

ENHANCING GUEST EXPERIENCE IN GUEST ROOMS THROUGH SUSTAINABLE STRATEGIES FOR INDOOR AIR QUALITY IMPROVEMENT IN SRI LANKAS LUXURY HOTELS

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Abstract: Enhancing the guest experience in Sri Lanka's luxury hotels requires a focus on sustainable strategies to improve indoor air quality (IAQ) which is essential for guest health and comfort. The tropical climates like in Sri Lanka presents unique challenges, such as high humidity, which can lead to mold growth and pollutant accumulation. Poor IAQ can result in discomfort and health issues for guests, undermining the reputation of luxury hotels. This paper explores sustainable solutions to enhance IAQ, such as including upgrading ventilation systems, regular maintenance of HVAC units, and the use of eco-friendly building materials and cleaning products. By focusing on long-term improvements rather than short-term fixes, hotels can provide a healthier environment. Key strategies include incorporating advanced filtration systems to reduce VOCs and particulate matter, leveraging natural ventilation, and managing humidity to prevent mold. The use of indoor plants and responsible pest control are also explored as additional measures. This study provides original insights into how sustainable IAQ practices can enhance guest satisfaction while aligning with global sustainability trends. The research uses a qualitative approach, with case studies of luxury hotels in Sri Lanka. Through expert interviews the study assesses current IAQ practices and their impact on guest experiences. This research contributes to the field by offering valuable insights into the integration of IAQ improvement strategies into sustainable hotel practices, positioning Sri Lanka's luxury hotels as leaders in promoting a healthier, more sustainable guest experience.

Keywords. *Hotel Industry: Indoor Air Quality: Sri Lanka: Sustainability*

1. Introduction

The luxury hotel industry is a key player in the global tourism sector, renowned for offering unparalleled comfort and sophisticated experiences (Tomašević, 2018). As awareness of environmental sustainability grows worldwide, luxury hotels are increasingly striving to balance opulence with ecological responsibility (Pereira et al., 2021). A critical component of this endeavour is the improvement of IAQ, which plays a significant role in guest comfort, health, and overall experience (W. Chan et al., 2009). Poor IAQ can cause discomfort and health issues, detracting from guest satisfaction and potentially discouraging future stays (W. Chan et al., 2009). Thus, enhancing IAQ through sustainable strategies is not only an environmental imperative but also essential for maintaining competitive advantage in the luxury market (Chenari et al., 2016).

Globally, the focus on sustainability in luxury hotels extends beyond visual appeal, encompassing eco-friendly practices that enhance guest experiences (Amatulli et al., 2021). In Sri Lanka, the luxury hotel sector is an important contributor to the tourism industry, a vital part of the country's economy. While the focus on sustainability has gained momentum globally, there is a noticeable gap in research specifically addressing sustainable strategies for IAQ improvement within Sri Lanka's luxury hotels. Most existing studies on sustainability in the Sri Lankan hospitality industry have primarily concentrated on energy efficiency, waste management, and water conservation. However, IAQ has not received the same level of attention, despite its significant impact on guest health and satisfaction. This study aims to examine how luxury hotels are adopting sustainable strategies to improve IAQ and, consequently, enhance guest experiences. By analysing the practices of several leading hotels, this research seeks to identify effective IAQ management strategies and assess their impact on guest satisfaction. This study focus on IAQ as a critical but underexplored aspect of sustainability in Sri Lanka's hospitality sector, offering a unique contribution to both academic literature and industry practice by providing valuable insights for hotel managers, sustainability officers, and facility management professionals, helping them better understand the relationship between IAQ and guest experience. Additionally, the findings will inform policymakers and industry stakeholders about the importance of IAQ in fostering sustainable hospitality practices, contributing to Sri Lanka's position as a leader in eco-conscious tourism through the adoption of sustainable IAQ.

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2. Literature Review

2.1. INDOOR AIR QUALITY IN HOTELS

IAQ refers to the condition of the air within and around buildings and structures, particularly as it relates to the health and comfort of building occupants (Kamaruzzaman & Sabrani, 2011). Good IAQ is essential for maintaining a healthy indoor environment, as people spend a significant amount of time indoors, whether at home, work, or in public spaces like hotels and restaurants (Bluyssen, 2013). Poor IAQ can lead to various health problems, ranging from minor irritations to severe health issues, including respiratory diseases and cardiovascular problems (Kumar et al., 2023). IAQ in hotel guest rooms is a critical component of providing a comfortable and healthy environment for guests. As people often spend a significant amount of time in hotel rooms during their stays, ensuring good IAQ is essential for guest satisfaction and overall health (Borowski et al., 2022).

