ISSN: 2393-8048
International Advance Journal of Engineering, Science and Management (IAJESM)
Multidisciplinary, Multilingual, Indexed, Double Blind, Open Access, Peer-Reviewed, Refereed-International Journal.
SJIF Impact Factor =8.152, July-December 2025, Submitted in July 2025

Adoption of Green Hospitals and Their Impact on Healthcare Sustainability in India

Puspita Gupta, Department of Management, Vikrant University, Gwalior

Abstract

The necessity of quality healthcare services in India has grown spirally along with the environmental strain since hospitals require various resources to provide services. In its turn, the concept of green hospitals has appeared as one of the promising ways of contrasting the situation with the need to enhance its environmental performance without jeopardizing the quality of patient care. This paper explores the contemporary state of the green hospitals in India by way of secondary research of green hospital projects referring to 110 hospital projects both within the public and the private sector. The results demonstrate that although the formal green ratings such as LEED and GRIHA moderately receive traction, there is a big embrace of non-certified but effective green initiatives among the hospitals (43.6%). Energy savings (30%) were the most frequently reported environmental outcomes followed by waste reduction (26.4%) and water conservation (24.5%) environmental outcomes. The most common green infrastructure technologies turned out to be solar panels and rainwater harvesting systems, and green technology was primarily offered by the private sector institutions. The findings confirm the increased pivot in India towards sustainability in healthcare and indicate the requirement of support through policy, documentation, and capacity-building particularly in the area of the public and charitable healthcare sectors to facilitate mainstream and quantifiable green-transformation of healthcare.

Keywords: Green Hospitals, Sustainable Healthcare, Environmental Impact, LEED Certification, GRIHA Rating.

1. INTRODUCTION

The healthcare sector in India is extremely fast changing, because of the growing population, the elevation in life expectancy, urbanization, and the need of good quality healthcare services. Although such advancements are essential in enhancing better health among citizens, there has been a sharp rise in the use of natural resources and creation of healthcare wastes. Hospitals constitute maxed out resource institutions and as such run 24-hours a day depending mostly on power, water, air conditioning, and medical devices. Such ongoing consumption is quite demanding to the environment especially in a nation like India, where energy crunch, water scarcity, and pollution are the burning problems already.

Green hospitals are healthcare facilities which are designed, built and run in a manner that reduces ecological impact of the facility to the extent of improving care quality and facilitating the healing space. These hospitals combine elements of sustainable design and using the latest in environmental technologies allow them to minimize energy required, water conservation and the amount of waste produced.

The green hospital phenomenon is in a relatively early stage in India; however, it is picking up. Some of the first few institutions to have already attained certifications are LEED (Leadership in Energy and Environmental Design), GRIHA (Green Rating of Integrated Habitat Assessment), and NABH (National Accreditation Board of Hospitals & Healthcare Providers) green accreditation. These are certifications that keep their delivery closer to the world of sustainable infrastructure and operation efficiency by adhering to the environment. Even though these are good signs, the overall healthcare situation in India is still marred by unstable awareness, regulatory decrees.

2. LITERATURE REVIEW

Bisoi and Mankar (2024) A thorough research on green hospital and heeling architecture being developed and integrated into the Indian healthcare setting was carried out. Some of the points, which came out of their research, included the need to have an environmentally

responsible infrastructure when it comes to hospital design, with priority on those architectural aspects, which contribute to ecological doctoring, as well as mental health. They noted that a few Indian healthcare facilities had already started using environment friendly construction material, use of day light to the fullest, and using green space like vertical gardens and courtyards to improve the quality of the air indoors and creating a healing atmosphere. The paper has elaborated that these design features not only met the international green construction standards but also helped minimize the stress that most of the patient's experience, improve the recovery rates, and cut down on energy use.

Chauhan, Jakhar, and Jabbour (2022) delved into the practical aspect of sustainable healthcare by discussing how telemedicine came to be during the COVID-19 pandemic and how this trend can be used in promoting significant environmental impact reduction. Though the research mainly did not dwell on the aspect of hospital buildings, it gave vital information regarding the role of digital transformations to supplement the physical developments of sustainability. The researchers pointed out that the transition to remote consultations resulted in a huge drop in patient and staff commuting, and therefore cut vehicular emissions, fuel consumption, and reduced the number of vehicular emissions as a whole, despite the number of health services provided ad remained in stone. Also, they were able to discover that telemedicine reduced resources utilization in hospitals including the use of utilities in the waiting room, paper-based recordings, and use of facilities.

