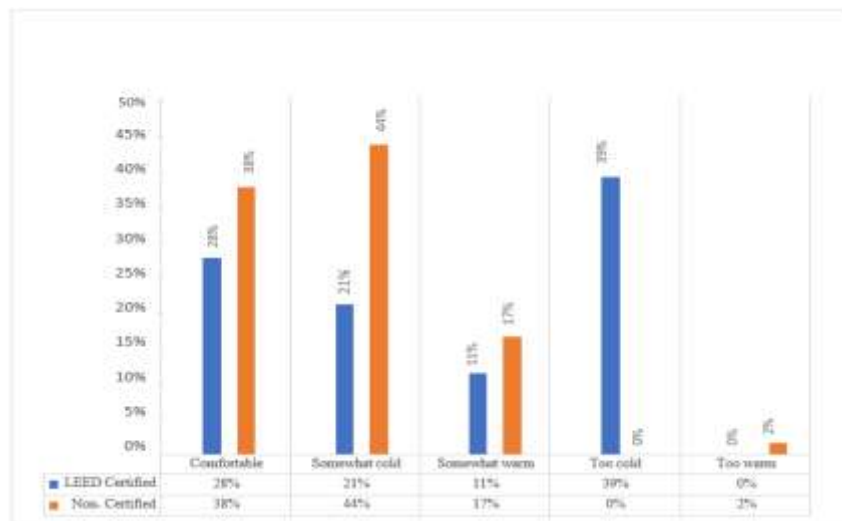


Fig. 2 Occupants' opinions on thermal comfort of buildings

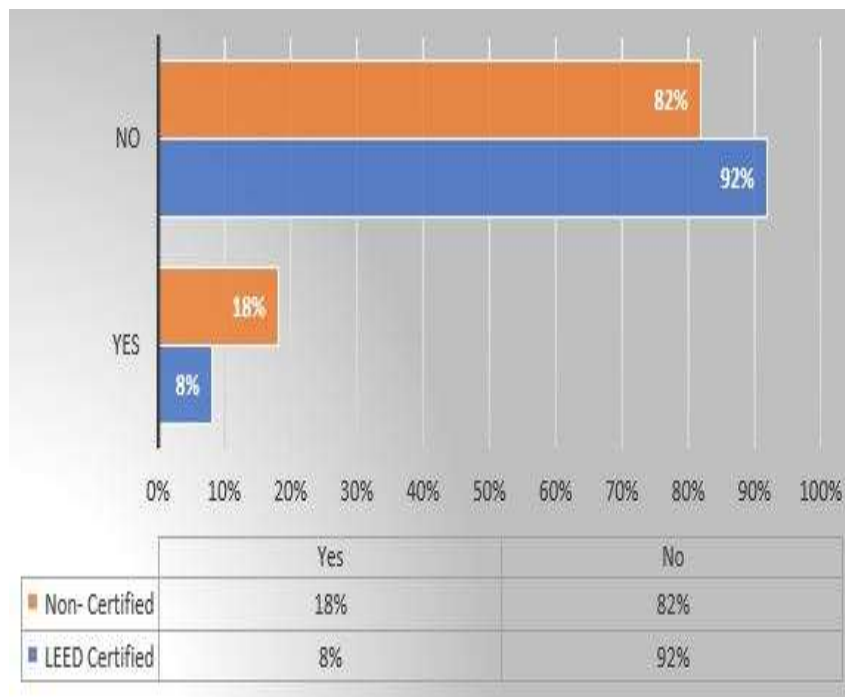


Fig.3 Occupants' control over temperature in buildings



Fig. 4 Mean values for the 7 IEQs for the buildings

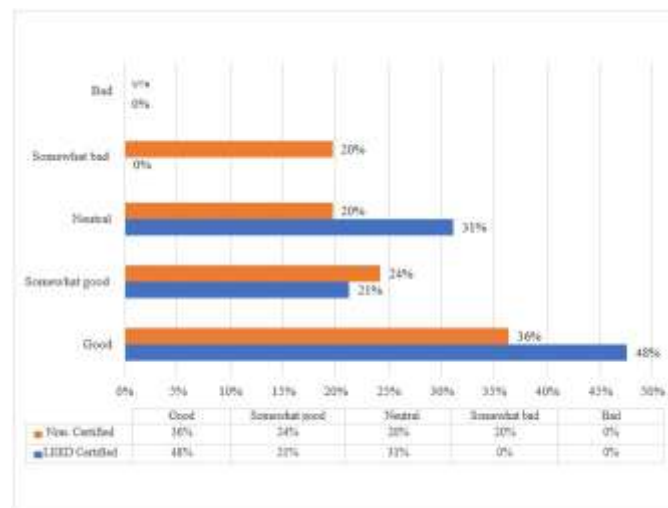


Fig. 5 Occupants' opinions on indoor air quality of buildings

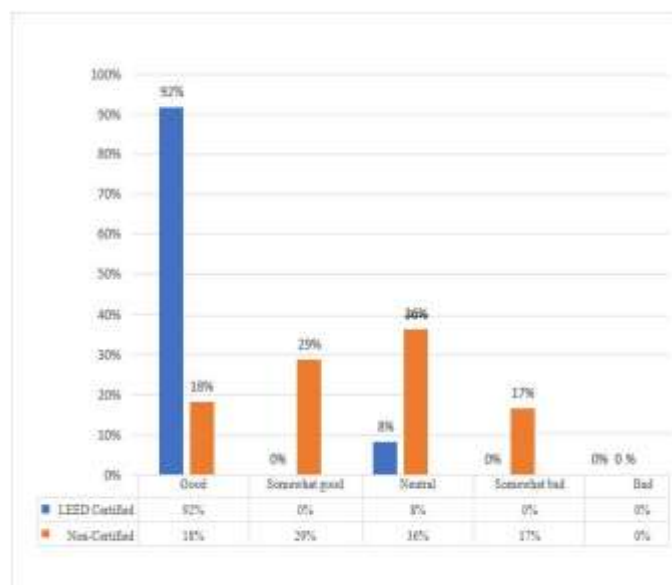


Fig. 6 Occupants' opinions on the lighting of buildings

LEED certification allocates at least five points to indoor lighting, a relatively high amount compared to other IEQ factors, reflecting its impact on productivity, health, and well-being. In LEED-certified buildings, lighting received outstanding ratings, with 92% of occupants, as shown in Fig. 6, rating it as “Good” (5/5 or 100%), resulting in an overall mean score of 4.84. Additionally, 87% of respondents felt no improvements were needed, while 13% suggested minor adjustments, particularly regarding the automatic lighting timer, which turns off at 10:00 PM, later than typical working hours. In contrast, non-certified buildings received a lower lighting rating of 3.48, with the most common response being “Neutral.” Half of the occupants suggested improvements, such as changing fixtures or adjusting brightness levels. These findings indicate that LEED-certified buildings significantly outperform non-certified ones in lighting quality.

Acoustics, though only accounting for one point in LEED certification, has become increasingly important with the rise of open-plan office designs. In non-certified buildings, acoustic ratings averaged in the “neutral” range, with mixed responses of “somewhat yes” and “somewhat no” regarding sound quality as shown in Fig. 7. In contrast, LEED-certified buildings received exclusively positive responses, resulting in a higher average score of 4.43 compared to 3.09 in non-certified buildings. When the occupants were asked about comfort in having private conversations and the availability of private spaces, responses aligned with overall acoustic ratings. Non-certified buildings received mean scores of 3.09, 3.05, and 3.76 for questions 12, 13, 14, whereas LEED buildings scored higher at 4.43, 3.98, and 4.07, further demonstrating their superior acoustic performance.