2.2. IMPORTANCE OF INDOOR AIR QUALITY IN HOTELS

Good IAQ ensures a comfortable and healthy environment, which is essential for guests who spend considerable time in their rooms. Hotels are unique environments where high occupancy levels and diverse activities increase the risk of indoor air pollution. Guests expect clean, fresh air in their rooms, and any negative experiences related to air quality can lead to complaints and negative reviews (Borowski et al., 2022). The first thing guests often notice upon entering a room is the air quality. A fresh, clean-smelling room sets a positive tone for their stay. Conversely, unpleasant odors or stale air can lead to immediate dissatisfaction. Good IAQ can significantly affect sleep quality. Poor air circulation or odors can disturb sleep, leading to a less restful experience. This is especially important for guests who may be jet-lagged or on a tight schedule. Guests spend a significant amount of time in their rooms. Consistently good air quality enhances their overall experience, making them more likely to return and recommend the hotel to others.

Many people suffer from allergies or asthma, and poor IAQ can trigger symptoms. Dust, mold spores, and other allergens can exacerbate these conditions. IAQ is closely linked to the overall perception of cleanliness in a hotel. Guests associate fresh air with cleanliness, while odors or stuffiness can lead to perceptions of poor hygiene. Moreover, maintaining high IAQ standards is essential for meeting health and safety regulations and enhancing the hotel's brand image as a responsible and customer-focused establishment (Bluyssen, 2013). Many countries have regulations regarding IAQ standards in public accommodations. Hotels must comply with these regulations to avoid legal issues and potential fines.

Additionally, good IAQ contributes to energy efficiency and sustainability by reducing the need for excessive heating, ventilation, and air conditioning (HVAC) operations, thereby lowering operational costs and minimizing environmental impact (Ilmonen, 2015). Efficient management of IAQ through proper ventilation and filtration systems can help reduce energy costs. This is particularly important in tropical countries where air conditioning is often necessary. By prioritizing IAQ, hotels can enhance guest loyalty, attract more customers, and create a healthier, more sustainable environment for both guests and staff. Maintaining good IAQ often involves sustainable practices, such as using eco-friendly cleaning products and minimizing the use of volatile organic compounds (VOCs). This aligns with broader sustainability goals and can attract environmentally conscious guests.

2.3. INDOOR AIR QUALITY PERFORMANCE BENCHMARKS IN HOTELS

IAQ is an important aspect of maintaining a healthy and comfortable environment, particularly in hotel guest rooms where guests expect a high level of comfort and safety. In tropical countries like Sri Lanka, factors such as high humidity, temperature variations, and outdoor pollution can significantly impact IAQ. To ensure a pleasant and healthy stay for guests, it is essential to monitor and manage several key IAQ parameters.

Table 1: IAQ Performance Benchmarks in Hotel Guest Rooms

Metrics	Benchmark	Reference
Temperature	The optimal indoor temperature range is generally between 22-26°C (71.6-78.8°F).	(Monash University, 2019) (Ministry of Environment, 2022)
Humidity	Ideal indoor relative humidity levels should be between 30-60%.	(Institute of Air Quality Management, 2021) (ASHRAE 62.1, 2022) (Ministry of Environment, 2022)
Carbon Dioxide (CO2)	CO2 levels should ideally be 491 ± 46 ppm.	(Neumeister-Kemp et al., 2012) (Lin et al., 2021) (Andrew Persily et al., 2025)
Particulate Matter (PM2.5 and PM10)	PM2.5 should be less than 50 µg/m ³ (24-hour mean). PM10 should be less than 100 µg/m ³ (24-hour mean).	(Ministry of Environment, 2022)

Volatile Organic Compounds (VOCs)	Total VOC levels should be kept below 500 µg/m ³ .	(C. S. Chan et al., 2011) (Lin et al., 2021)
Carbon Monoxide (CO)	CO levels should be kept below 9 ppm over 8 hours.	(ASHRAE 62.1-2022, 2022)