Dion and Evans (2024) addressed the strategy and management of sustainability of healthcare buildings specifically within the context of corporate governance and efficient management of energy. In their research, they tried to look into the roles of institutional leadership, regulatory systems and accountability systems as some of the factors that facilitated proper execution of sustainability initiatives in hospitals. The authors found that hospitals having formal sustainability charters, green committees and leadership-based environmental policies tended to record steady improvements in energy reduction and overall environmental performances. In addition, they talked about the importance of energy audit, performance measurement and third-party benchmarking tools in directing hospitals in achieving measurable sustainability results.

Dion, Evans, and Farrell (2023) carried out an in-depth exploration of game-changing energy efficiency projects being developed by hospitals seeking to adopt greater sustainability. Their study has evidence of case-based studies by which the hospitals have already deployed a full scale of retrofitting interventions including instalment of solar photovoltaic system, conversion to LED lighting, use of energy efficient HVAC including deployment of smart energy management systems. The research has shown that these kinds of interventions not only led to great operational costs savings and cut in carbon emissions but also increased the resilience and the functioning stability of the healthcare facilities. Critically, the authors pointed out the need to institute perpetual monitoring, reporting on the environmental and feedback to make such interventions effective in the long term. They reasoned the solution to sustainability in hospital management is a multi-tier strategy including technical innovation, cross disciplinary teamwork, and use of real time data conversion in providing decision-making decisions.

3. METHODOLOGY

This research paper is a quantitatively descriptive and summary based highlighting the major use of secondary data as a study objective in measurement of the level of green hospital and its effects on health sustainability in India. The use of the research design will not engage in primary data collection in form of survey or questionnaires rather compilation, analysis and interpretation of available documented data will be used.

3.1 Research Design

It is an exploratory and non-experimental and descriptive study. It is based on desk-based research and content analysis of reports, case studies and institutional publications available on

green hospital project in India. The method enables the researcher to get a wide and objective apprehension of the practices prevailing without conducting research at the field level.

3.2 Sample Size

The sampling approach applied in identifying suitable hospital facilities to be the subject of the study was purposive sampling. Hospitals were selected on the basis of their website description of participation in green or sustainable health activities. This may consist of certified green buildings, hospitals with renewable energy uptake, superior biomedical waste management systems or water saving infrastructure or institutionalised ways of environmental policy.

The ultimate sample size was composed of 110 hospital facilities or healthcare infrastructure projects in different regions all over India. Hospitals both in the public and the private sector were used so as to have a variety.

3.3 Data Analysis Method

On completion of selection and reviewing of documentations related to the 110 hospitals, the data wearer coded and categorised data concerning the major variable variables:

- Green certification/ Sustainability practice type taken up,
- Measures of resource efficiency (e.g. percentage decreases in use of energy or water),
- Kind of environmental and operating results attained.

This information was later tabulated in the form of frequency and percentage tables to make a quantitative note of green (or non) adoption patterns. There is no use of inferential statistical tools because it was not aimed to offer the hypothesis testing, but descriptive views.

4. RESULT AND DISCUSSION

This section provides an in-depth profile of the adoption behaviour, environmental effects, infrastructural properties and the ownership elements of green hospitals in India utilizing secondary information by use of 110 hospital institutions. To get a complete picture of sustainability in the healthcare sector of India, the analysis is formulated into four major thematic domains. All sub-sections are validated by quantitative frequency and percentage data in order to show the distribution of practices and outcomes across the sample. Graphic representations also make it clear and give an understanding of comparisons.

4.1 Adoption Levels of Green Certifications and Strategies

The table below shows the recording of a detailed quantitative description of the categories of the green certifications and approaches that are being implemented by 110 of the hospital facilities in India. The classification has the following type of international certifications (e.g. LEED), national rating systems (e.g. GRIHA), sustainability-integrated NABH accreditation and other non-certified green practices.

