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The Future of Green Hospitals: Sustainable Business Models and Adoption Prospects in Indonesia and Malaysia

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ABSTRACT

The concept of a green hospital represents the future direction of sustainable healthcare development, necessitating empirical studies to support the design of a sustainable business model. This research aims to explore the practical implications of green hospital adoption in Malaysia and Indonesia, providing valuable insights into enhancing patient care and fostering environmental sustainability. Employing a qualitative approach, the study investigates community preferences when choosing hospitals, the existence of eco-friendly care departments, the implementation of environmentally friendly activities, and management efforts toward green hospital adoption. Data collection involved interviews with hospital patients and management, supported by secondary data from Malaysia, with qualitative data analyzed using NVIVO software. The findings reveal significant progress in adopting green hospital practices, including waste and energy reduction, minimized use of PVC, and procurement of eco-friendly products and low-carbon foods. Malaysia's implementation rates of green hospital principles averaged 96.87% in services and 96.78% in management. These results highlight the feasibility of adopting sustainable green hospital practices, driven by high community demand and positive management responses. However, gaps in management's understanding of the green hospital concept emphasize the need for literacy and capacity-building initiatives. This research serves as a pioneering step toward designing a sustainable green hospital business model, laying the foundation for integrating sustainability into healthcare management and promoting environmentally responsible practices.

1. INTRODUCTION

The definitions of "green health" and "green hospitals" are continuously evolving, with sustainability becoming an integral component of these concepts. To support "green health" and "green hospitals," hospital administrators implement sustainable environmental management strategies in areas such as energy conservation, efficient waste disposal, and safe medication administration, aiming to minimize adverse effects on patients, surrounding populations, and the environment [1]. A commitment to sustainability in "green health" and "green hospitals" not only enhances financial performance, competitive positioning, and market differentiation, but also contributes to broader environmental and societal benefits, rendering it a critical competitive tool for construction enterprises [2]. However, there remains limited research on how patients, visitors, and medical staff interact with sustainable green hospital design. This aligns with Wood et al.'s [2] observation that "little research has been conducted on how hospitals' end-users—both the staff that work there and the visiting public—perceive green hospital designs." Therefore, this study aims to design a sustainable business model for green hospitals, providing a framework for future adoption and long-term viability.

The healthcare industry is increasingly pressured to adopt sustainable practices that improve operational efficiency, reduce costs, and maintain high-quality services [3]. Hospitals' experience with process improvement and operational efficiency initiatives positions them advantageously in addressing sustainability concerns and integrating environmental efforts [3, 4]. A green hospital is defined as a hospital that enhances patient outcomes while minimizing its environmental impact [1]. By integrating sustainable processing technologies and adopting green building concepts, green hospitals aim to optimize the health of their environments while reducing pollution from waste [3, 5]. Key elements of sustainable green hospitals include energy efficiency, environmentally friendly building design, alternative energy generation, sustainable transportation, locally sourced food, water conservation, and the provision of

green open spaces within hospital premises [4, 6]. These features underscore the critical role of sustainability in shaping the future of environmentally responsible healthcare [7, 8].

Most people spend time indoors in uncomfortable conditions and get more exposure to most indoor pollutants than in outdoor situations. Therefore, his well-being depended on the atmosphere in the room. Environmental degradation is a major global problem [9, 10]. Green buildings greatly affect public health at both the human and demographic levels. On a human level, it improves indoor quality, whereas on a demographic level, it reduces electricity use and emissions, increases global warming, and causes heart disease, premature death, and asthma [11, 12]. A green hospital can be defined as a hospital that is planned, built, and maintained with due regard to the principles of sustainable health and the environment. Hospital structures must be built to provide optimal use of electricity, water, and materials. Reduction of structural effects on human health and the environment through planning, development, improvement, and disposal [11, 13, 14].

Currently, hospitals require proper management to provide the best services and achieve sustainable financial performance [15]. The successful health care business models increase customer loyalty, consumer benefits and can contribute to the creation of a competitive cost structure, taking into account the choice of the appropriate automation option and health organization processes digitization. The business model is similar to the strategic plan that is later implemented through organizational structures, processes, and systems.