3. Research Methodology

A qualitative research approach was selected to achieve the objectives of this study, as it is particularly suited to exploring the thoughts, opinions, and experiences of respondents within their specific contexts (Mills & Birks, 2014). This approach is ideal for understanding the complexities involved in enhancing guest experiences through sustainable strategies for IAQ improvement in Sri Lanka's luxury hotels. By focusing on the selection and implementation of sustainable strategies, the study aims to understand how these strategies can improve IAQ and contribute to guest satisfaction. Three luxury hotels in Sri Lanka were selected as case studies using purposive sampling to ensure they represent a variety of approaches to IAQ management and sustainability initiatives. These hotels, having been operational for more than twenty years, provide a robust context for analysing the implementation and impact of IAQ improvement strategies. Data were collected through expert interviews with hotel managers, sustainability officers, and facility management personnel, which provided insights into the current IAQ management practices and the sustainable strategies being employed or considered. An expert is defined as an individual possessing an advanced level of knowledge or proficiency in a specific domain or activity. An expert survey constitutes a research method involving the collection of data from a preselected group of individuals to gain deeper insights into a particular subject. This approach empowers researchers to amass a substantial volume of information within a concise timeframe. The interviews were semi-structured to allow flexibility and depth in exploring the participants' experiences and perspectives. Additionally, observational visits to the selected hotels were conducted to gather firsthand information on IAQ measures in place. The interview transcripts were analysed using content analysis.

Table 2: The Profile of the Selected Hotel Buildings and Experts

Cases	Building profile	Respondent	Experts profile
C1	7 story five start hotel building, thirty-nine (39) years old	C1R1	Chief Engineer with ten (10) years of working experience in hotel buildings and responsible for all engineering and maintenance activities
		C1R2	Manager Housekeeping (8) years of working experience in the hotel sector and responsible for housekeeping and laundry activities
		C1R3	Executive Sustainability (4) years of working experience in hotel industry
C2	9 story five-star hotel building, fifty-one (51) years old	C2R1	Facility Manager with ten (12) years of working experience in hotel buildings
		C2R2	Manager Housekeeping with eight (8) years of working experience in hotel buildings
C3	15 story five-star hotel, forty (40) years old	C3R1	Chief Engineer with eight (8) years of working experience in Hotel sector
		C3R2	Manager Housekeeping with eight (6) years of working experience in hotel buildings

Simultaneously, the principle of saturation is applied in qualitative data collection to determine the appropriate sample size. Saturation is reached when interviews no longer yield new information, indicating that further data collection would be redundant. This principle ensures that the sample size is sufficient to capture the full range of insights without unnecessary repetition, optimizing the efficiency and effectiveness of the research process.

4. Findings

4.1. CAUSES FOR THE IMPROPER INDOOR AIR QUALITY IN GUEST ROOMS IN SRILANKAN LUXURY HOTELS

All experts mentioned that improper IAQ in hotels can arise from a variety of factors that significantly affect both guest comfort and health. Understanding these causes is essential for hotel management to implement effective solutions. Ensuring good IAQ is essential for the comfort and health of hotel guests and staff, especially in tropical regions like Sri Lanka.

The effectiveness of ventilation systems plays a critical role in maintaining IAQ. C1R3 mentioned that, "without adequate ventilation, pollutants like carbon dioxide, volatile organic compounds (VOCs), and particulate matter can accumulate, leading to discomfort and potential health issues". Similarly, C2R2 mentioned that, "Inadequate ventilation is a common issue, as many

