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Adopting green and sustainable practices in the hotel industry operations- an analysis of critical performance indicators for improved environmental quality

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Abstract

Purpose – This study aims to address the adoption issues of green and sustainable practices in the hotel industry. The study identifies critical performance indicators (CPIs) and utilizes Hotel Carbon Management Initiative (HCMI) framework to prioritize CPIs for achieving a robust adoption framework for green and sustainable practices.

Design/methodology/approach – The hotel industry is driven by changing ecological degradation, and it is necessary to achieve feasible development goals. This research article formulates the CPIs derived from HCMI and decision-making model is created using the Analytic Hierarchy Process (AHP).

Findings – In this research, CPIs of HCMI are considered and aim to formulate five major CPIs of HCMI, namely air pollution, energy efficiency, water conservation, noise pollution and waste management. The study identifies the need for better control and sustainable growth in the Indian hotel industry with minimum carbon emissions coupled with the green approach adoption.

Research limitations/implications – The CPIs work on minimization of risks and maximizing optimality of return on investment. The development of the hotel industry will be improved and immensely welcomed by capping the carbon emission with the green initiatives. This research is limited as urban hotels are surveyed in this study.

Originality/value – This work makes a valid argument to establish HCMI as a model initiative for environment quality improvement and further extension of other activities in the hospitality sector and scale-up sustainable practices for future-ready circular economies.

Keywords Hotel carbon management initiatives (HCMI), Green practices, Sustainability, Eco-friendly hotels, Supply chain, Analytic hierarchy process (AHP)

Paper type Research paper

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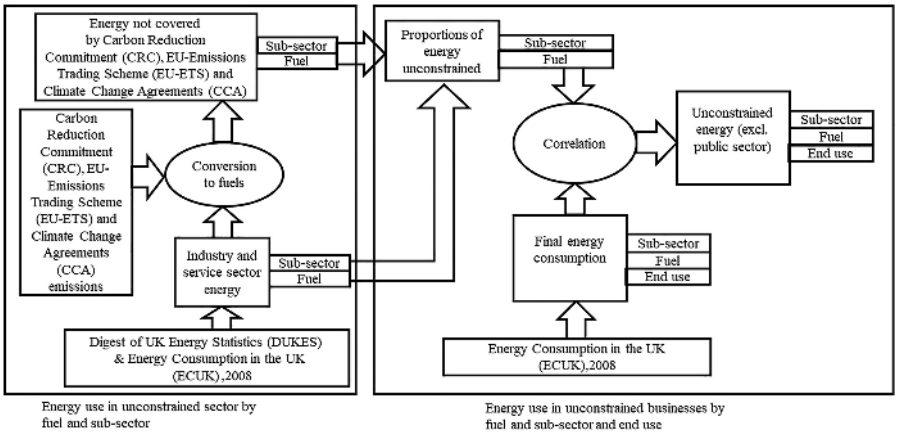
1. Introduction

The hotel business is a crucial component of the service sector that provides safe accommodation/networking facilities as per the need and requirements of customers. It works in close combination with allied service sectors like travel, tourism, and hospitality. The hotel industry is emerging as a vast sector of growth and catalyzed by the higher rate of globalization and urbanization across the world. Developing nations have also shown a tremendous scope of business in recent decades in this sector. Considering the scope and business scope of a developing nation like India, it is approaching to reserve fifth place among the top rankers globally by the end of 2030 in the hospitality sector (EHL, 2022). The travel expenses rose enormously amounting to US$ 40 billion in 2020. It is likely that international hotel conglomerates are also going to bid on this puffy economic boom and will attract Foreign Direct Investments (FDIs) (Kirkegaard, 2020). The expected growth in FDIs in the hospitality sector is nearing 50% by 2022 unlike the current 43% (UNCTAD Report, 2020). Research shows that post-COVID-19, travel is happening, and domestic travel is increasing. This has given rise to highly conscious clients looking for compelling services in the hotel sector in India. Leisure holiday destinations in India like Shimla, Gulmarg, Ooty, etc. are seeing a surge of high demand; coping with the needs and wants of the new growth markets. It will be challenging to accommodate a large population demanding the need for an eco-friendly environment with maintaining the desirable services and other facilities at a large scale for the hotel and tourism industries in developing nations like India. In recent times, health, hygiene, and green practices in the hospitality and hotel sector are the need of the hour.

The current trend in the hotel industry presents sustainability as the hallmark of the recent decade. It advocates the extended implementation of green practices like removing plastic disposal items, eliminating unnecessary consumption of resources, reducing food waste, and other environmental considerations. Seeing this growth landscape, it is essential to formulate and debate and search for methods that can yield sustainable results. The government policy regulating this sector necessitates the inclusion of green management in their supply chains (Badhotiya *et al.*, 2016). India is the powerhouse of the ever thriving economy and foreign investors who are looking for sustainable competitive advantages while keeping an environment-friendly focus as per need. The major areas of consideration will be the implementation of sustainable green models with the aim of profit maximization policies contributing to yearly growth. The optimal utilization of resources is the central agenda in the policy that has environment-friendly work culture (Soni *et al.*, 2020).