Table 1: Adoption Levels of Green Certifications / Strategies

Adoption Level	Frequency	Percentage
LEED certified (all levels)	28	25.5%
GRIHA-certified or rated	20	18.2%
NABH with integrated sustainability	14	12.7%
Other green practices (non-certified)	48	43.6%
Total	110	100.0%

As shown in Table 1, to indicate the extent to which green practices implemented in the sample of hospitals are not certified, the percentage is high (43.6 %). This is an indication that there is a high propensity towards measures of sustainability without third-party validation. The share of the LEED certification is 25.5%, followed by GRIHA with 18.2% and NABH with sustainability integration with 12.7%, which represent an intermediate degree of formality in the involvement with rigorous green rating schemes.

The extensive figure below is a pictorial illustration of distribution of the green certification as well as the adoption of the strategies levels as percentages in the 110 hospitals sampled. It offers more evident comparative picture on the percentage of every category in the total sample.

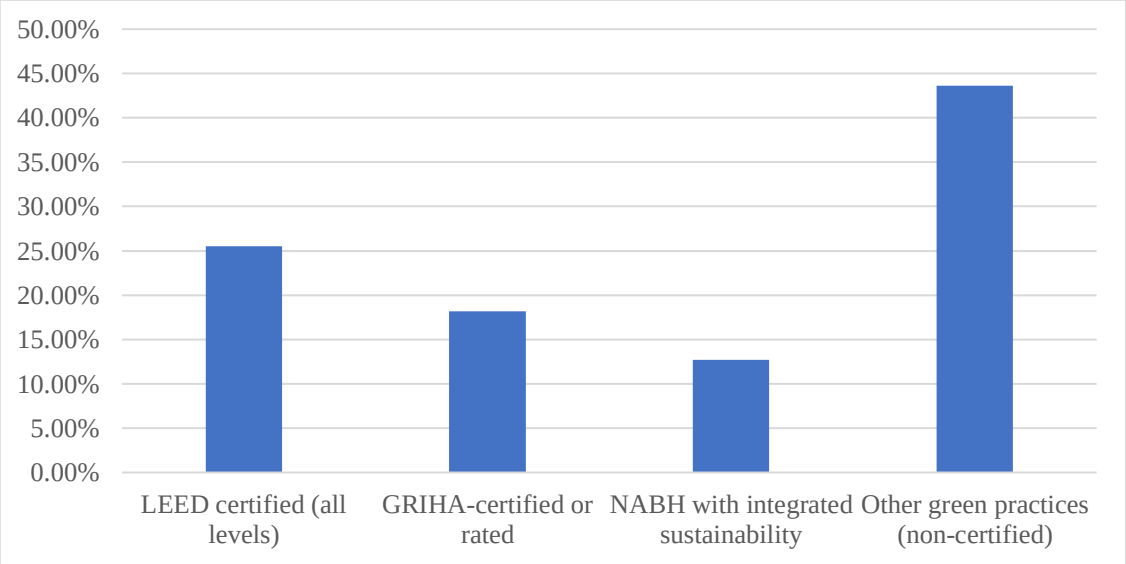

Figure 1: Graphical Representation of the Percentage of Adoption Levels of Green Certifications / Strategies

Figure 1 graphically supports the predominance of the noncertified green practices by the Indian hospitals. The bar of the column labelled as Other green practices (non-certified) stands taller, which is a vivid expression of the fact that it takes the first place. Meanwhile, LEED and GRIHA are issued on similar levels indicating their relatively equal levels of adoption, whereas NABH with integrated sustainability is regarded as the lowest visual item.

4.2 Reported Primary Environmental Impact Categories

In order to assess the real results of the green hospital efforts, the given research divides the main ecological impacts that were stated by the 110 chosen hospitals. These effects are concerned with assessable gains in water and energy consumption, effects on waste level management and situations when a particular environmental outcome was not recorded. The table below gives an idea of the frequency and percentage distribution of these categories of impacts.