hotels struggle with systems that fail to circulate fresh air adequately, leading to the accumulation of indoor pollutants such as carbon dioxide, VOCs, and other contaminants". C1R1 mentioned that, "the use of chemical cleaning products can release VOCs and harmful chemicals into the air, degrading IAQ". Emissions from building materials and furnishings, such as carpets, paints, and furniture, contribute to poor IAQ by off-gassing formaldehyde and other chemicals. The materials used in hotel construction and furnishings can significantly impact IAQ. C3R1 highlighted that "many common building materials, such as paints, carpets, and pressed wood products, emit VOCs that can degrade air quality." The emissions from these materials can contribute to the presence of indoor pollutants, particularly in newly constructed or renovated spaces where the off-gassing of VOCs is most pronounced explained by most of the experts (5/7). Moreover, C1R1 and C3R1 mentioned that, Inadequate air filtration systems can fail to capture these particles, allowing them to circulate throughout the hotel. Moreover, C2R1 mentioned that, "lack of proper airflow design can result in uneven distribution of fresh air, leaving some areas with stale air". The cleaning products used in hotels can also affect IAQ. "Traditional cleaning products often contain harsh chemicals that release fumes into the air," said by the C2R2. Similarly, C1R2 and C3R2 mentioned that these chemical fumes can contribute to indoor air pollution, particularly in areas where ventilation is inadequate, leading to potential health concerns for both guests and staff. Most of the experts (4/7) highlighted that the activities of hotel guests can introduce various pollutants into the indoor environment. Similarly, C1R3 stated that "Smoking in rooms, the use of personal care products, and cooking in kitchenettes are all potential sources of indoor air pollutants". In addition to that expert C1R2 and C2R2 also mentioned that smoking, in particular, releases a range of harmful chemicals into the air, while cooking can generate particulate matter and odors that affect IAQ.

Many hotels in Sri Lanka rely on a combination of natural and mechanical ventilation to manage IAQ. However, according to all the experts in older buildings, ventilation systems may not be up to modern standards, resulting in insufficient air exchange and the buildup of indoor pollutants. Sri Lanka's tropical climate presents unique challenges for maintaining IAQ. On the other hand, C1R1 stated that "High humidity levels can lead to condensation and encourage the growth of mold and mildew". Similarly, C2R2 and C3R1 mentioned that Mold spores are a common concern, as they can cause respiratory problems and allergies. The combination of warm temperatures and high humidity creates an environment conducive to mold growth, particularly in poorly ventilated areas. Additionally, C1R1 mentioned that "Weather conditions also play a significant role; for example, during rainy seasons or in regions with high humidity, the likelihood of moisture and mold problems increases. Conversely, in drier climates, dust and airborne particles can be more prevalent." In addition to that, C1R2 mentioned that, "Seasonal changes in temperature can affect HVAC efficiency, making it more challenging to maintain optimal IAQ." Air conditioning is prevalent in Sri Lankan hotels to provide relief from the tropical heat. "However, without regular maintenance, air conditioning units can become a source of pollution themselves," pointed by C3R1. According to C1R2, C2R1 and C3R2, Dust, mold, and bacteria can accumulate in filters and ducts, and if not cleaned regularly, these contaminants can be circulated throughout the hotel, degrading air quality and potentially causing health issues for occupants.

According to the C2R1 "Improper maintenance, such as overwatering, can lead to mold growth and increased humidity, which can counteract the potential benefits of plants". Most of the experts (4/7) mentioned that Effective pest control is necessary to maintain a clean and hygienic environment in hotels, but it can also impact IAQ. On the other hand, "The use of chemical pesticides can introduce harmful substances into the air," the C1R2 stated. Indoor air can be affected by these chemicals, which may linger in the environment and pose health risks to occupants. The location of a hotel can significantly influence its IAQ. C1R3 stated that "Hotels situated in urban areas or near busy roads may experience higher levels of outdoor air pollution, such as vehicle emissions, entering the building,". The infiltration of outdoor pollutants, including nitrogen dioxide and particulate matter, can affect the indoor environment, particularly in areas where windows and doors are frequently opened. And also, C1R2 identified that "Guest activities and occupancy levels add another layer of complexity, as high occupancy and activities like smoking, cooking, and the use of personal care products introduce additional pollutants".

Regular maintenance is crucial for sustaining good IAQ. According to C2R1 "Ensuring that all mechanical systems, such as HVAC and plumbing, are regularly inspected and maintained prevents problems like leaks and mold". Similarly expert C1R1 and C3R1 mentioned that neglecting routine maintenance can lead to issues such as water leaks and inefficient HVAC operation, which can contribute to poor air quality. Water damage is a common issue that can severely impact IAQ. "Leaks and flooding can lead to mold and mildew, which are major contributors to poor IAQ," the expert C1R2 advised. Water intrusion, whether from plumbing leaks or external sources, can create conditions conducive to mold growth, significantly affecting IAQ and potentially causing structural damage. Addressing these issues comprehensively, rather than relying on short-term fixes, is crucial for maintaining a healthy and comfortable environment for hotel guests and staff in Sri Lanka's tropical climate.