Carbon management/emissions are one of the critical issues which emphasize sustainable growth for any industry. As per the report of UNEP (2019), the member countries of the G20 are responsible for global carbon emissions based on the point of consumption. Notably, India is placed among the top four countries responsible for CO_2 emissions. Therefore, we must understand the need for evaluating and resolving current business practices in the hotel industry that contributes much to the hospitality sector. The diabolical practices in the hotel sector such as poor building design, poor service design, and poor maintenance will lead to adverse environmental problems. The practices because of superficial planning thus risk the environmental conditions and decrement green practices ratings of the Indian hotel industry. Therefore, there is a need to develop eco-friendly and sustainable models for the Indian hotel industry. The energy consumption and its residual carbon emissions need to be taken care of for the sustainable growth of Indian hotels. Hotels are forced to use green practices due to the fluctuating economy and consumer loyalty there being delayed by the government and corporate sector both. Figure 1 shows the determination of unconstrained energy by sub-sectors.

The HMCI provides a powerful framework for control over carbon consumption and monitors its growth pattern. The study of HMCI is largely dependent on secondary data



Source(s): Adopted from Rawlings *et al.*, 2014

Figure 1.
Determination of unconstrained energy by sub-sector

considering the criteria which are responsible for the carbon emission in the hotel industry such as air pollution, water conservation, noise pollution, waste management, etc. Many initiatives regarding the control and mitigation of carbon emissions are being taken from the last few decades when the intercontinental hospitality firm came up as a whistle-blower in the field of eco-friendly hotel services in the year 2008. It was the world's first 100 percent eco-accommodating hotel brand. This created a milestone for establishing the concept of sustainability in the hotel industry. Their green CPIs included: giving non-perishable food to foundations, utilizing solar energy, twist energy to create power for the hotel, water collecting framework to supply water to toilets, reused glass windows, furniture, and apparatuses made altogether from reused materials, family unit waste to give warmth and water. The hotel building may be planned to utilize eco-accommodating materials capable of decreasing the heat of summers amid the coldness of winters. The hotels have unique designs and utility for several rooms. The swimming pool may be situated at the housetop to keep the building cool for summers. Eco-friendly steps are being taken to diminish waste products, water contamination, air contamination, and sound contamination since 2008. All such initiatives are elements that help in adopting green and sustainable practices in the hotel industry for improved environmental quality.

Nowadays, the global scenario for sustainable and eco-friendly hotels is being discussed by social activists, environmentalists, and regulatory bodies creating pressure to amend the corporate strategy at large. The growing problem of climate change is a burning issue globally and every organization is looking for an inductive alternative. Brand management and eco-friendliness have become a focus for hotels and the hospitality industry too. There are several abrupt strategies in practice for achieving sustainability; some of them are discussed in past literature. Newman and Dale (2005) talk about the role of agency in brand building and maintaining the image of the organization by addressing cohesiveness and overcoming challenges. Therefore, we see an inherent need to prioritize/formulate the critical performance indicators (CPIs) for green hotel management. Gossling (2010) explains greenhouse gases and air pollution. Air traffic and air pollution show an impact on various greenhouse gases and the CO_2 is studied for the determination and reduction of the carbon footprints in the hotel industry. The tourism and hotel industry is in definite need of various methodologies to reduce carbon footprints in a strict sense by managing energy resources by waste management and recycling processes (Gossling, 2010; Gossling *et al.*, 2013). The factors

such as air pollution, water conservation, energy, noise, and waste management were also studied in the sustainability survey of the Indian Hotel Accreditation Society (IHAS). The IHAS has considered all the factors and given these factors the status of supreme adaptability. This consideration helps in adopting green and sustainable practices in the hotel industry operations for improved environmental quality.

This research paper tries to answer the following research questions (RQ):

RQ1. What is the recent development in the hotel industry for establishing green practices for sustainable growth of the hotel industry?

RQ2. Which are the CPIs impacting green hotel management practices?

RQ3. What is the impact of various CPIs on the eco-friendly environment of the hotel with the help of a case study?

The research questions considered focus on meeting the goals of minimizing the carbon footprints in the hospitality industry (especially the hotel industry) by adopting green practices and investigating the important environmental factors. The most important factors are identified using a very popular Analytic Hierarchy Process (AHP) methodology. The next section presents the literature review.

2. Literature review

Green practices in the hotel industry are very broadly discussed in the past literature (Manaktola and Jauhari, 2007). The practical and tactical applications of green and sustainable practices for making eco-friendly hotel chains are being in the focus from the start of the 21st century (Graci and Dodds, 2008). Some efforts are in practice from the start of the 21st century for improving the eco-friendliness of hotels and provide sustainable growth for the service industry. Some of the recent contributions and systematic growth in the field of green and sustainable hotel industries for an eco-friendly environment are presented in Table 1.

The literature reveals that the consumers are also concerned about the environment where the hotel is located and are willing to pay higher for eco-friendly hotels for a better experience (Kang *et al.*, 2012). There is a need of giving importance to providing an eco-friendly and fresh experience to tourists and visitors. An analytical and strategic approach was required to implement the green practices in the existing hospitality and services industry leading to the development of sustainable hotels (Han *et al.*, 2010). This would require staff and management training for the implementation of green practices (Kim and Choi, 2013). Water utilization and climatic/environmental disturbances are come out as major concern areas for the hotel industry. The relevance of the climatic factors in the growth of the hospitality business is given importance while policymaking. The studies sufficiently give the specificity of water as the one of major criteria for the food enterprise for growth and preservation (Fleming *et al.*, 2015). Earlier, Jones *et al.* (2014) highlighted major issues for consideration in hotel management, which indicated the importance of sustainability reporting methods.