To design a sustainable and appropriate hospital business model in the future, studies are needed that can become the basis for decision making. This study was conducted to investigate the current needs of the community by exploring the current conditions felt by the community. The plan to adopt a green hospital needs to be finalized by exploring the current opinion of hospital management. The concept of green hospitals holds the potential to revolutionize healthcare towards greater sustainability. Green hospitals offer numerous benefits to both the environment and individuals through green design, energy efficiency, and eco-friendly procurement. Despite the existing challenges, these can be tackled with innovative ideas and technologies [16, 17]. The green architecture concept, gaining global importance owing to ecological concerns about global warming, promotes energy reduction, efficient use of natural resources, and health protection [18, 19]. Green hospitals aim to efficiently use energy, water, and materials and increase ecological awareness, meeting criteria across waste, environmental, water, energy, hazardous substance management, and material selection [20, 21].

Hospitals cannot avoid changes in the healthcare industry [22]. As the environmental landscape becomes increasingly complex, a shift in perspective among hospital stakeholders is necessary. This change inevitably impacts hospital service management and customer experience, compelling hospitals to adapt and evolve their practices to maintain excellent patient care while ensuring sustainable operations. One of the concepts of change that is currently trending is the concept of "green hospitals". Changes in property improvements in Indonesia show a trend toward adopting green ideas. Recently, the implementation of green hospitals has become a new method of hospital management [23]. This is because hospitals are known to be one of the largest contributors to waste and carbon emissions. Green hospitals integrate processing technology by applying the concept of green building in hospitals with the aim of optimizing the health of the hospital environment from the waste pollution it produces. In general, the elements of green hospitals are energy efficiency, green building design, alternative energy generation, transportation, food, water, and availability of green open spaces in the hospital area.

Currently, hospitals require proper management to provide high-quality services while achieving sustainable financial performance. Successful healthcare business models increase customer loyalty, enhance consumer benefits, and contribute to the creation of competitive cost structures by integrating automation and digitization of healthcare processes [24]. As environmental concerns and sustainability take center stage, the concept of green hospitals has emerged as a transformative approach in hospital management. Green hospitals aim to reduce environmental impacts by optimizing energy and water use, adopting eco-friendly building designs, and minimizing waste pollution. Despite their potential, the adoption and implementation of green hospitals face challenges, including a limited understanding of stakeholder needs and the feasibility of sustainable business models in various contexts. This study aims to design a sustainable business model of green hospitals with a focus on integrating sustainable practices into healthcare service delivery and management. By exploring current conditions, stakeholder perspectives, and community needs, this study seeks to answer the following primary research question: *What are the critical factors for developing a sustainable green hospital business model that balances environmental, social, and financial objectives?*

Through a detailed evaluation of hospitals in Indonesia and Malaysia, this study investigated the feasibility, practicality, and criteria necessary for adopting green hospital models. It emphasizes the integration of customer preferences, hospital management insights, and sustainable design principles. The findings are expected to contribute to decision-making frameworks that promote the widespread adoption of green hospitals and address global ecological concerns while enhancing healthcare service quality and operational efficiency. By establishing a robust sustainable business model of green hospitals, this research aims to pave the way for eco-conscious and patient-centered healthcare systems in the future.

2. LITERATURE REVIEW

Wood et al. [2] found that end-users perceived “safety mechanism during emergency” as being of the utmost importance and also the feature they were satisfied with. The other demanded qualities were at an average degree of satisfaction; however, green hospital design must take efforts to maximize the use of natural light and ventilation while considering the building orientation, materials should be free from toxicity and be environmentally friendly, the landscape should be strategically designed, and the facilities should increase the sense of a healing environment and water-efficient equipment. Their research used a survey conducted in Malaysia.

Aza et al. [25] evaluated the components of the Green Hospital in Teaching and Private Hospitals covered by Tehran University of Medical Sciences. Independent t-tests and analysis of variance were used for the data analysis. Their

study showed that the dimensions of "environmental leadership and management" rated the highest, and water management had the lowest rating. Although private hospitals earned higher scores in all aspects of green hospitals apart from management, leadership, and chemicals compared with teaching hospitals, there was no statistically significant difference between these dimensions and types of hospitals. Given that the hospitals studied did not meet green hospital standards properly, it seems necessary to prepare a comprehensive action plan to improve their weaknesses and meet these standards. A green hospital, although not globally defined, is a facility designed to utilize natural resources efficiently and sustainably, reducing its carbon footprint and enhancing patient care. Key considerations in planning such facilities include energy and water conservation, alternative energy sources, waste management, and the use of eco-friendly materials and practices [26].