Table 2: Primary Environmental Impact Reported

Impact Category	Frequency	Percentage
Energy savings	33	30.0%
Water savings	27	24.5%
Waste reduction	29	26.4%
No measurable impact reported	21	19.1%
Total	110	100.0%

The table 2 indicates the energy savings to be the most frequently reported of these environmental impacts with the fraction of the hospital case reports at 30%. Waste reduction (26.4%) and water savings (24.5%) follow, which points to the fact that efficiency in the use of resources is the focus of green actions in Indian hospitals. Nevertheless, in 19.1% of the facilities no measurable environmental impact was stated and there can be some flaws in monitoring or reporting sustainability results.

The subsequent bar graph is a graphical representation of the percentage distribution of primary environmental impacts on which the hospitals reported. It also assists in making the comparison of relative focus on the results of different sustainability procedures like energy and water conservation or waste management.

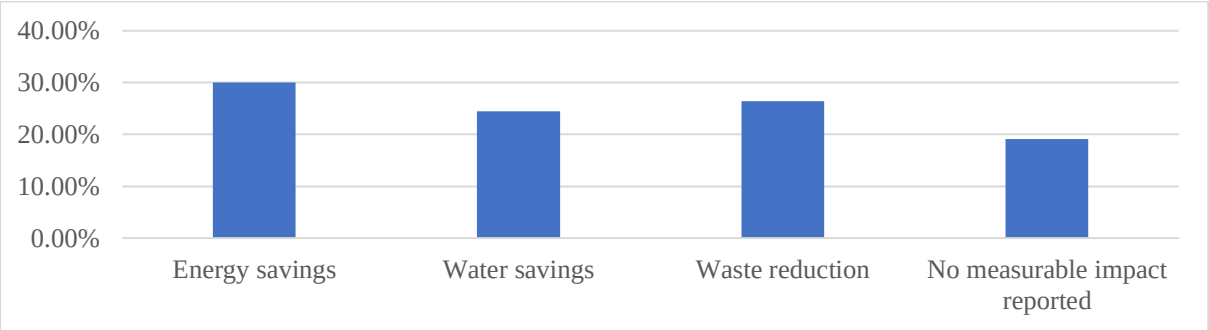

Figure 2: Graphical Representation of the Percentage of Primary Environmental Impact Reported

The graph shown in figure 2 clearly shows that energy savings is the best result attained followed by waste reduction, and water savings. The visual contrast also indicates that almost every twenty hospitals (the lowest bar) reported zero lack of environmental improvements, and it serves as a confirming factor of the potential improvement to the sustainability reporting practices or its impact assessment mechanisms in the healthcare infrastructure.

4.3 Types of Green Infrastructure Installed

The other objective of studying the establishment of sustainability in Indian hospitals is on the type of green infrastructure that is implemented on the facilities. This encompasses physical deployment that involves environmental protection like renewable energy systems, rain water harvesting, energy efficient electrical and wastes treatment mechanisms.

Table 3: Type of Green Infrastructure Installed

Green Infrastructure Type	Frequency	Percentage
Solar panels / renewable energy	32	29.1%
Rainwater harvesting systems	30	27.3%
Energy-efficient lighting / HVAC	26	23.6%
Waste treatment / composting units	22	20.0%
Total	110	100.0%

As shown in Table 3, the most common type of green infrastructure that has been implemented is solar panels and other renewable energy systems, with the percentage of it found in the hospitals amounting to almost 29.1. Close behind is rainwater harvesting systems with 27.3% and this shows that they have made a lot of focus on the water sustainability. The use of energy-efficient lighting and HVAC systems comprises 23.6% whereas the least common are the waste treatment or composting units having only 20% of the hospitals fitted with them. The high proportion of proposed infrastructure-based strategies indicates relatively balanced (although uneven) prioritization of such strategies, with systems involving energy and water systems given a wee bit more priority than the infrastructure of waste management.

The figure below has been used to display the percentages of types of green infrastructure installed in the hospitals surveyed.