One example is the agriculture and food industry, where waste needs to be better disposed of and utilized. Waste management techniques are crucial for the sustainable growth of the food industry. The increasing use of green manures improves the fertility rates of the soil and the waste management process. The sustainable development of the hotel industry can be achieved by tactical and strategic moves, analyzing the environmental factors affecting the hotel industry growth (Mardani *et al.*, 2016; Al-Aomar and Hussain, 2017). The appropriate location and the noise levels at the hotel also have equal importance in attracting customers and visitors. So, there should be also consideration given to noise level reduction in the periphery of the hotel sector to provide the customer with a satisfactory residence experience

S. No.	Author and year	Region of research	Type of research	Major finding
1	Kang *et al.* (2012)	USA	Empirical research	The paper determines the willingness of consumers to pay for premium for green services in luxury hotels. Total 37% customers were willing to pay extra for eco-friendly causes and 67% of them were female
2	Kim and Choi (2013)	Florida	Qualitative research	The research article investigated the employee's seriousness towards implementation of green hotel practices. According to the survey the overall performance which was achieved in a green practice drill is lower
4	Fleming *et al.* (2015)	Australia	Descriptive research	The paper focuses on empirical study of two Australian wines companies 'organizational behavior and practices towards green industrial practices for climate change and seasonal demand
6	Mardani *et al.* (2016)	Malaysia	Empirical research	The article focuses on energy efficient technique analysis with analytical decision-making for five-star hotels. It recommends ranking the electrical appliances based on their consumption and power utility to determine the effectiveness of the hotel industry
7	Al-Aomar and Hussain (2017)	UAE	Descriptive research	The article develops a framework for green practices in hospitality by focusing on value creation and green awareness. The study reveals that 63% of U.A.E five-star hotels are aware about the green practices and are very aggressive for its implementation
8	Baqar *et al.*, 2018	Pakistan	Empirical research	The study evaluates the level of discomforts due to the noise pollution to the patients in the hospital and the side effects to the health of the patients. It was observed that all the multi-specialty hospitals surpassing the international noise standards
9	Fuentes-Medina *et al.* (2018)	Spain	Exploratory research	The paper identifies the critical performance indicators (CPIs) of hotel industry by analyzing the customer needs. 2. The attributes of the value chain like staff training, customer perception, room service, eco-friendly buildings need to be addressed properly
10	Ma *et al.* (2018)	China	Empirical research	The author's purpose is to develop a technique to safeguard the world heritage buildings with analytic hierarchy approach (AHP) to make effective decision-making. The study concludes by suggesting the reuse and redevelopment of the resources with proper maintenance activities for Non-World Heritage Tulous

(*continued*)

Table 1.
Recent contributions in the field of green and sustainable practices

S. No.	Author and year	Region of research	Type of research	Major finding
11	Hsiao *et al.* (2018)	Taiwan	Quantitative research	The study analyses how the hotels are rearranging there work procedures to adapt to the green and sustainable hospitality practices. 2. The paper recommends reorganizing functional activities like inventory collection, customer pick and drop, service delivery system as per green sustainable management
12	Calabrese *et al.* (2019)	Italy	Descriptive research	The article focuses on applying the strategic decision-making approach to determine the crucial factors to address sustainability issues. The results show the importance of running hotels using fair practice leading to more sustainable model as it holds the maximum weightage of 15.48%. Human rights are given least importance in the survey that is needed to address in detail
13	Rahman *et al.* (2019)	Bangladesh	Empirical research	The study emphasizes on developing a hierarchy model for ranking the quality factors to achieve sustainable growth and business excellence in Bangladesh hotel industry
14	Kularatne *et al.* (2019)	Sri Lanka	Linear programming	The study adopts the double bootstrap approach to determine the efficiency level of the several hotel buildings technically in Sri Lanka
15	Asadi *et al.* (2020)	Malaysia	Descriptive research	It studies the effect of green innovative practices for achievement on sustainable development emphasizing on carbon footprint reduction. The study concludes that innovative green practices can explain 55% of variance in environmental performance leading to 50% economic growth
16	Han *et al.* (2020)	Korea	Quantitative research	It studies the mechanism of hotel waste reduction and water conservation techniques for sustainable and green practices. The paper concludes that customer awareness towards environmental concern is an import attribute for implementation of green practices in hotels
17	Vatan and Yilmaz. (2020)	Istanbul	Exploratory research	The study explains new ceramic techniques for providing sustainable solutions for safer and comfortable stay of customers. The hypothesis conceptual model fills the void present tourism industry and extent hospitality. It emphasizes on use of technological innovations to provide green, healthier, and safer experience to customers

Table 1. (*continued*)

S. No.	Author and year	Region of research	Type of research	Major finding
18	Omune *et al.* (2021)	Kenya	Descriptive research	The research article focuses on the implementing environmentally friendly practices by considering energy saving, waste management and water conservation. 2. The study recommends awareness and training programs for hotel employees in green and environmental practices, It also urged subsidization in inventories related to recycling of products and waste management
19	TM *et al.* (2021)	India	Descriptive research	It is systematic literature review focusing on sustainability, environment effects and green practices in restaurants. The paper recommends widening the scope from restaurants to big hospitality industries and tourism
20	Oriade *et al.* (2021)	UK	Empirical research	The study focuses on the sustainable and green practices to improve hotel efficiency and organizational behavior. The paper concludes by saying customer and staff environmental awareness is the most crucial green practice parameter that needs to be considered by Nigerian and Ghanaian hotels

Table 1.

