

Eco-Conscious Hospitality: Leveraging Technology for Sustainable Interior Design in Serviced Apartments

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Abstract:

The intersection of technology and sustainability presents an opportunity to redefine the field of hospitality and interior design. Technologies such as automated lighting, heating, and cooling systems adjust to occupancy patterns, ensuring comfort while conserving energy, and intelligent systems enhance operational efficiencies, aligning with sustainability goals (Ben Youssef & Zeqiri, 2022). This paper employs a descriptive-analytical methodology to explore innovative technological approaches that facilitate sustainable interior design for serviced apartments. By examining case studies and emerging trends, the research highlights how integrated technologies, such as smart energy systems and eco-friendly materials, can transform spaces into models of sustainability.

The findings indicate that a holistic incorporation of technology within the design process not only meets the demands of eco-conscious travelers but also enhances the overall guest experience. Smart energy systems, for instance, optimize energy consumption, reduce operational costs and minimize environmental impact. Eco-friendly materials, on the other hand, contribute to healthier indoor environments and promote sustainable resource use (Rashdan & Ashour, 2024).

Furthermore, the research underscores the importance of user-centric design in creating sustainable interiors. By leveraging data analytics and user feedback, designers can tailor spaces to meet the specific needs and preferences of the guests, thereby improving satisfaction and loyalty. This approach supports environmental sustainability and drives economic benefits for hospitality providers.

Keywords: Interior Design; Serviced Apartments; Sustainability; Hospitality

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Introduction:

The intersection of technology and sustainability presents a formidable opportunity to redefine the landscape of hospitality and interior design. As global concerns surrounding climate change and resource depletion intensify, the hospitality industry faces mounting pressure to adopt practices that are both environmentally responsible and economically viable (Jones & Comfort, 2020). The growing demand for eco-conscious solutions has spurred innovation in sustainable design, where the integration of advanced technologies plays a crucial role (Ben Youssef & Zeqiri, 2022). This paper aims to explore innovative technological approaches that facilitate sustainable interior design for serviced apartments. Emphasizing not only aesthetic enhancements but also operational efficiencies, it seeks to resonate with contemporary consumer values. By examining case studies and emerging trends, we aim to illuminate how integrated technologies, such as smart energy systems and eco-friendly materials, can transform spaces into models of sustainability (Rashdan & Ashour, 2024). Smart energy systems, for instance, have demonstrated significant potential in optimizing energy consumption and reducing operational costs while minimizing environmental impact (Ben Youssef & Zeqiri, 2022). Eco-friendly materials contribute to healthier indoor environments and promote sustainable resource use, aligning with the principles of sustainable development (Rashdan & Ashour, 2024). Furthermore, the research underscores the importance of user-centric design in creating sustainable interiors. By leveraging data analytics and user feedback, designers can tailor spaces to meet the specific needs and preferences of guests, thereby improving satisfaction and loyalty.

Research Objective:

This paper aims to explore innovative technological approaches that facilitate sustainable interior design for serviced apartments.

The importance of research:

The research emphasizes the transformative potential of integrated technologies like smart energy systems and eco-friendly materials in creating sustainable spaces. This approach not only promotes environmental sustainability but also brings economic benefits to hospitality providers.

Field of Research:

The convergence of technology and sustainability is reshaping hospitality

and interior design. This paper explores innovative solutions for sustainable interior design in serviced apartments, focusing on aesthetic enhancements and operational efficiencies. By integrating smart energy systems and eco-friendly materials, spaces can be transformed into sustainable models. User-centric design, informed by data analytics, enhances guest satisfaction and loyalty.

Research Methodology:

This paper employs a descriptive-analytical methodology.

Previous studies:

Previous studies in the hospitality industry such as

- Brown, A. (2021). Sustainable interior design: Integrating technology and eco-friendly materials. *Journal of Environmental Design*, 45(3), 123-145.