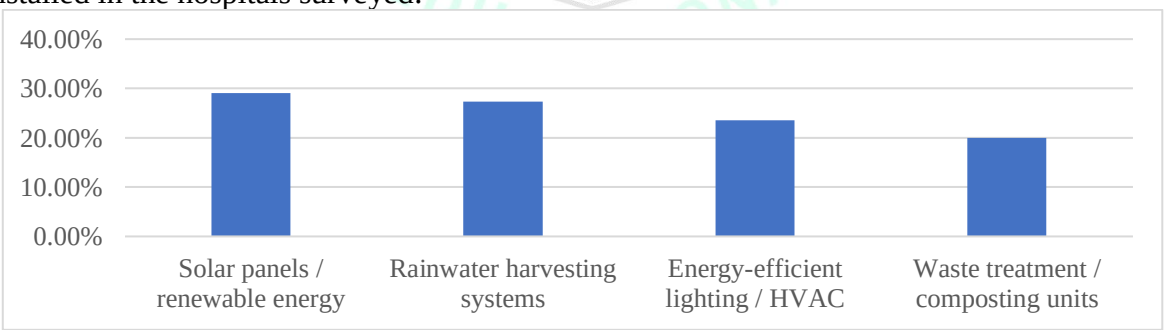

Figure 3: Graphical Representation of the Percentage of Type of Green Infrastructure Installed

Figure 3 made it clear that solar energy facilities are the most commonly applied green feature in Indian hospitals and the precedent of that are the rainwater harvesting systems. The bars corresponding to the facets of energy efficient lightings/HVAC and waste treatment units are shorter which denotes a relatively low rate of adoption.

4.4 Institutional Ownership of Green Hospitals

To assess the drivers of healthcare sustainability in India, it is vital to have an idea of which kinds of institutions are most diligently embracing green hospital practices. The classification will look at the type of ownership of the hospital facilities under evaluation- whether it is in the hands of the private sector, the public/government-owned or the charitable/trust run organizations. See table below, which shows how green hospital initiatives occur within each of these sectors in terms of frequency and percentage (frequency is used as a proxy measurement because the sample size is small at present).

Table 4: Institutional Ownership of Green Hospitals

Sector Type	Frequency	Percentage
Private sector	60	54.5%
Public/government	34	30.9%
Charitable / Trust-run	16	14.6%
Total	110	100.0%

Table 4 shows that the private sector drives green hospital development to a greater degree and the majority of its facilities (54.5%) have adopted sustainable elements. It is then followed by public/government hospitals with 30.9% and then the charitable or trust-run hospitals with 14.6%.

The next figure gives a pictorial representation of the institutional holding trends among the green hospitals of the sample. It lays emphasis on individual role of each of the sectors in shaping out a sustainable healthcare infra-structure.

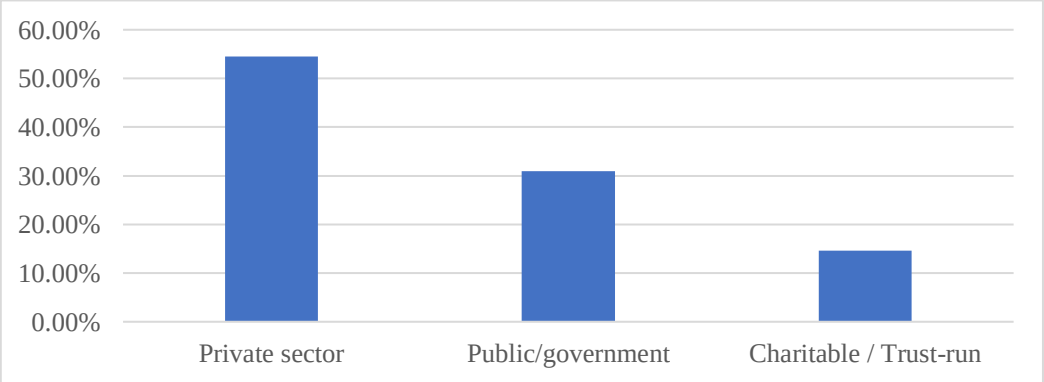

Figure 4: Graphical Representation of the Percentage of Institutional Ownership of Green Hospitals

The visual representation in figure 4 further substantiates the fact that the private industry contributes very highly to the implementation of green healthcare initiatives. The bar indicating private institutions is barely over 1.5 times higher in comparison to that of public hospitals and almost four times as much as the bar against charitable hospitals.