(Baqar *et al.*, 2018). Sajjad *et al.* (2018) presented the study of sustainability in Pakistan hotel industry. They highlighted that there must be collaboration between government, community, and private sector to embrace sustainability.

The analytical approach for studying the crucial factors affecting sustainability and carbon footprints is formally understood to determine the importance of each factor affecting hotel energy efficiency (Fuentes-Medina *et al.*, 2018; Ma *et al.*, 2018; Hsiao *et al.*, 2018). The various factors which contribute to the growth of the hotel industry by increasing its efficiency level and decreasing carbon emissions are classified and ranked in the literature for the development of high performing sustainable models for the hotel industry (Calabrese *et al.*, 2019; Rahman *et al.*, 2019; Kularatne *et al.*, 2019). Hotels are rated as the most energy consumption buildings leading to excessive release of greenhouse gases. Energy consumption has a major role in controlling carbon emissions (Asadi *et al.*, 2020). The control necessarily provides us with the proper utilization of energy resources and gives the energy conservation for the proper utilization in the hospitality sector (Han *et al.*, 2020). In most developing countries the knowledge about energy efficiency, particularly in the building sector, is low level and this is needed to be addressed (Vatan and Yilmaz, 2020).

The strategies of developed countries used for industrialized countries might not be suitable for developing countries (Omune *et al.*, 2021), so there is a need to have demographic and geographically customized solutions for the developing nations regarding green practices in various service sectors. This will have a direct impact on the sustainable growth of the hotel industry in India. Energy-efficient and cost-effective building design options for the case of developing nations like India are very much required (TM *et al.*, 2021). The Energy-efficient building design is a non-trivial issue involving several interdependent design criteria which are very well utilized in European countries (Oriade *et al.*, 2021). The global critical factors, which encompass the essence of sustainable practices in the hotel industry, highlight

the importance of green motivation in the management policies (Ahmed *et al.*, 2021). Green motivation is seen in all major practices as well as procurement facilities of the hotel industry. It is crucial to set green motivation in the proactive environmental management of the hotel industry. Pereira-Moliner *et al.* (2021) establish that in Spain's hotel industry synergistic sustainability performance relationship is an unwinding factor in the managing process. The major pillars of sustainability were identified in three dimensions; namely, economic, environmental, and social. These pillars must be optimally addressed to optimize the sustainability angle of the management.

Past studies reveal that developing nations like India is having a huge potential to work towards eco-friendly and green sustainability for hotel industries. This also emphasizes the need to develop energy-efficient systems for the Indian hotel industry's growth that can sustain changing environment and comply with government green policies. In changing climates, poor and passive design strategies might conflict with each other leading to an inefficient building. There is an urgent demand for energy conservation techniques in the hotel design and hotel service industry. There is a need for an in-depth study of green practices and sustainability models for hotel chains using building energy simulation with parametric analysis (Kwatra *et al.*, 2021). Industry 4.0 is coming up with smart solutions for increasing energy efficiency and decreasing carbon footprints. Industry 4.0 smart digital solutions help to reduce the wastage of food and improve the recycling of the water for conservative. It also manages the guest transport services effectively using internet of things (IoT) connectivity leading to efficient customer services (Youssef and Zeqiri, 2022). It is very evident from the literature that the hotel industry requires to identify the CPIs and provide them weightage in their building design and policy for making eco-friendly hotels. This can be only achieved through an empirical study of the existing hotel industries. Zotova *et al.* (2020) established that carbon-neutral interventions should be implemented in the current hotel management scenario. The hotel industry is now looking to cut down greenhouse carbon emissions and reduce ecological footprints. The management is considering the reduction of carbon footprints from transportation, venue and accommodation, catering, and hotel waste. Major steps are being towards carbon neutrality by maximizing virtual participation and video conferencing. There is solid room for innovations in the development of eco-friendly waste management systems. The use of recyclable units in hotels is cutting down carbon emissions from hotel waste. Gössling and Lund-Durlacher (2021) recently notes carbon emissions from tourist accommodation and climate change in Austria. The current accommodation strategies are investigated and asserted that these strategies should be adapted to fewer carbon emissions systems. They should switch to renewable energy curving away from traditional energy sources which are resulting in high carbon emissions. The next section presents the methodology of prioritization.