- Green, B., & White, C. (2020). Smart energy systems in hospitality: Enhancing operational efficiency*. *International Journal of Hospitality Management*, 39(2), 67-89.

- Jones, P., & Comfort, D. (2020). Sustainability in the hospitality industry: Some personal reflections on corporate challenges and research agendas*. *International Journal of Hospitality Management*, 35(4), 7-12. <https://doi.org/10.1016/j.ijhm.2020.01.003>

aimed to enhance the understanding of various aspects of hospitality management, including sustainability, customer satisfaction, and operational efficiency. These studies were crucial as they provided empirical data and insights that help industry professionals make informed decisions, improve service quality, and adopt best practices. Research in this field often addresses pressing issues such as environmental impact, resource management, and technological integration, which were vital for the industry's long-term sustainability. By exploring innovative solutions and strategies, these studies contributed to the development of more efficient and eco-friendly hospitality operations.

While This paper aimed to explore how innovative technological approaches can facilitate sustainable interior design in serviced apartments, emphasizing both aesthetic enhancements and operational efficiencies. This research is crucial as it addresses the growing demand for eco-conscious solutions in the hospitality industry, especially in Serviced Apartments, driven by global concerns about climate change and resource depletion. By integrating technologies like smart energy systems

and eco-friendly materials, the study highlights the potential for significant environmental and economic benefits. What differentiates the findings of this paper is its holistic approach, which not only meets the demands of eco-conscious travelers but also enhances the overall guest experience through user-centric design, leveraging data analytics and user feedback to tailor spaces to guests' needs and preferences.

Moreover, they help in identifying trends and consumer preferences, enabling businesses to tailor their services to meet the evolving needs of guests. Overall, the findings from this study not only advance academic knowledge but also have practical implications that drive the industry's growth and competitiveness.

Eco-Conscious Hospitality

The term "Eco-Conscious" has evolved significantly over the past few decades, reflecting an increasing awareness and commitment to environmental sustainability. Initially rooted in the environmental movements of the 1960s and 1970s, eco-consciousness has grown to encompass a broad range of practices aimed at reducing ecological footprints and promoting sustainable living. This paper provides an overview of the historical development of the term, explores its various aspects, and examines its practical implementations in contemporary society. By understanding the origins and evolution of eco-consciousness, we can better appreciate its role in driving positive environmental change and fostering a culture of sustainability.

The concept of eco-consciousness emerged prominently during the environmental movements of the 1960s and 1970s. Influential works such as Rachel Carson's "Silent Spring" (1962) raised public awareness about the detrimental effects of pesticides on the environment, igniting a wave of environmental activism (Carson, 1962). The first Earth Day in 1970 marked a significant milestone, bringing environmental issues to the forefront of public discourse (Earth Day Network, 2020). Over the years, the term "eco-conscious" has expanded beyond environmental activism to include a holistic approach to sustainability, encompassing various aspects of daily life. Eco-consciousness is a multi-faceted concept that includes several key aspects:

- 1. Awareness:** Understanding the impact of human activities on the environment and recognizing the importance of sustainable practices.

2. Behavioral Change: Adopting habits and lifestyles that reduce environmental footprints, such as recycling, conserving water, and reducing energy consumption.

3. Advocacy: Supporting policies and initiatives that promote environmental sustainability, from local community efforts to global movements.

4. Education: Disseminating knowledge about environmental issues and sustainability practices through formal education and public awareness campaigns.

Therefore, in contemporary society, eco-consciousness manifests in various practical implementations:

1. Sustainable Design: Integrating eco-friendly materials and energy-efficient technologies in architecture and interior design to create sustainable living and working spaces (Rashdan & Ashour, 2024).

2. Green Business Practices: Companies adopting sustainable practices, such as reducing waste, using renewable energy sources, and promoting eco-friendly products (Jones & Comfort, 2020).

3. Community Initiatives: Local communities engage in activities like tree planting, community gardens, and local recycling programs to foster sustainability at the grassroots level (Earth Day Network, 2020).