4.2. SUSTAINABLE STRATEGIES FOR OVERCOME IDENTIFY CAUSES

In Sri Lanka, many luxury hotels face significant challenges with improper IAQ in guest rooms, leading to a considerable number of guest complaints. Despite the severity of the issue, a considerable number of hotels often resort to short-term solutions like air fresheners, which only mask the symptoms without addressing the root causes of IAQ problems. Other temporary fixes include increased use of surface cleaners, frequent replacement of air filters, and occasional use of ozone generators to neutralize odors. These measures fail to tackle underlying issues such as inadequate ventilation, high humidity, and the presence of VOCs from building materials and furnishings. The short-term approach does not resolve persistent problems related to mold, dust accumulation, or external pollution infiltration, which continue to impact guest

comfort and health. Consequently, without a focus on long-term, sustainable solutions hotels are unable to provide a lasting improvement in IAQ, leaving guests dissatisfied and potentially compromising the hotel's reputation. Here, the strategies are presented alongside their relevant identified causes.

4.2.1 Inadequate ventilation and air filtration will cause for improper IAQ in guest rooms.

All experts mentioned that, improving IAQ in hotel guest rooms is essential for guest satisfaction and the sustainability of operations. Implementing effective strategies requires an understanding of both the environmental and operational aspects of hotels. C1R2 mentioned that, *"effective ventilation is a cornerstone of maintaining good IAQ. Modern hotels are increasingly adopting advanced ventilation solutions to ensure optimal air quality. Ventilation is fundamental to IAQ."* Moreover, C1R1 and C2R1 highlighted that, upgrading to energy-efficient HVAC systems, equipped with filters, ensures that particulate matter and airborne pollutants are effectively removed from indoor air. These systems also reduce the carbon footprint by optimizing energy use, aligning with our sustainability goals. C2R1 and C3R1 mentioned that *"Schedule frequent replacement or cleaning of air filters to maintain their efficiency and ensure unobstructed airflow."* Moreover, C2R2 and C3R3 suggested that *"Install systems equipped with AI and IoT capabilities to adapt ventilation and filtration in real-time based on occupancy and IAQ levels"*.

4.2.2 Lack of proper airflow design and insufficient air exchange.

Majority of the experts (4/7) mentioned that, natural ventilation can be equally effective when designed properly. Designing guest rooms to utilize cross-ventilation is a sustainable way to enhance airflow. C1R1 and C2R1 mentioned that, by aligning windows and vents to take advantage of natural breezes, we can significantly reduce the need for mechanical ventilation, which not only conserves energy but also creates a more natural and pleasant environment for guests. C3R1 and C2R1 mentioned that, use energy recovery ventilators (ERVs) or heat recovery ventilators (HRVs) to introduce a continuous supply of fresh air, without significantly increasing energy costs. Moreover, C1R1 and C1R3 suggested that, Variable air volume systems allow for dynamic adjustment of air supply based on occupancy and air quality needs, enhancing air exchange without overburdening the HVAC system.

4.2.3 Mold growth

C1R1 and C2R1 highlighted that, using energy-efficient dehumidifiers helps maintain a balanced indoor climate. This not only prevents mold but also makes the indoor environment more comfortable for guests. Similarly, C1R1 suggested that, *"use energy-efficient dehumidifiers to maintain optimal indoor humidity levels (30-50%) to prevent mold growth and dust mites."* In addition to using dehumidifiers, selecting appropriate building materials is crucial. C2R1 mentioned that, *"choosing moisture-resistant drywall and mold-resistant paints can prevent mold proliferation. These materials provide a passive solution to a persistent problem in humid environments, reducing the likelihood of costly repairs and health issues related to mold."* The majority expert (5/7) mentioned that better to use proper insulations like ensure walls, windows, and roofs are properly insulated to prevent moisture intrusion and condensation. Moreover, C3R1 and C2R1 suggested that Energy Recovery Ventilators (ERVs) provide fresh air while managing humidity, preventing moisture accumulation in guest rooms without significant energy loss.