3. Methodology

In this study initially, the topic was searched and explored to know the background details and requirements of the hotel industry covering environmental concerns. The paper covers the available published literature and information in the domain of eco-friendly sustainable hotel industries. It determines the need of investigating the major CPIs for the sustainable growth of the hotel sector. A sampling survey strategy was adopted to determine the CPI's impact on the hotel industry and its plan for eco-friendly sustainable practices. The data collection was done by arranging appointments with the managerial staff of the hotel selected for the study. The data analysis was done using the AHP methodology. It provides concrete results to the existing environmental concerns of the hotel for having green practices implementation. The following Figure 2 presents the research methodology adopted. The method adopted is the standard approach used to estimate the priorities of CPI or critical indicators (Prakash *et al.*, 2021).

Figure 2.
Methodology adopted

3.1 AHP as prioritizing tool

The study requirement was to identify a suitable tool or methodology which can provide the priority level amongst the crucial factors for the sustainable and eco-friendly hospitality sector**.** In this context, various tools are available, and the authors have decided to select AHP for prioritizing/formulating the various factors as it is one of the oldest and most reliable decision-making approaches that many businesses have been using to carry out their decisions to achieve long-term goals (Emrouznejad and Marra, 2017). It was introduced by Thomas L. Saaty in the 1970s and has been contemplated and refined ever since then. The AHP is an organized system for investigating and sorting out complex choices, because of social decision problems. It provides logical and rational solutions for a given problem with quantifying parameters of the concerned issue along with alternate paths for goal achievement. It is a method with multi-criteria decision-making capable of determining levels and preferences for these kinds of problems. AHP helps to design the whole structure of the problem and removes the inconsistent data sources before giving a framework. AHP strategy is connected to the poll overviews gathered from meetings/surveys. As a matter of primary importance of objectives; they are being chosen and after that choice of a few criteria as per objective. The AHP is a well-established method for detecting the importance of factors with their respective contribution in totality. The formal mathematical setting and steps for AHP are given as follows. The readers are requested to follow articles on analytic hierarchy process overview, applications, and methods by Vaidya and Kumar (2006), Ku and Fan (2009), Emrouznejad and Marra (2017). With challenging economic conditions existing in many markets, hoteliers often lack the time and resources to properly evaluate the business costs and benefits of investment synced with environmental technologies and sustainability initiatives (Delmonico *et al.*, 2018). The potential investments are required, and the same evaluation needs to be done. The broad objective may be kept as including cost-saving opportunities and enhancing operational efficiency to demonstrate a positive commitment to the environment (Calabrese *et al.*, 2019; Asadi *et al.*, 2020).

3.2 AHP model

The AHP problem is formulated here using a mathematical model. AHP is distinctive because it can quantify criteria and alternatives. AHP converts the comparisons of empirical nature

into numerical data. The importance of the chosen factor defines hierarchy through the assessment of elements. The AHP problem is formulated here using a mathematical model. AHP is distinctive because it can quantify criteria and alternatives (Saaty, 1990). AHP converts the comparisons of empirical nature into numerical data. The importance of the chosen factor defines hierarchy through the assessment of elements (Hwang and Yoon, 1981).

In the first step, the problem is decomposed into a hierarchical structure or criteria on which the subsequent levels depend. In the next step, pair-wise comparison of the criteria based on the hierarchy is carried out. The attribution presents a hierarchy of a minimum of three levels. The main idea is to classify them from top-level to middle to bottom-level alternatives. If the criteria are vague or abstract then, the sub-criterion is generated through the multi-level hierarchy. The calculation of the weights is done by the formula given by Belton and Stewart (2002):

$$W = \frac{n.(n-1)}{2} \tag{1}$$

In equation (1), n = total number of elements being compared. Further, using j = total number of criteria, i.e. $[n.(n-1)j]$. The comparison matrix is given by:

$$C = [c_{kp}]_{n\times n} = \begin{bmatrix} \frac{w_1}{w_1} & \cdots & \frac{w_1}{w_n} \\ \cdots & \cdots & \cdots \\ \frac{w_n}{w_1} & \cdots & \frac{w_n}{w_n} \end{bmatrix} \tag{2}$$

In equation (2), c_{kp} = is a pair-wise comparison rating for the k-th and p-th criteria. The Matrix C is reciprocal, which means $c_{pk} = c_{pk}^{c-1}$ and all its diagonal elements are unity. Hence, we get $c_{pk} = 1,\ k = p$. After this, the vector of weights of criteria is given by (Saaty, 1990),

$$w = [w_1, w_2, \ldots, w_n] \tag{3}$$

Then the solution can be obtained to calculate: λ_{max} (eigenvalue of C) by the equation:

$$\lambda_{max} = Cw \tag{4}$$

In the next step, the local consistency of the priority is estimated. The calculation of maximum Eigen weights (λ_{max}) is done. The calculation of CI (Consistency Index) and CR (Consistency Ratio) is done. The maximum Eigen weight is given by,

$$\begin{bmatrix} y_1 \\ \vdots \\ y_n \end{bmatrix} = \lambda_{max} = \begin{bmatrix} a_{11}x_1 & \cdots & a_{n1}x_n \\ \cdots & \cdots & \cdots \\ a_{n1}x_1 & \cdots & a_{nn}x_n \end{bmatrix} \tag{5}$$

Next, a global priority by summing corresponding criteria weights and the results are calculated. Braunschweig and Becker (2004) gave a method to sum these values to calculate the final priority list.