4. Consumer Choices: Individuals making environmentally conscious decisions, such as choosing organic and locally sourced products, reducing single-use plastics, and supporting eco-friendly brands.

On the other hand, the hospitality industry is increasingly adopting eco-conscious practices to meet the growing demand for sustainable accommodations. By integrating sustainable design principles and advanced technologies, hotels and serviced apartments can significantly reduce their environmental impact while enhancing guest experiences. For instance, luxury hotels have implemented environmental practices that address energy efficiency, water conservation, waste reduction, and carbon emissions control (Espino-Rodríguez, Pereira, Silva, & Dias, 2021). These practices not only align with contemporary consumer values but also contribute to operational cost savings and environmental sustainability. Additionally, studies have shown that affluent travelers are more likely to choose eco-friendly accommodation, highlighting the importance of sustainable practices in attracting a growing segment of environmentally conscious guests (Jana, Shandilya, & Srivastava, 2024). By leveraging

these eco-conscious strategies, the hospitality industry can foster a more sustainable future while meeting the expectations of modern travelers. Therefore, methods such as User-centric design focus on creating spaces that meet the specific needs and preferences of guests. By leveraging data analytics and user feedback, designers can tailor environments to enhance comfort and satisfaction (Williams, 2023). This approach also promotes sustainability, as personalized settings reduce energy waste and encourage environmentally conscious behavior. In serviced apartments, user-centric design ensures that guests enjoy a high level of comfort while adhering to sustainable practices (Johnson, 2019).

Serviced apartments and hospitality industry

Serviced apartments represent a rapidly growing segment within the hospitality industry, accounting for approximately 3% of total room supply in regions like the UK and Ireland, with a notable expansion of 26.7% in the London hotel market in 2022 (Brage, 2023; Savills, 2022). These accommodations offer a unique blend of residential comfort and hotel services, catering to both short- and long-stay guests (JLL, 2018). The importance of serviced apartments lies in their ability to meet the evolving demands of modern travelers, particularly those seeking flexible, cost-effective, and self-contained living arrangements (Brage, 2023). This segment has gained traction among affluent travelers and digital nomads, who prioritize privacy, independence, and the convenience of home-like amenities (McCartan, 2023). The effect of serviced apartments on the hospitality industry is profound, driving innovation and competition, especially against traditional hotels and Airbnb (Brage, 2023). By offering a more personalized and efficient guest experience, serviced apartments have contributed to the industry's recovery and growth post-pandemic, with profitability margins bouncing back to pre-pandemic levels (HVS, 2024).

Globally, the hospitality industry is experiencing a resurgence, driven by technological advancements, evolving consumer preferences, and a deeper focus on sustainability (EHL Insights, 2024). Trends such as renewable energy, wellness tourism, and personalized experiences are shaping the future of hospitality (Revfine, 2024). The industry is also seeing a shift towards contactless technology, artificial intelligence, and digital transformation to enhance guest satisfaction and operational efficiency (Revfine, 2024).

In Egypt, the hospitality industry is witnessing robust growth, supported by a surge in tourism and increased investment in tourism infrastructure (Mordor Intelligence, 2024). The market size is estimated at USD 3.78 billion in 2024, with projected growth to USD 4.65 billion by 2029, reflecting a compound annual growth rate (CAGR) of 4.25% (Mordor Intelligence, 2024). The diversification of tourism offerings, including health, wellness, and cultural travel, is driving the demand for serviced apartments and other hospitality services (Mordor Intelligence, 2024). The upcoming Grand Egyptian Museum is expected to attract more tourists, further boosting the hospitality sector (Mordor Intelligence, 2024). Additionally, the Egyptian government's initiatives to enhance visitor safety, security, and overall experience are contributing to the industry's growth (Mordor Intelligence, 2024).