Currently, the concept and term "Green Hospital" has become a reference for several companies. The Health Sector, which consumes large amounts of resources and generates waste, is a public health problem. There was a rapidly growing awareness among the public about facilities whose designs incorporated green construction principles. Wood et al. [2] evaluated the use of QFD in designing green hospitals, determined end-user requirements, and translated them into appropriate technical requirements for implementation at various operational planning levels. Therefore, based on the quality demanded by end-users, this research presents a QFD tool for green hospital design for public and private hospitals: the House of Quality Green Design (HOQGD). In particular, Green Hospital is related to the needs of the community, which is a large part of the treatment services for tropical diseases. Tropical disease is a disease that often occurs in tropical and subtropical climates, such as Indonesia. Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity and mortality worldwide. Persistent airflow obstruction has been identified as one of its characteristics. COPD is correlated with an increased chronic inflammatory response in the airways and lungs to noxious particles and gases and is also progressive [27].

Therefore, business modelling as a process for the design of business operations is mostly directed at the value of manufactured products and customer interests, and is second only to the company's internal business processes [28, 29]. Likewise, information technology support will greatly assist the government and business owners/managers in making decisions based on available business information to innovate or create new business plans that suit the tastes and preferences of the changing business environment [30]. This business model is also related to the emergence of the concept of a value proposition that considers all consumer desires [28]. A commonly used business model is that of Osterwalder and Pigneur [31], which is illustrated in their book Business Model Generation and further developed in their other book Value Proposition Design, which has become the most famous. Research on the interaction between business operations, business modelling, and types of competitive advantage shows that business operations business models are used as a tool for the formation, development, and management of a company's competitive advantage [32]. His business model design is based on the Osterwalder and Pigneur model [31], which adds a value proposition matrix and an interaction scheme between business functions and model elements to intensify its use in the management of business operations. It helps strengthen the coordination of activities involving managers from all structural subdivisions for business operations during the creation of value propositions for each consumer segment, taking into account the preferences and maximum expectations of customers.

The US and European nations currently offer the majority of definitions of green hospitals. This entails the following: environmental acceptance is first and foremost necessary when choosing a location for hospital buildings; sustainability and universities of buildings are also taken into consideration in the design processes; green materials and products should be chosen during the construction process; the green concept is ingrained in the renovation and construction processes, and it is taken into account during the follow-up operation. In addition to the fundamental national requirements for hospitals in China, issues related to green hospitals include environmental protection, sustainable development of hospital construction engineering, energy and water conservation, reduced pollution in daily operations, patient satisfaction with healthcare services, and related hospital green management measures [33].

To provide healthcare, hospital administrations must actively explore ways to capture renewable energy sources (such as water, wind, sun, geothermal heat, and organic matter). Governments must support subsidies and other measures that promote the use of renewable energy, as well as the use of medical devices that consume little or no energy. By locating healthcare facilities as close to public transportation stops as possible, using locally sourced building materials, and incorporating design elements such as water harvesting, natural ventilation, day lighting, and planting trees on site, healthcare facilities can improve their environmental sustainability index [34].

To create a green hospital, Persahabatan Hospital's leadership and stakeholders have developed and implemented environmental strategy planning, which includes: (1) Creating a master plan based on green building and environmental legislation. (2) Creating a marketing plan to promote the benefits of a hospital's green environment. (3) Preserve a maximum of 80% of the open space, which is green. (4) Sustainable socialization of green hospital culture. (5) Efficient use of paper, water, and other resources, including electrical energy. (6) Provision of hospital waste-treatment facilities. (7) Creating ideas to improve the hospital environment. (8) Create collaboration for environmental and green hospital information systems. (9) Create a green hospital by setting qualified human resources to implement strategic strategies [35].

All facets of life, including community health services and medical activities, are covered by Sustainable Development Goals. As part of the health system, hospitals not only conduct medical examinations, treatment, and research on treatment modalities, but they also ensure that the conditions are in place to meet other non-medical goals of the health sector, such as sustainable development goals [12].