3.3 Utilization of AHP

The study considers the following factors for AHP implementation to know the effect of carbon emission on the hotel industry. These factors are attributes such as minimizing air pollution (A1), preserving energy (A2), increasing water conservation (A3), reducing noise pollution (A4), and effective waste management (A5). The criteria selected are cost (C1),

hotel image (C2), government regulations (C3) and local community pressure (C4). The objective is the selection of the best attributes/CPIs for fulfillment of the Hotel Carbon Management Initiative (HMCI) goals.

3.4 AHP implementation

The AHP is implemented to achieve the results of the criteria and the selection of the factors for prioritizing the CPIs. The data is collected by the survey from a hotel (referred as hotel ABC) located outskirts of Gurugram district of the state Haryana, India. The survey form was used to collect to capture the thoughts of the industry experts. A total of five experts were able to provide us with the required inputs and were considered decision-makers for this study. The expert requested not to disclose their identity and full privacy. Table 3 weightage is the mean of the survey response of the experts. In the present work, the contribution for each of the CPIs in HMCI is calculated using AHP. The goal is to determine which CPIs, i.e alternatives, are best given the criteria. In step 1, perform weigh the criteria, and compare the five alternatives to the criteria. Table 3 shows the weightage given by experts to all criteria for relative importance. In the next step, the weights of all five alternatives (A1 to A5) against the criteria set (C1 to C5). Finally, the weighted importance of each criterion is then multiplied against the score of each alternative to get the weighed score and the overall priority score is calculated.

Figure 3 shows the CPIs priority score summary graph. Table 2 depicts the evaluation criteria and alternative summary for established CPIs for HMCI. Table 3 shows the weightage given by experts to all criteria for relative importance towards their contribution to the overall adoption of green and sustainable practices. Table 4 calculates CPIs evaluation with respect to criteria C1, i.e. cost which could be saved and minimized by controlling water harvesting techniques and its conservation. Table 5 presents CPIs evaluation with respect to criteria C2, i.e. hotel image shows most dependency on controlling the increasing water conservation and reduction of noise pollution. Table 6 shows CPIs evaluation with respect to criteria C3, i.e. government regulations are governed by factors of air pollution. Table 7 presents CPIs evaluation with respect to criteria C4, i.e. local community pressure gets more affected by the proper waste management system. Smart technology can help in the above cases by enhancing environmental quality in the supply chain and operations of the hotels.

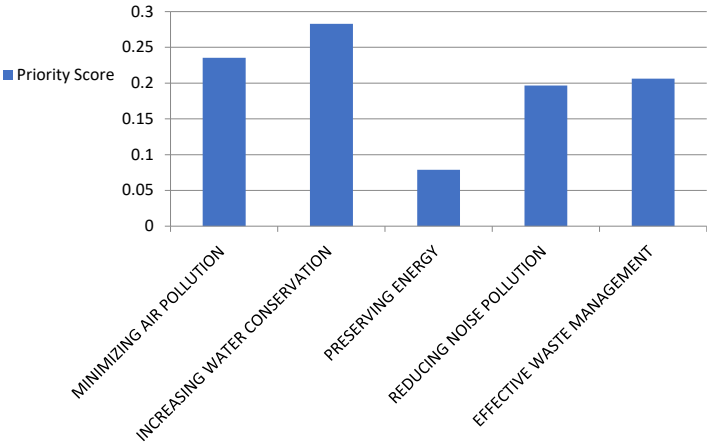


Figure 3.
CPIs priority score summary as per weightage

S. No.	CPIs, i.e. alternatives	Abbreviation/Code
1	Minimizing air pollution	A1
2	Increasing water conservation	A2
3	Preserving energy	A3
4	Reducing noise pollution	A4
5	Effective waste management	A5

S. No.	Criteria	Abbreviation/Code
1	Cost	C1
2	Hotel image	C2
3	Government regulations	C3
4	Local community pressure	C4

Table 2. Evaluation criteria and alternative summary

	C1	C2	C3	C4	Eigen vector	Weight	Comp Eigen vector
C1	1	1	1/3	3	1	0.2141	0.9775
C2	1	1	3	5	1.968	0.4214	1.8943
C3	3	1/3	1	3	1.3161	0.2818	1.3127
C4	1/3	1/5	1/3	1	0.3861	0.0827	0.3323
					Consistency index = 0.1722	λmax = 4.5167	Consistency ratio = 0.1914

Table 3. Weightage given by experts to all criteria for relative importance

	A1	A2	A3	A4	A5	Eigen vector	Weight	Comp Eigen vector
A1	1	1/3	5	7	1/7	1.1076	0.1561	0.9792
A2	3	1	5	7	3	3.1598	0.4453	2.4081
A3	1/5	1/5	1	5	1/5	0.5253	0.074	0.4399
A4	1/7	1/7	1/5	1	1/3	0.2671	0.0376	0.234
A5	7	1/3	5	3	1	2.0362	0.2869	2.011
						λmax = 6.0722	Consistency index = 0.2681	Consistency ratio = 0.2393