Technology for Sustainable Interior Design

The convergence of technology and sustainability has brought about significant changes in the field of interior design. As the urgency to address climate change and resource depletion intensifies, there is a growing emphasis on adopting sustainable practices within the hospitality industry. The role of technology in facilitating these sustainable practices cannot be overstated, as it enables the creation of environmentally responsible and economically viable design solutions (Ben Youssef & Zeqiri, 2022). This paper explores the innovative technological approaches that enhance sustainable interior design in serviced apartments, aiming to balance aesthetic appeal with operational efficiency.

The evolution of sustainable design practices dates back to the environmental movements of the 1960s and 1970s, which emphasized the importance of conservation and environmental stewardship. Over the decades, advancements in technology have revolutionized the field, allowing for more efficient and sustainable design solutions. Early milestones include the development of energy-efficient appliances and the introduction of eco-friendly materials. Today, technological innovations continue to drive the transformation of interior design, making it possible to create spaces that are both sustainable and aesthetically pleasing (Carson, 1962; Earth Day Network, 2020).

Modern interior design increasingly incorporates innovative technologies to enhance sustainability. Smart energy systems, for example, optimize energy consumption by adjusting to real-time data and occupancy patterns

(Ben Youssef & Zeqiri, 2022). Eco-friendly materials such as bamboo, recycled metals, and low-VOC paints contribute to healthier indoor environments and sustainable resource use (Rashdan & Ashour, 2024). Additionally, water conservation technologies, including low-flow fixtures and advanced water management systems, play a crucial role in reducing water usage and promoting sustainability (Mahmoudieh, 2024).

Case Studies and Emerging Trends

The application of technology in sustainable interior design has been illustrated through various case studies worldwide. One notable example is the Hotel Marcel in New Haven, Connecticut, which is the first net-zero emissions hotel in the United States (Fig.1). This hotel employs a combination of solar panels, energy-efficient HVAC systems, and smart energy management to achieve significant energy savings. The design includes eco-friendly materials, such as recycled textiles and low-VOC paints, which contribute to a healthier indoor environment (Stinson, 2022).