5. CONCLUSION

The paper gives a detailed analysis of the adoption of green hospitals in India in terms of the impacts on the environment as well as the infrastructure policies that have been adopted in various healthcare facilities in the country. The results reveal that the sustainability activities are making constant developments, whereby numerous hospitals, despite not having any formal certifications, are implementing energy efficient, water-conserving and waste reducing activities. The impressive usage of solar panels and rainwater harvesting systems demonstrates the rising level of conscious resource use whereas the decrease in waste treatment infrastructure

use shows the sections in need of improvement. The prevalent situation of the strong performance of the privatized sector also exposes the unequal situation in terms of funding and capacity hence the significance of reinforcing policies support and incentives towards the construction of the public and charitable hospitals. Among other things, the evidence indicates a positive trend in the direction of a sustainable healthcare system in India.

REFERENCES

1. *Bisoi, A. K., & Mankar, D. D. (2024). Green Hospitals and Healthcare Facilities with Healing Architecture in India. Indian Practitioner, 77(7).*
2. *Chauhan, A., Jakhar, S. K., & Jabbour, C. J. C. (2022). Implications for sustainable healthcare operations in embracing telemedicine services during a pandemic. Technological Forecasting and Social Change, 176, 121462.*
3. *Dion, H., & Evans, M. (2024). Strategic frameworks for sustainability and corporate governance in healthcare facilities; approaches to energy-efficient hospital management. Benchmarking: An International Journal, 31(2), 353-390.*
4. *Dion, H., Evans, M., & Farrell, P. (2023). Hospitals management transformative initiatives; towards energy efficiency and environmental sustainability in healthcare facilities. Journal of Engineering, Design and Technology, 21(2), 552-584.*
5. *Karamat, J., Shurong, T., Ahmad, N., Afridi, S., Khan, S., & Khan, N. (2019). Developing sustainable healthcare systems in developing countries: examining the role of barriers, enablers and drivers on knowledge management adoption. Sustainability, 11(4), 954.*
6. *Karamat, J., Shurong, T., Ahmad, N., Afridi, S., Khan, S., & Mahmood, K. (2019). Promoting healthcare sustainability in developing countries: Analysis of knowledge management drivers in public and private hospitals of Pakistan. International Journal of Environmental Research and Public Health, 16(3), 508.*
7. *Kumari, S., & Kumar, R. (2020). Green hospital-A necessity and not option. Journal of Management Research and Analysis, 7(2), 46-51.*
8. *Kumari, S., & Saini, C. P. (2022). An investigation of factors affecting the adoption of Green hospitals among healthcare professionals. Transnational Marketing Journal, 10(3), 505-514.*
9. *Martins, J. M., Aftab, H., Mata, M. N., Majeed, M. U., Aslam, S., Correia, A. B., & Mata, P. N. (2021). Assessing the impact of green hiring on sustainable performance: mediating role of green performance management and compensation. International Journal of Environmental Research and Public Health, 18(11), 5654.*
10. *Sanyal, T., Rakshit, I., & Bhattacharjee, P. (2024). Green healthcare: initiatives and adaptations for sustainable future. Environment, Development and Sustainability, 1-28.*
11. *Soares, A. L., Buttigieg, S. C., Bak, B., McFadden, S., Hughes, C., McClure, P., ... & Bravo, I. (2023). A review of the applicability of current green practices in healthcare facilities. International Journal of Health Policy and Management, 12, 6947.*
12. *Swarnakar, V., Bagherian, A., & Singh, A. R. (2023). Prioritization of critical success factors for sustainable Lean Six Sigma implementation in Indian healthcare organizations using best-worst-method. The TQM Journal, 35(3), 630-653.*
13. *Tarkar, P. (2022). Role of green hospitals in sustainable construction: Benefits, rating systems and constraints. Materials Today: Proceedings, 60, 247-252.*
14. *Thakur, V., Mangla, S. K., & Tiwari, B. (2021). Managing healthcare waste for sustainable environmental development: A hybrid decision approach. Business Strategy and the Environment, 30(1), 357-373.*
15. *Vaishnavi, V., & Suresh, M. (2023). Modelling the factors in implementation of environmental sustainability in healthcare organisations. Management of Environmental Quality: An International Journal, 34(1), 137-158.*