The idea of green buildings or green architecture was introduced because of concerns about the environment and human health. This movement has gained support since the final decades of the nineteenth century. The Vittorio Emanuele II Gallery in Milan, which adopted system control of ventilation to improve indoor air quality, is one such example. Subsequently, this movement began to grow into other fields, such as politics, health, and science. Hospitals are now the focus of green architecture implementation as the primary

element in the healthcare sector, creating a green and healthy hospital. The idea of a structure that can maintain the health of the environment while using power, water, and fuel as effectively as possible as well as improve people's health is known as a green building [11].

People and all other stakeholders need the management of non-medical waste in hospitals and their surroundings to build a Green Hospital in order to live healthy lives. The supervision of non-medical waste has a direct impact on patient comfort and happiness in terms of trash containers, waste collection, and waste carrying [12]. Suwasono et al. [36] suggested that green hospital indicators also consider the adjustments of local hospital management experts and the perspectives of 220 medical professionals in addition to the indicators for measuring the green building and medical industries globally. Subsequently, Taiwan Green Hospital Indicators were proposed. Green hospitals can be introduced using two key indicators, environmental management and environmental education, and extended eleven sub-indicators [37]. Danilov et al. [38] found that despite being resource-intensive, healthcare facilities can significantly decrease their environmental impact and enhance both staff well-being and patient recovery through sustainable practices. These practices include improving indoor air quality, green interior materials, and strategic landscaping.

The factor of highest importance, according to research among end users of public and private hospitals, is "safety mechanism during emergencies". The following are listed in decreasing order of importance after this: "increase natural lighting", "increase natural ventilation", "use of toxic-free materials", "building orientation", "healing environment", "atmospheric condition", "install water efficiency equipment", "strategic landscape", and "use of environmentally friendly materials". Their research recommended that the government implement many of these requirements into rules that would affect how architects and construction firms build hospitals [2].

The Green Building Index (GBI) was developed in Malaysia to promote sustainability in the built environment and increase public knowledge of environmental issues among developers, architects, engineers, planners, designers, contractors, and other industry professionals. The GBI was specifically created to meet the needs of the cultural and social context, tropical Malaysian climate, and environmental and developmental contexts [20].

3. METHODOLOGY

This study employs a qualitative research approach [39] to explore the perceptions of people in Lampung Province, Indonesia and hospital management regarding the adoption of the green hospital concept in industrial areas for the future. Qualitative methodology was chosen to provide in-depth insights into community and managerial attitudes, expectations, and challenges associated with green hospital implementation. This study aims to understand how the concept of green hospitals can be integrated into healthcare settings, considering the unique dynamics of industrial areas in the province.

3.1 Study context

The Lampung Province was chosen as the study area because of its growing industrial activities and increasing awareness of environmental sustainability. The province's industrial areas create unique environmental challenges, making them an ideal context for studying the feasibility and acceptance of green hospitals. Hospitals play a crucial role in public health in this region, and their environmental impact presents both challenges and opportunities for sustainable health care development.

3.2 Sampling strategy

The sampling strategy targeted both public and hospital management to obtain a comprehensive understanding of the adoption of green hospitals. A total of 1,159 respondents were surveyed, including outpatients, inpatients, and hospital visitors. Additionally, 43 officials, including government hospital representatives and middle- and high-level managers from private hospitals, participated in the study. The sampling approach ensured representation across different stakeholder groups, capturing diverse perspectives on the adoption of green hospitals. Hospital sampling was conducted randomly, while considering the classification and categorization of hospitals based on their facilities and service capabilities. Hospitals in Indonesia are classified into four types, A, B, C, and D, based on their size, resources, and the range of services provided. Type A hospitals are the largest and most resource-intensive, providing a wide range of specialized services, whereas Type D hospitals cater to basic healthcare needs. This study sampled five hospitals representing all these classifications to ensure a comprehensive understanding of green hospital practices and challenges. Furthermore, the study considered the distinction between general hospitals and specialty hospitals, which cater to specific patient groups such as those with chronic or rare diseases. This sampling strategy enabled this study to capture variations in perceptions and practices across different hospital types and categories [40-42].