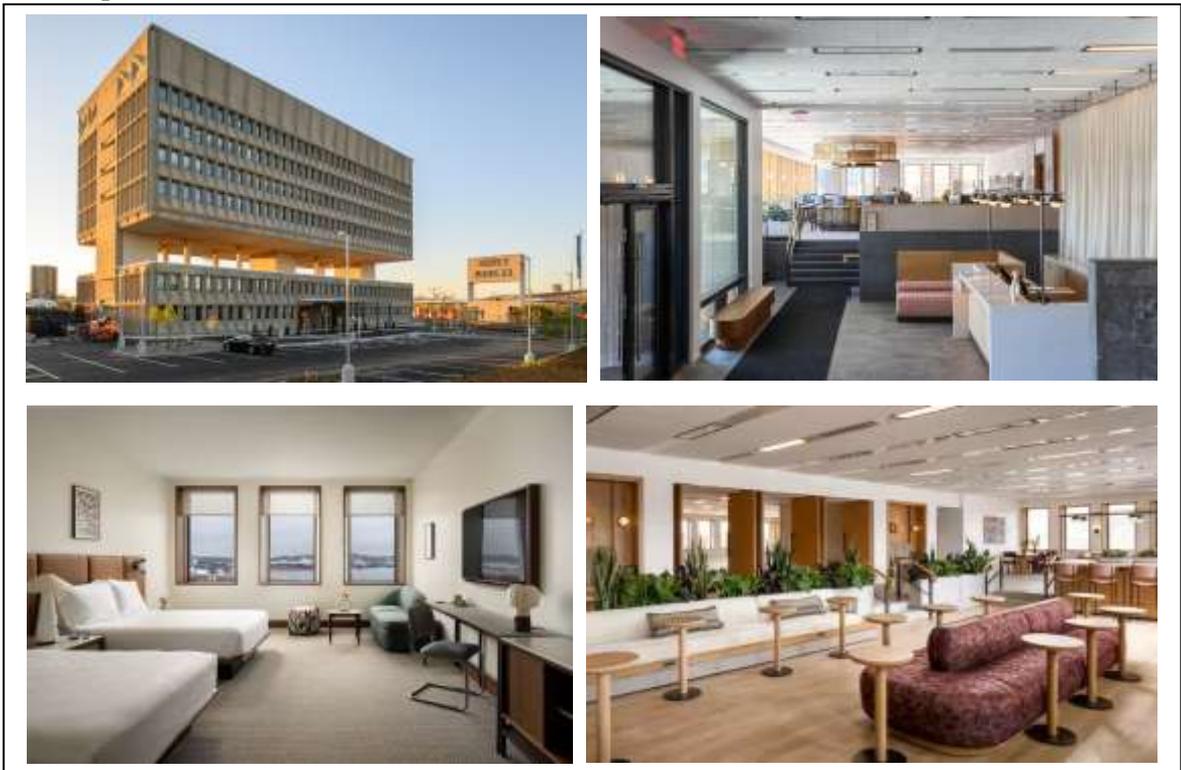


Fig.1 – The Hotel Marcel in New Haven, Connecticut, United States.

Another example is the 1 Hotels brand, which emphasizes sustainability through various technological and design innovations. The 1 Hotel Brooklyn Bridge (Fig.2) utilizes a rainwater reclamation system for irrigation and a combined heat and power system for energy efficiency. The hotel also features reclaimed materials, including wood from the Coney Island Boardwalk, highlighting the use of sustainable resources in interior design (Adams, 2019).

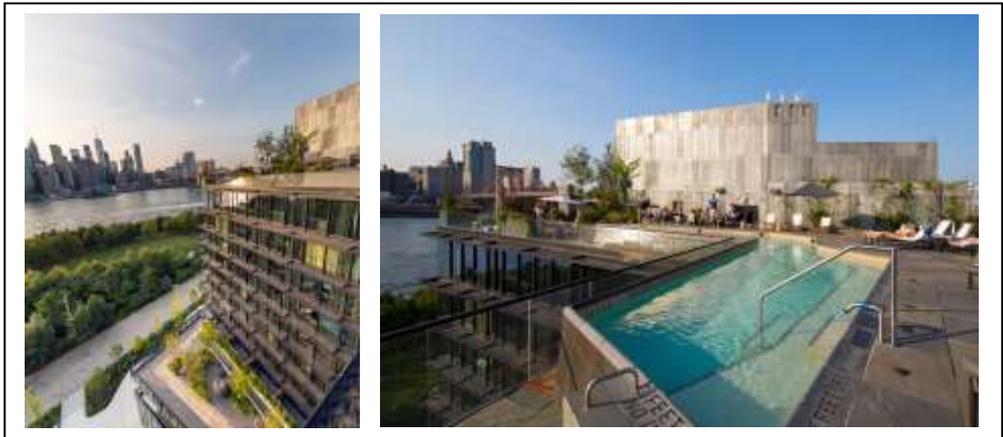


Fig.2 – The rainwater reclamation system for irrigation and a combined heat and power system for energy efficiency at 1 Hotel Brooklyn Bridge.

Emerging trends in sustainable interior design include the integration of biophilic design principles, which aim to connect building occupants more closely to nature. This approach incorporates natural elements such as green walls, indoor gardens, and natural light to enhance well-being and environmental sustainability (Fig.3). Additionally, the trend of adaptive reuse, which involves repurposing old buildings for new uses (Fig.4), is gaining momentum. This practice not only preserves historical architecture but also reduces the environmental impact of new construction (Brown, 2021).