The office layout in LEED buildings has been rated by occupants as primarily “Good” and “Somewhat Good”, with a few occupants selecting “somewhat bad,” as shown in Fig. 8. The average rating was 4.25 for LEED buildings. For non-certified buildings, however, the average rating was 2.89. This is a difference in both types of buildings and tips the scale in favor of LEED-certified buildings. On the other hand, occupants of LEED buildings rated office furnishings as mostly “Good” or “Somewhat Good,” with a few selecting “Neutral” (Fig. 9), resulting in an average rating of 4.62. In contrast, non-certified buildings received a lower average rating of 3.42, indicating that LEED buildings were rated significantly higher than non-certified ones in terms of office furnishings.

The office cleanliness and maintenance in LEED buildings have been rated by occupants as primarily “Good” and “Somewhat Good,” as shown in Fig. 10. The average rating was 4.92 for LEED buildings. This is the highest rating for both of the buildings in any of indoor environmental quality. For non-certified buildings, however, the average rating was 4.70, with the categories selected by occupants being “Good” and “Somewhat good”. The ratings for both buildings were exceptionally high, with the LEED buildings being rated higher than the non-certified buildings.

Table IX shows the mean values for each IEQ for the LEED-certified and non-certified buildings analyzed within this research. Six out of the seven IEQs yielded higher results for the LEED-certified buildings when compared to the non-certified buildings. Thermal comfort was the one IEQ that had a higher rating for non-certified buildings. From the statistical analysis, the *t*-value was found to be 2.36, while the *p*-value was 0.04, which highlights the statistical significance of the findings and therefore the null hypothesis can be rejected. Hence, the occupant satisfaction of LEED-certified buildings is higher than non-LEED buildings when comparing environmental qualities.