3.3 Data analysis

Qualitative data collected in this study were meticulously analyzed using NVIVO software [43], which is a powerful tool for managing, coding, and synthesizing qualitative data. NVIVO's capabilities allowed for the efficient organization of a large volume of textual data, enabling researchers to identify patterns, themes, and insights that are central to understanding the adoption of green hospitals. The software facilitated systematic data management, making it easier to track recurring ideas and delve deeply into the nuances of respondents' feedback. The data analysis process began by cleaning responses to remove incomplete or irrelevant entries, ensuring that the dataset was focused and reliable. After cleaning, the data underwent a rigorous coding process, in which key concepts and themes related to green hospital adoption were identified and categorized. Codes were applied to reflect recurring ideas such as environmental practices, patient satisfaction, infrastructure, and management challenges. These codes served as the foundation for thematic analysis, in which related codes were grouped into broader categories that captured the essence of respondents' perceptions. The prominent themes included sustainability initiatives, infrastructure improvements, and barriers to implementing green hospital concepts. To enrich the analysis further, responses from different stakeholder groups—community members and hospital management—were

compared to uncover similarities and differences in their perspectives.

The study involved two primary groups of respondents: community members and hospital management. The 1,159 community respondents included outpatients, inpatients, and hospital visitors, offering diverse cross-sections of opinions and preferences. Their input is particularly valuable for understanding public attitudes toward green hospitals, especially in industrial areas where environmental awareness is heightened. On the other hand, the hospital management group consisted of 43 officials, including representatives from government hospitals and middle-to-high-level managers in private hospitals. The respondents provided critical insights into the operational, financial, and strategic dimensions of green hospital adoption. The inclusion of both public and private stakeholders is instrumental in capturing a holistic view of the challenges and opportunities associated with implementing green hospital practices. The investigation focused on several key areas to assess the feasibility and implications of adopting green hospitals. A major area of interest was community considerations, specifically, whether the implementation of green hospitals would influence public preferences for healthcare facilities in industrial areas. This study also examined existing eco-friendly practices in hospitals, such as waste management, energy efficiency, and sustainable procurement. Additionally, it explored the readiness and challenges faced by hospital management in adopting green hospital concepts and assessed the infrastructure and resource capabilities required for such a transition [44].

3.4 Pilot test

This study employed several methodological measures to ensure the reliability and validity of the findings. Survey instruments were pilot-tested with a small sample to refine the questions and ensure clarity, while triangulation was used to cross-validate data from interviews, surveys, and secondary sources. Random sampling of hospitals further enhanced the representativeness of the findings by including diverse hospital classifications and types. Ethical considerations were also central to the study, with informed consent obtained from all respondents, confidentiality maintained, and ethical approval secured from relevant review boards. Despite its robust framework, this study had certain limitations. The geographic focus on Lampung Province may limit the generalizability of the findings to other regions of Indonesia or beyond. Additionally, while qualitative methods provide rich insights, they may lack the statistical generalizability of quantitative approaches. The relatively small sample size of hospital officials (43) also poses a limitation, potentially leaving some management perspectives underrepresented. The methodological approach adopted in this study makes a significant contribution to the field of sustainable healthcare. Engaging a diverse range of stakeholders provides a balanced view of green hospital adoption, addressing both community needs and managerial challenges. The emphasis on sustainability aligns with global goals of mitigating environmental challenges while improving healthcare quality. Furthermore, the use of NVIVO software ensured rigorous and systematic analysis of the qualitative data, enhancing the reliability of the insights.

4. RESULTS

4.1 The development of green hospital in Indonesia

In 2021, there were 3.112 hospitals in Indonesia (BPS, 2022). The results of observations of secondary data showed that as many as 27 hospitals (0.87%) began implementing green hospitals. The analysis was carried out by studying hospital reports published on the website. If, in the explanation, it is found that the hospital has implemented one or more green hospital indicators, then the hospital is included in the green hospital category. A green hospital is a hospital concept designed by empowering the potential of nature as the main resource so that it is environmentally friendly and saves more energy expenditure. Seven elements must be considered for an environmentally friendly hospital: energy efficiency, green building design, alternative energy generation, transportation, food, waste, and water. In most hospitals in Indonesia, green hospitals still emphasize the efficiency and effectiveness of the use of water and electrical energy, as well as environmental waste management (Table 1).