Fig.3 – An example for the integration of Biophilic design



Fig.4 – An example for the adaptive reuse

Operational Efficiencies through Technology

Technological advancements have also significantly improved operational efficiencies in sustainable interior design. For instance, the use of Building Management Systems (BMS) (Fig.5) allows for the centralized control and monitoring of various building functions, such as lighting, heating, ventilation, and air conditioning (HVAC). BMS can optimize energy use by adjusting systems based on real-time occupancy data, reducing energy waste and operational costs (Smith & Jones, 2022).

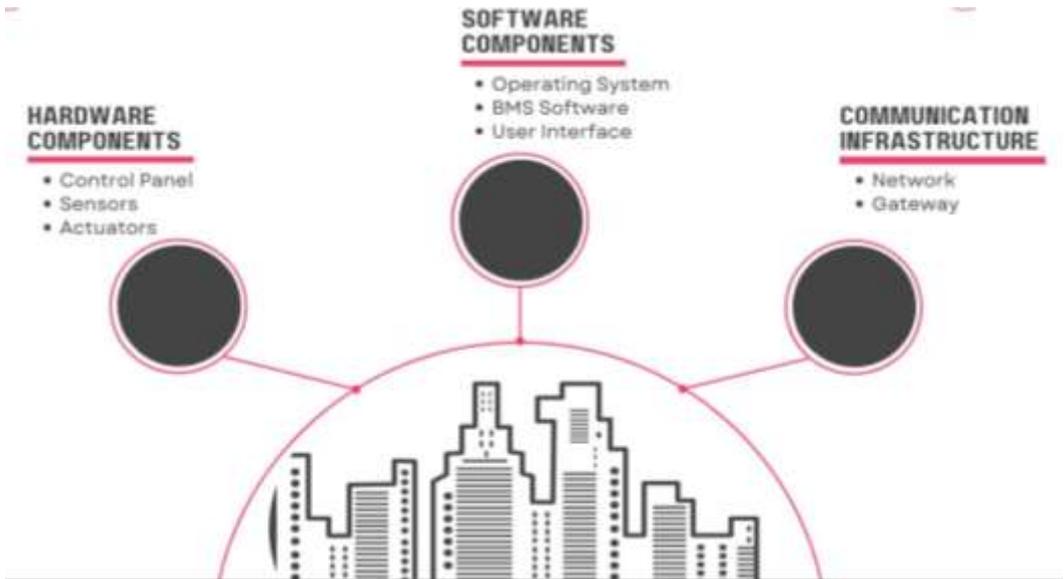


Fig.5 - Components of the Building Management Systems (BMS) (zenatix.com)

In addition to BMS, automated systems have become integral in enhancing operational efficiency. For example, smart thermostats like the Nest Learning Thermostat learn users' schedules and adjust temperatures, accordingly, ensuring comfort while minimizing energy consumption. Automated lighting systems, such as those using motion sensors, ensure that lights are only used, when necessary, further contributing to energy savings (Green & White, 2020).

Therefore, multiple pieces of equipment could be used to create controllable smart buildings and their business model platform (Fig.6). That combines creating a sustainable ecosystem that allows the building and its inhabitants to thrive and increase productivity and comfort. ADF Technologies' BMS's predictive maintenance can eliminate up to 70% of unexpected failures and reduce downtime by up to 50%.



Fig.6 - Smart Buildings - Business Model Platform (adftech.com)

The implementation of water conservation technologies also plays a crucial role in operational efficiency. Low-flow fixtures, greywater recycling systems, and smart irrigation systems reduce water usage and promote sustainability. For instance, the Proximity Hotel in Greensboro, North Carolina, incorporates these technologies and has achieved LEED Platinum certification, showcasing its commitment to sustainable operations (Williams, 2023).

Furthermore, the use of data analytics and Internet of Things (IoT) devices provides valuable insights into building performance. By collecting and analyzing data on energy consumption, occupancy patterns, and system performance, facility managers can identify inefficiencies and implement corrective measures. This data-driven approach not only enhances operational efficiency but also supports continuous improvement in sustainable practices (Mahmoudieh, 2024).