4.2.4 Improper maintenance.

Regular maintenance of air conditioning units is critical to ensure they function properly and do not become a source of pollution themselves. C2R1 mentioned that, *"regular maintenance of air conditioning units is essential, accumulation of dust and mold in the units can severely affect air quality if not addressed through routine cleaning and filter replacement. It's about keeping the system efficient and safe for our guests. Technology can further enhance this process"*. On the other hand, C3R2 and C2R2 mentioned that by allowing guests to control room temperatures, smart thermostats help conserve energy and maintain optimal comfort. C3R2 described that, *"They adjust automatically based on occupancy, ensuring efficiency and helping us to better manage energy use without compromising on guest experience."* Moreover, C2R1 and C3R1 suggested that, regularly inspect, clean, and replace components (such as HVAC filters, plumbing, and electrical systems) before issues arise. Standardized checklists ensure that all essential tasks are completed consistently, reducing the risk of overlooking critical items.

4.2.5 VOCs from building materials

VOCs are a significant concern for IAQ, as they are emitted by many conventional building materials and furnishings. C1R1 mentioned that, *"the off-gassing of VOCs from building materials is a significant source of indoor pollution, using low-VOC paints, adhesives, and furnishings reduces this risk, creating a safer environment for guests."* Sustainable furnishings also contribute to this effort. C2R2 mentioned that *"opting for sustainable furniture made from certified woods and non-toxic finishes contributes to improved IAQ in interior design. These choices support a healthier indoor environment and are part of a larger commitment to sustainability."* Similarly, C1R1 highlighted that, *"use paints, adhesives, sealants, and finishes with low VOC emissions to minimize off-gassing."* C1R1 and C2R1 mentioned that, Install Indoor Air Quality (IAQ) Monitors can detect VOC levels in real-time, allowing for immediate corrective measures if levels are too high.

4.2.6 VOCs from chemical cleaning products

Chemical cleaning products which release VOCs and other harmful contamination have a direct negative impact on IAQ, and C1R2 and C2R2 mentioned that transitioning to green cleaning products is a step towards a healthier indoor environment.

C1R2 mentioned that *“switching to green cleaning products has revolutionized our housekeeping practices. These products are free from harsh chemicals and volatile compounds, ensuring cleaner air for both guests and staff”*. It is about maintaining high cleanliness standards without compromising health. C2R2 mentioned that, *“using microfiber technology is another effective approach. C1R1 mentioned that, “microfiber cloths capture more dust and dirt than traditional cloths, reducing the need for chemical cleaners. This not only improves air quality but also enhances the effectiveness of cleaning routines, making them more sustainable.”* Moreover, majority of experts (6/7) mentioned that, selecting carpets, flooring materials, and underlays that have low VOC emissions and are certified by reputable organizations green seal will prevent the expose of VOCs inside the guest rooms.

4.2.7 Guest activities

Guest activities can also influence IAQ, particularly when it comes to smoking and cooking in guest rooms. C3R2 mentioned, *“Enforcing a no-smoking policy in guest rooms is a critical step towards better IAQ,”*. The expert suggested, *“by providing designated smoking areas outside, we can drastically reduce indoor pollutants associated with tobacco smoke, ensuring a healthier environment for all guests.”* Moreover, C1R2 and C2R2 highlighted that for rooms equipped with kitchenettes, proper ventilation systems should be installed to effectively remove cooking fumes and odors, preventing the accumulation of pollutants like particulate matter and nitrogen dioxide. C3R1 stated that *“promoting awareness among guests through informational materials or signage about the impact of smoking and cooking on IAQ can encourage more environmentally friendly behaviors”*. Furthermore, C1R3 mentioned that establishing a system to monitor IAQ and promptly address guest complaints, such as providing portable air purifiers or conducting deep cleaning between stays, ensures a continuous improvement in maintaining optimal air quality.

4.2.8. High humidity level

C1R2 and C3R2 mentioned, Indoor plants are increasingly used in hotels for their aesthetic appeal and ability to improve IAQ by absorbing CO₂ and other toxins. Indoor plants can improve air quality by absorbing CO₂ and certain toxins. C1R2 mentioned that, *“species like snake plants and peace lilies are particularly effective, though they must be cared for to prevent issues like overwatering, which can lead to mold. C1R1 suggested that, “the integration of biophilic design, which incorporates natural elements into interior spaces, offers additional benefits. Biophilic elements not only enhance air quality but also improve guests' well-being by connecting them with nature. Moreover, C2R1 mentioned that, “incorporating natural light and greenery creates a calming atmosphere, enhancing the overall guest experience.”* However C3R2 mentioned that there should be proper HVAC system and air circulation to maintain proper humidity levels in guest rooms.