Table 1. Distribution of green hospital in Indonesia

No.	Hospital Name	Province
1	RSJD DR.RM. Soedjarwadi - Klaten	Central Java
2	RSUD KRMT Wongsonegoro Semarang	Central Java
3	RSUD Karanganyar	Central Java
4	RSUP Dr.SoeradjiTirtonegoro - Klaten	Central Java
5	RSUD Hj. Anna LasmanahBanjarnegara	Central Java
6	RSUP Dr Kariadi - Semarang	Central Java
7	RSUD Sidoarjo	East Java
8	RS Universitas Indonesia (RSUI) - Jawa Barat	West Java
9	RSUD R. Syamsudin, SH Kota Sukabumi	West Java
10	RS Muhammadiyah Bandung Selatan (RSMBS)	West Java
11	RSUD dr. ChasbullahAbdulmadjid Kota Bekasi	West Java
12	RS Santo Borromeus Bandung	West Java
13	Brawijaya Hospital Saharjo - DKI Jakarta	DKI Jakarta
14	RS Kanker Dharmais - Jakarta Barat	DKI Jakarta
15	RS Pusat Pertamina Jakarta	DKI Jakarta
16	RS Pupuk Kaltim Bontang	East Kalimantan
17	RSUD Dr Kanujoso Djatiwibowo - Balikpapan	East Kalimantan
18	RSUD Abdoel Moeloek Lampung	Lampung
19	RS Umum Imanuel Way Halim	Lampung
20	RS Urip Sumoharjo	Lampung
21	RSUD Sleman	Yogyakarta
22	RSUP Dr Sardjito - Yogyakarta	Yogyakarta
23	Rumah Sakit Khusus Bedah Banjarmasin Siaga -KalSel	South Kalimantan
24	RSUD Haji Makassar - SulSel	South Sulawesi
25	RSUD Depati Hamzah Pangkalpinang	Bangka Belitung
26	RSIA Bina Medika - Tangerang Selatan	Banten
27	RSU Bunda Thamrin - Medan	North Sumatera

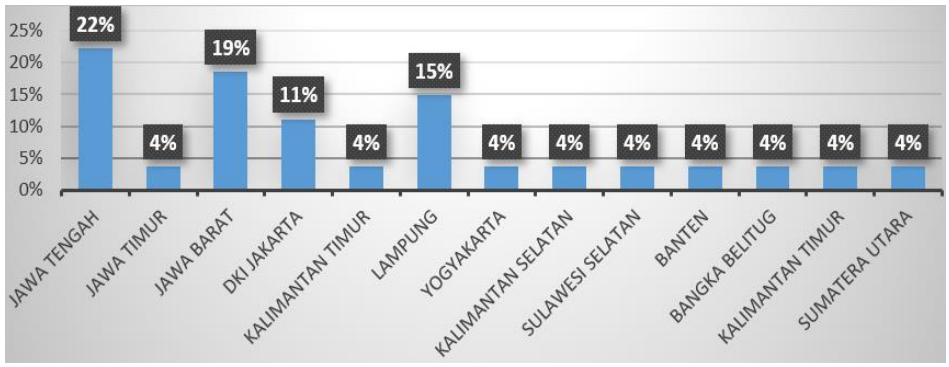

Figure 1. Percentage of green hospital in Indonesia per province

Figure 1 shows that Central Java Province had the highest number of green hospitals (22%), followed by West Java (19%), Lampung (15%), and DKI Jakarta (11%).

4.2 The results of patients and hospital visitors

The adoption of green hospitals requires significant investments and resources, making it crucial to integrate sustainable development principles into strategic hospital management. Designing an effective strategy for green hospital adoption requires robust data collection and analysis to ensure informed decision making. A key focus of this study was to examine whether the implementation of green hospitals influences individuals in industrial areas when choosing healthcare facilities. These findings indicate a strong community support for green hospital initiatives. A survey using open-ended questions revealed that 99% of patients and hospital visitors stated that they preferred a green hospital as their choice for treatment (Table 2). This overwhelming preference suggests that green hospital adoption has the potential to attract more patients, particularly in industrial areas where environmental awareness is growing due to proximity to pollution and ecological challenges.

Table 2. Considerations in hospital selection

Answer Category	Number of Respondents	Percentage
Very Important	1	0%
No, take into consideration	15	1%
Yes, take into consideration	1.143	99%
Total	1.159	100%

These findings align with the principles of sustainable development, emphasizing the balance between economic growth, environmental protection, and social equity. Green hospitals not only address environmental sustainability by reducing energy consumption, waste, and carbon emissions but also contribute to the health and well-being of communities, fostering social sustainability. Furthermore, their ability to attract patients and improve operational efficiency can enhance financial sustainability and ensure a hospital's long-term viability.