Table 4. CPIs evaluation with respect to criteria C1, i.e. cost

	A1	A2	A3	A4	A5	Eigen vector	Weight	Comp Eigen vector
A1	1	3	3	1/3	1/5	0.9029	0.1615	1.4321
A2	1/3	1	5	1	5	1.5281	0.2734	1.7697
A3	1/3	1/5	1	1/3	3	0.5818	0.1041	0.6736
A4	3	1	3	1	3	1.9332	0.3458	1.7617
A5	5	1/5	1/3	1/3	1	0.6444	0.1153	1.1274
						λmax = 6.7646	Consistency index = 0.4411	Consistency ratio = 0.3939

Table 5. CPIs evaluation with respect to criteria C2, i.e. hotel image

4. Result and analysis

The comparison between criteria and their specific impact analysis shows the priority order as given below in Table 8. The score obtained has order A2>A1>A5>A4>A3. Based on the above results, the scores of the A1, A2, A3, A4, and A5 are obtained. The scores are tabulated

in Table 8. The criteria A2 (increasing water conservation) has obtained the highest score regarding the carbon management system for the hotel sector based on a survey of Hotel ABC Gurugram. The ranking is purely based on quantitative data and tool application for criteria's weightage. The study also provides the histogram of the criterion's score as found in Table 8. It can be easily seen that A2 is the highest and rendering A1 be second highest. This means that the first focus of any hotel should be increasing the water conservation methods and avoiding the air polluting substance (Gossling, 2010) used in abundance with alternate energy sources. The results presented above show that increasing water conservation (A2) is the most critical factor contributing about 28.28% towards environmentally friendly sustainable growth as per HMCI green practices requirements. While energy preserving techniques scores with minimum weightage in the overall priority index with 7% sensitivity towards environmental concerns of eco-friendly hotels, the histogram clearly explains the clear difference in the contribution of all five CPIs to achieving the goal of HMCI for better growth of hotels.

5. Discussion

Based on the results, it is recommended that Hotel ABC, Gurugram must first focus on increasing water conservation as the first and foremost objective for the implementation of green practices to achieve HMCI goal. The implication of this critical factor is most crucial in

	A1	A2	A3	A4	A5	Eigen vector	Weight	Comp Eigen vector
A1	1	5	7	1	3	2.5365	0.4089	2.507
A2	1/5	1	3	3	1	1.1247	0.1813	1.0169
A3	1/7	1/3	1	1/5	1/3	0.3165	0.051	0.2733
A4	1	1/3	5	1	1/7	0.7505	0.121	0.8793
A5	1/3	1	3	7	1	1.4758	0.2379	1.5553
						λmax = 6.2318	Consistency index = 0.3079	Consistency ratio = 0.2749

Table 6. CPIs evaluation with respect to criteria C3, i.e. government regulations

	A1	A2	A3	A4	A5	Eigen vector	Weight	Comp Eigen vector
A1	1	1	5	3	1/3	1.3797	0.2278	1.2007
A2	1	1	3	3	1	1.5518	0.2563	1.3246
A3	1/5	1/3	1	1/3	1/5	0.3385	0.0559	0.2931
A4	1/3	1/3	3	1	1/3	0.6444	0.1064	0.5533
A5	3	1	5	3	1	2.1411	0.3536	1.8921
						λmax = 5.2639	Consistency index = 0.066	Consistency ratio = 0.0589

Table 7. CPIs evaluation with respect to criteria C4, i.e. local community pressure

CPI	Priority score	Rank	Comment
Minimizing air pollution	0.2355	2	
Increasing water conservation	0.2828	1	*First priority
Preserving energy	0.0787	5	
Reducing noise pollution	0.1967	4	
Effective waste management	0.2063	3	

Table 8. Scores for CPIs priority

HMCI for other hotels with similar standards. Considering next, minimizing air pollution is the second critical factor in maintaining an eco-friendly environment in hotels with better quality living standards and air quality index in the periphery. They must also focus on effective waste management techniques in their hotels. The wastage of the hotels should be recycled. The eco-friendly process should be performed to utilize waste and reduction of carbon emissions from harmful products dumped inside the grounds. Noise pollution reduction is also a concern of hotels nowadays as it contributes to the customers' service and satisfaction level a lot. The soundproof building design is thus, recommended that customers are not getting disturbed by annoying noises around the periphery of the hotel. Energy conservation is a growing need in the current business scenario where growing machinery usage is heavily contributing to the problem of carbon emissions at large. It is recommended that building design should primarily focus on water management, and green practices to avoid air pollution as CPI for achieving the goals of HMCI. The study results are based on an expert survey and the AHP technique. It is recommended that hotels must keep water conservation in the most priority with proper utilization, recycling, reuse, and storage for effective HMCI that can help in adopting green and sustainable practices in the hotel industry operations for improved environmental quality.