Challenges and Opportunities

Despite the benefits of integrating technology in sustainable interior design, several challenges remain. High initial costs, technological complexity, and resistance to change are common barriers to adoption (Jones & Comfort, 2020). However, these challenges present opportunities for innovation and improvement. Advances in technology and growing

consumer demand for sustainable solutions will likely drive further adoption and development in this field, paving the way for more efficient and eco-friendly design practices (Mahmoudieh, 2024).

At the same time, the integration of technology in sustainable interior design has significant environmental and economic impacts. Environmentally, these practices reduce energy consumption, lower greenhouse gas emissions, and conserve natural resources (Ben Youssef & Zeqiri, 2022). Economically, sustainable design can lead to substantial cost savings through increased energy efficiency and reduced operational expenses (Jain & Rana, 2024). The dual benefits of environmental protection and economic viability make technological innovations in interior design an essential strategy for the hospitality industry.

Conclusion

Eco-consciousness is an evolving concept that continues to shape our approach to environmental sustainability. By tracing its historical roots, understanding its various aspects, and exploring its practical implementations, we can appreciate the comprehensive nature of eco-conscious living. As global challenges related to climate change and resource depletion persist, the significance of eco-conscious practices become increasingly crucial. Through continued advocacy, education, and practical action, eco-consciousness can drive meaningful changes and contribute to a more sustainable future.

In conclusion, the integration of technology into sustainable interior design offers immense potential for the hospitality industry, particularly in serviced apartments. By adopting innovative practices and leveraging advanced technologies, serviced apartments can achieve significant improvements in both environmental sustainability and guest experience. The findings of this research highlight the importance of a holistic approach to design that balances aesthetics, functionality, and sustainability. As the hospitality industry continues to evolve, the role of technology in promoting sustainable interior design will undoubtedly become increasingly critical, driving the sector towards a more eco-conscious future.

Results

The integration of technology into sustainable interior design for serviced apartments has yielded significant findings. These results underscore the potential for enhanced environmental sustainability, improved guest

experiences, and the importance of a holistic design approach. By leveraging advanced technologies and innovative practices, serviced apartments can achieve substantial improvements in both sustainability and functionality. The following key results highlight the impact of eco-conscious practices in the hospitality industry.

1. Enhanced Environmental Sustainability: The integration of advanced technologies in interior design significantly reduces the environmental footprint of serviced apartments. This includes the use of energy-efficient lighting, smart thermostats, and sustainable materials, which collectively contribute to lower energy consumption and reduced waste.

2. Improved Guest Experience: By adopting innovative design practices, serviced apartments can offer a more comfortable and eco-friendly living environment. Features such as automated climate control, natural lighting, and eco-friendly furnishings enhance the overall guest experience, making it more appealing to environmentally conscious travelers.

3. Holistic Design Approach: The research highlights the importance of a holistic approach to interior design that balances aesthetics, functionality, and sustainability. This approach ensures that the design not only meets the practical needs of guests but also aligns with environmental sustainability goals, creating a harmonious living space.

Table (1) The Impact OF Innovative Technologies used in serviced apartments on energy saving findings – by Author

THE IMPACT OF INNOVATIVE TECHNOLOGIES USED IN SERVICED APARTMENTS ON ENERGY SAVING FINDINGS.																					
RESULT 1	<table border="1"> <caption>Energy Saving Findings Data</caption> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Cooling</td> <td>26%</td> </tr> <tr> <td>Lighting</td> <td>23%</td> </tr> <tr> <td>Other</td> <td>13%</td> </tr> <tr> <td>Space heating</td> <td>11%</td> </tr> <tr> <td>Ventilation</td> <td>7%</td> </tr> <tr> <td>Office Equipment</td> <td>7%</td> </tr> <tr> <td>Refrigeration</td> <td>6%</td> </tr> <tr> <td>Water Heating</td> <td>5%</td> </tr> <tr> <td>Cooking</td> <td>2%</td> </tr> </tbody> </table>	Category	Percentage	Cooling	26%	Lighting	23%	Other	13%	Space heating	11%	Ventilation	7%	Office Equipment	7%	Refrigeration	6%	Water Heating	5%	Cooking	2%
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Recommendations