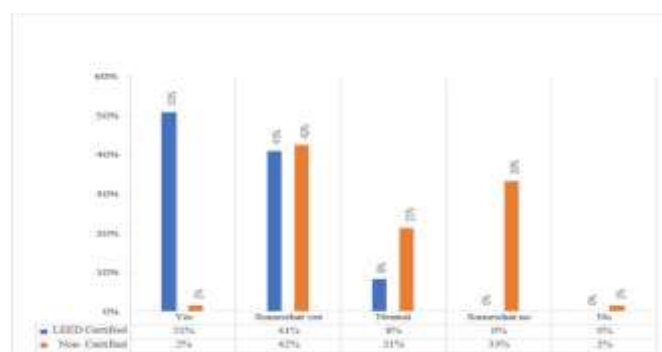


Fig. 7 Occupants' opinions on the acoustics of buildings

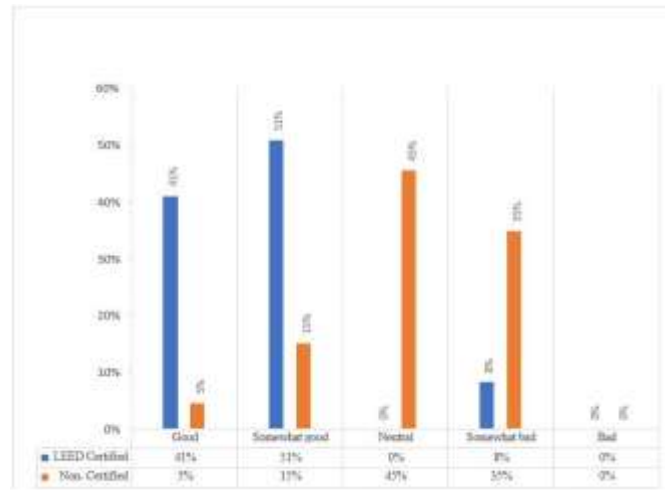


Fig. 8 Occupants' opinions on office layout of buildings

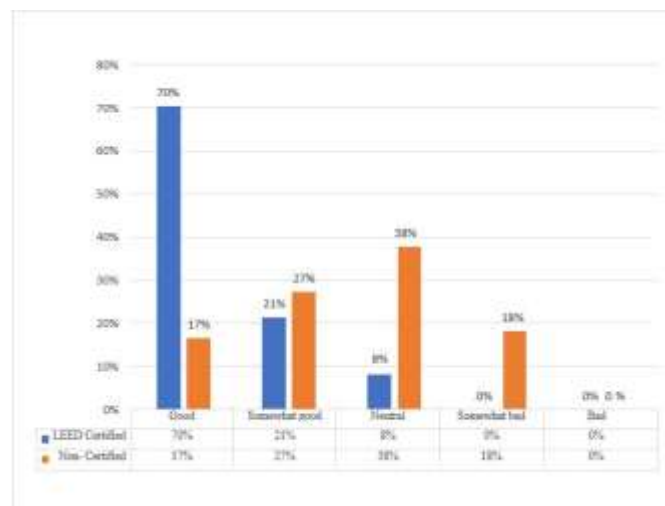


Fig. 9 Occupants' opinions on office furnishing of buildings

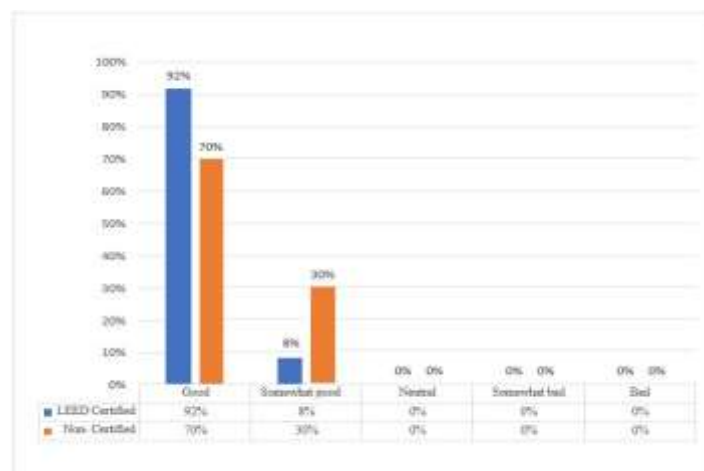


Fig. 10 Occupants' opinions of cleanliness and maintenance of buildings

TABLE IX MEAN VALUES FOR LEED AND NON-LEED BUILDINGS.

Main IEQ	Mean Value for LEED-Certified Buildings	Mean Value for Non-Certified Buildings
Thermal Comfort	3.38	4.17
Air Quality	4.16	3.77
Lighting	4.84	3.48
Acoustics	4.43	3.09
Layout	4.25	2.89
Furnishings	4.62	3.42
Maintenance	4.92	4.70

IV. CONCLUSIONS

This study investigated whether the occupants' satisfaction with LEED-certified buildings exceeds non-certified buildings. This was determined through an in-depth comparison of seven Indoor Environment Qualities. These include: Thermal Comfort, Indoor Air Quality, Acoustics, Lighting, Office Layout, Office Furnishings, and Cleanliness/Maintenance. The overall score out of 35 was 30.6 for LEED-certified buildings and 25.5 for non-certified buildings. It was determined that the non-certified buildings had a higher mean rating than LEED buildings in the IEQ thermal comfort, with the mode response for LEED buildings being "Too Cold". For the other six (6) other IEQs, however, LEED buildings scored distinctively higher. Therefore, it can be concluded that LEED-certified buildings do provide higher satisfaction for occupants when compared to non-certified buildings.

Based on conducting this research the following recommendations can be made: 1) Further implementation of government incentives is required for LEED certification of buildings since LEED buildings are usually more expensive to construct than non-LEED buildings, 2) Marketing of incentives to the public although there may be some present, however, the vast majority of persons are not aware of LEED and its local incentives, 3) The adjustment of temperature in open spaces to a more comfortable temperature is recommended, 4) The installation of thermostats or controls in the air conditioning system for zones in LEED-certified buildings is required, 5) Further publication/marketing of LEED buildings to encourage the public of this type of certification and the benefits of these buildings is necessary, 6) Conduct Post Occupancy Evaluations as a benchmark for improvement and 6) Conduct occupant surveys regularly and improve on problems that do exist.

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