6. Conclusion

It has been observed that they are a need for focusing more on green practices for the satisfaction of the HMCI concerning global needs. The Indian hotel industry has shown initiatives to focus on eco-friendly measures and practices in the recent few years leading to sustainable and green development in the tourism and hospitality sector. This paper has identified the contribution of crucial factors like minimizing air pollution, preserving energy, increasing water conservation, reducing noise pollution, and effective waste management. The significance of each element for HMCI is explained and their importance is briefly summarized. Water Management and air pollution reduction are the most crucial factors in a profitable sense for strong as well as weak stakeholders of the hospitality sector. For these two cases, smart technology can help by enhancing environmental quality in the supply chain and operations of the hotels with proper water conservation to reduce the unnecessary cost involved in the utility. Waste management can reduce the cost as well as improve the service level of the hotel with proper image building in the market. It also considers a few government concerns and regulations regarding cleanliness and the environment. The exploration of methodologies based on the advancement of this model will allow hotels to achieve HMCI goals with the development of the widely accepted model for the hospitality sector. This will lead to competitive and stress-free sustainable growth for developing nations' hotel industry without compromising on profit margins and service quality. This research is focusing on energy-efficient systems by proper utilization of available natural and man-made resources. Renewable sources for power generation can lead to viable environmental solutions and cost savings. The results conclude that these potential investments require the same evaluation as any other business decisions – focusing on the minimization of risk and optimization of return on investment. This paper has recognized cost-saving opportunities and enhanced operational efficiency revealing a positive commitment to the environment.

The various contributing factors are analyzed with AHP, and the final priority order of CPI is obtained as A2>A1>A5>A4>A3. This has presented that water conservation is needed to be focused on a priority basis leading to a 28.28% weightage in overall operational efficiency. Air pollution reduction and effective waste management contribute by 23.55% and 20.63% respectively towards achieving sustainable and eco-friendly growth of hotels. This study helps us to improve the overall efficiency of sustainable

hospitality without comprising cost and resources. This is a continuous process where the adoption of green practices in the hotel industry is needed at the organizational level to cope with the need for sustainable hospitality. Water management is a worldwide issue and proper policymaking from the government and tourism agencies is required considering the future requirements and sustainable growth of all hostels. The hotel managers should run programs and awareness drills for the staff for conserving energy and having proper waste disposal and recycling.

This is very evident from the conclusion that operational efficiency plays a vital role in the sustainable and economic growth of the hotel industry. The adoption of advanced and smart technology solutions can further increase the effectiveness and efficiency of major operations through innovation.

7. Managerial implication and future scope

Sustainable practices in the hotel industry impact customer experience in a positive manner and the probability of revisiting customers also increases that will certainly help business. The implementation of sustainability methods increases employee happiness levels and pride, feeling more connected to their organization. This creates a positive environment and works culture for the staff and guests. The managers can direct the hotel team to purchase more environmentally friendly supplies for hotels e.g. cleaning products to achieve sustainable goals. This will lead to total monitoring of the purchased raw materials from the initial stage to the final consumption providing proper utilization of energy and avoiding unnecessary wastage of food and other services.

The current study focuses on only deluxe and large-scale hotel chains situated in suburban locations of India. So, there is a wide scope for improving the study by looking at rural cottage hotels, and hotel villas far from cities. There is a need to study the dimensions that this cross-sectional study will bring to the table. The hotel industry in India is growing at a very large scale so the small hotels and restaurants which are not using these green practices (HMCI) in their work culture can implement the suggestions of this study for making their hotels green and sustainable entities. It would also help them to take government subsidies and compete in the global eco-friendly scenario. To assess the recognized components further with wide aspects CPIs are needed to explore with more extended research work in rural areas. Assessment of other relevant parameters in a wider context is very much needed. In the future, the extension of present work can be done using any mathematical modeling/software-based modeling method to make the study more accurate and practical. This is very evident from the conclusion that operational efficiency plays a vital role in the sustainable and economic growth of the hotel industry. So, this is a clear indication that the adoption of advanced and smart technology solutions can increase the effectiveness and efficiency of all operations by adding innovative solutions to the present status.

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Further reading

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Appendix

Sample survey from for adopting green and sustainable practices in the hotel industry

Please rate your response/agreement regarding the following green practices in your organization on the scale of 1 to 5 where 1 is lowest score and 5 highest. Provide your comment to the specific questions.

Rate your green practices followed	[1] [2] [3] [4] [5]
Rate commitment by top management to adopt green practices	[1] [2] [3] [4] [5]
Rate strategic planning practices	[1] [2] [3] [4] [5]
Need of commitment for ecofriendly services	[1] [2] [3] [4] [5]
Status of green suppliers of raw materials	[1] [2] [3] [4] [5]
Status of environmental partnership with suppliers	[1] [2] [3] [4] [5]
Rate the emphasis in improving air quality	[1] [2] [3] [4] [5]
Rate the status of reward system for energy saving in hotels	[1] [2] [3] [4] [5]
Hotels are in need of increasing water harvesting capacity	[1] [2] [3] [4] [5]
Rate the waste management services postproduction/service	[1] [2] [3] [4] [5]
Rate the green innovations	[1] [2] [3] [4] [5]
Rate the status of environmental knowledge	[1] [2] [3] [4] [5]
Rate the process followed in your hotel for air pollution control	[1] [2] [3] [4] [5]
Rate the process followed in your hotel for reducing noise pollution	[1] [2] [3] [4] [5]
Rate the process followed in your hotel for effective waste management	[1] [2] [3] [4] [5]
Rate the process followed in your hotel for water conservation	[1] [2] [3] [4] [5]
Rate the process followed in your hotel for preserving energy	[1] [2] [3] [4] [5]
How much HMCI norms followed, Plz rate.	[1] [2] [3] [4] [5]

Comments

Name (Optional): Company Name: Location:

Experience (in years): Position: Age:

Figure A1.

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