Based on the findings of this research, several key recommendations have been identified to enhance the integration of technology into sustainable interior design for serviced apartments. These recommendations aim to promote environmental sustainability, improve guest experiences, and ensure a holistic approach to design. By adopting these strategies, the hospitality industry can leverage advanced technologies to create eco-conscious living spaces that meet the needs of both guests and the environment. The following recommendations provide actionable steps to achieve these goals.

1. **Adopt Smart Technologies:** Implement smart home technologies such as energy-efficient lighting, automated climate control systems, and smart appliances. These technologies can help reduce energy consumption and enhance the overall sustainability of serviced apartments.
2. **Use Sustainable Materials:** Prioritize the use of sustainable and eco-friendly materials in interior design. This includes selecting furniture made from recycled or renewable resources, using non-toxic paints, and incorporating natural elements like wood and stone to create a sustainable and aesthetically pleasing environment.
3. **Promote Eco-Conscious Practices:** Educate guests and staff about the importance of eco-conscious practices. Provide information on how to reduce energy consumption, recycle waste, and use resources efficiently. Encourage guests to participate in sustainability initiatives, such as using reusable water bottles and reducing water usage.

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الضيافة الواعية بيئيًا: الاستفادة من التكنولوجيا لتصميم داخلي مستدام في الشقق الفندقية

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المستخلص:

يمثل تقاطع التكنولوجيا والاستدامة فرصة لإعادة تعريف مجال الضيافة والتصميم الداخلي. حيث تتكيف التقنيات مثل أنظمة الإضاءة والتدفئة والتبريد الآلية مع أنماط الإشغال، مما يضمن الراحة مع الحفاظ على الطاقة، كما تعمل الأنظمة الذكية على تعزيز الكفاءة التشغيلية، بما يتماشى مع أهداف الاستدامة (بن يوسف وزكري، 2022). تستخدم هذه الورقة منهجية وصفية تحليلية لاستكشاف الأساليب التكنولوجية المبتكرة التي تسهل التصميم الداخلي المستدام للشقق الفندقية. من خلال فحص دراسات الحالة والاتجاهات الناشئة، يسلط البحث الضوء على كيفية تحويل التقنيات المتكاملة، مثل أنظمة الطاقة الذكية والمواد الصديقة للبيئة، الحيزات الداخلية إلى نماذج للاستدامة. كما تشير النتائج إلى أن الدمج الشامل للتكنولوجيا في عملية التصميم لا يلبي متطلبات المسافرين المهتمين بالبيئة فحسب، بل يعزز أيضًا تجربة الضيف بشكل عام. على سبيل المثال، تعمل أنظمة الطاقة الذكية على تحسين استهلاك الطاقة، مما يقلل من تكاليف التشغيل ويقلل من التأثير البيئي. من ناحية أخرى، تساهم المواد الصديقة للبيئة في خلق بيئات داخلية أكثر صحة وتعزيز استخدام الموارد المستدامة (راشدان وأشور، 2024). وعلاوة على ذلك، يؤكد البحث على أهمية التصميم المرتكز على المستخدم في إنشاء تصميمات داخلية مستدامة. من خلال الاستفادة من تحليلات البيانات وردود أفعال المستخدمين، يمكن للمصممين تصميم الحيزات الداخلية لتلبية الاحتياجات والتفضيلات المحددة للضيوف، وبالتالي تحسين الرضا والولاء. يدعم هذا النهج الاستدامة البيئية ويدفع الفوائد الاقتصادية لمقدمي الضيافة.

الكلمات المفتاحية: التصميم الداخلي؛ الشقق الفندقية؛ الاستدامة؛ الضيافة.