4.2.9. Inadequate Pest Control

Traditional pest control methods often involve harsh chemicals that can negatively impact IAQ. Sustainable pest management focuses on non-chemical strategies. C2R2 mentioned that, *“traditional pest control methods can introduce harmful chemicals into the indoor environment”*. C1R2 and C3R2 highlighted that, Integrated Pest Management (IPM) emphasizes non-chemical methods, such as sealing entry points and maintaining cleanliness, to deter pests. C2R2 mentioned that, *“using essential oils like peppermint and eucalyptus as natural repellents is an effective way to manage pests without compromising air quality”*. Using natural repellents is one of the best methods to improve indoor air quality, as they not only provide an eco-friendly solution but also help eliminate pollutants and irritants without introducing harmful chemicals into the environment.

4.2.10 Outdoor pollution

External pollution from traffic and industrial activities can infiltrate hotel buildings, impacting IAQ. Advanced solutions are needed to address this challenge. External pollutants from traffic and industrial areas can infiltrate hotel buildings, affecting IAQ. C1R1 explore that, *“advanced air filtration systems with activated carbon filters can trap these pollutants, ensuring clean indoor air. Green building design can further mitigate the impact of external pollution.”* C3R1 mentioned that *“Incorporating features like green roofs and walls can improve insulation and air filtration, reducing the impact of external pollutants”*. These features not only improve IAQ but also enhance the building's energy efficiency, contributing to overall sustainability goals.

4.2.11 Water leakages and damages

Preventive maintenance and effective water management are essential to prevent issues like leaks and water damage, which can significantly impact IAQ. C2R1 mentioned that *“routine maintenance of plumbing and HVAC systems is essential to prevent leaks and ensure efficient operation,”*. Moreover, C1R1 and C2R2 mentioned, neglecting maintenance can lead to water damage and mold growth, severely impacting IAQ. C2R2 suggested, *“smart leak detection systems provide a proactive solution. These systems can quickly identify and alert staff to leaks, allowing for prompt repairs”*. This proactive approach prevents water-related IAQ issues and protects the building's infrastructure.

By implementing these sustainable strategies, hotels can significantly improve IAQ in guest rooms, enhancing guest satisfaction and demonstrating a commitment to environmental responsibility. These measures not only contribute to a healthier environment but also align with the growing demand for sustainable practices in the hospitality industry.

5. Conclusion

IAQ in Sri Lanka's luxury hotels is essential for enhancing guest satisfaction and ensuring a sustainable operation. The findings indicate that a reliance on short-term solutions, such as air fresheners and surface cleaners, does not address the root causes of poor IAQ. Sustainable strategies, such as upgrading ventilation systems, managing humidity, and selecting eco-friendly building materials, are crucial for long-term improvement. Implementing energy-efficient HVAC systems with advanced filtration and cross-ventilation designs can effectively reduce pollutants and energy consumption. Regular maintenance of air conditioning units and the use of smart thermostats are also vital in maintaining optimal air quality and efficiency. Addressing VOC emissions through the use of low-VOC paints and sustainable furnishings can significantly reduce indoor pollutants. Transitioning to green cleaning products and microfiber cleaning methods further supports IAQ improvement. Additionally, enforcing no-smoking policies and incorporating indoor plants with proper maintenance can enhance air quality and guest well-being. Sustainable pest control and mitigating external pollution through advanced filtration and green building designs also contribute to a healthier environment.

By focusing on these sustainable practices, hotels can provide a healthier and more comfortable environment for their guests. These efforts not only improve IAQ but also align with the growing demand for environmentally responsible practices in the hospitality industry, ultimately enhancing the reputation and competitiveness of Sri Lanka's luxury hotels. The implications of these findings are significant for both hotel management and the broader hospitality industry. For management, adopting sustainable IAQ practices can enhance guest satisfaction and reduce health risks, ultimately bolstering hotel reputation and competitiveness. For the industry, the shift toward sustainable solutions aligns with growing consumer demand for environmentally responsible practices, positioning Sri Lanka's luxury hotels as leaders in sustainable hospitality. Thus, long-term commitment to IAQ improvements through proactive maintenance, eco-friendly materials, and innovative technology supports both operational sustainability and improved guest experience, creating a model for luxury hospitality in tropical climates.

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