The adoption of green hospitals is not merely an environmental initiative but a comprehensive strategy for achieving sustainable development in the healthcare sector. By integrating green technologies, resource-efficient practices, and community-centered care, hospitals can become pivotal contributors to global sustainable development goals (SDGs), particularly SDG 3 (Good Health and Well-being), SDG 11 (Sustainable Cities and Communities), and SDG 12 (Responsible Consumption and Production). Ultimately, successful adoption of green hospitals can lead to improved financial performance, stronger patient loyalty, and enhanced resilience in an increasingly eco-conscious society.

This study also explores whether the community has experienced tangible benefits from the implementation of environmentally friendly practices by hospitals. The findings revealed that 59% of respondents reported partial benefits, 37% indicated they had fully experienced the benefits, and 4% stated they had not observed any benefits (Table 3). These results demonstrate that while no hospital has fully transitioned to a green hospital model, many are taking meaningful steps toward environmental sustainability through the adoption of eco-friendly practices. Key initiatives undertaken by these hospitals include reducing plastic usage, increasing reliance on natural sunlight to replace electricity, and implementing waste separation systems for clinical and nonclinical (nonmedical) waste. These practices align with the principles of sustainable development, addressing the environmental, social, and economic dimensions.

The partial benefits reported by the respondents highlight the incremental nature of the transition to green hospitals. As these facilities strive to balance operational demands with sustainability goals, their efforts contribute to broader objectives of sustainable development. Specifically, such practices support SDG 3 (Good Health and Well-being) by creating healthier environments for patients and staff and SDG 12 (Responsible Consumption and Production) by promoting resource efficiency and waste management. These findings underscore the importance of scaling up these practices to achieve the full potential of green hospitals. By continuously improving sustainability initiatives and engaging with the community, hospitals can maximize their positive environmental and social impact. These actions not only enhance public perception and trust, but also pave the way for a sustainable healthcare system that supports long-term ecological and societal well-being.

Table 3. Benefits of implementing eco-friendly hospitals

Answer Category	Number of Respondents	Percentage
Already, overall	425	37%
Already, only partially	687	59%
Not yet	47	4%
Total	1.159	100%

A survey of public satisfaction with hospitals implementing environmentally friendly practices, as shown in Table 3, revealed that 27% of respondents were very satisfied, while 44% expressed satisfaction. These findings indicate that the adoption of green hospitals significantly enhances public satisfaction, and demonstrates a strong positive reception of sustainable healthcare initiatives. This high level of satisfaction underscores the value of environmentally friendly practices for meeting community expectations and fostering trust. Green hospital initiatives, such as waste reduction, energy efficiency, and sustainable infrastructure, not only address environmental concerns, but also improve the overall healthcare experience. These efforts align with the principles of sustainable development, particularly by supporting SDG 3 (Good Health and Well-being) and SDG 11 (Sustainable Cities and Communities) through the creation of healthier and more resilient healthcare environments. The results also highlighted that sustainable healthcare practices can serve as a competitive advantage for hospitals. By prioritizing eco-friendly initiatives, hospitals are likely to experience increased patient loyalty and satisfaction, positioning themselves as leaders in sustainable health care. This reinforces the importance of integrating sustainability into strategic hospital management to ensure long-term benefits for the environment, community, and healthcare system (Table 4).

Table 4. Satisfaction with implementing eco-friendly hospitals

Answer Category	Number of Respondents	Percentage
Very Satisfied	307	27%
Satisfied	505	44%
Quite satisfied	319	28%
Dissatisfied	24	2%
Very Dissatisfied	1	0%
Total	1.159	100%

4.3 The results on hospital management

The informants used in this qualitative research have heterogeneous characteristics based on the level of education, length of work, sex, and age. The demographic characteristics of the participants are presented in Table 5.

Table 5. Demographic of informant

Category	Informant	%
Education		
Diploma	5	11%
Bachelor	17	40%
Master Degree	21	49%
Length of Work		
> 15 years	7	16%
10-15 years	24	56%
5-10 years	8	19%
< 5 years	4	9%
Sex		
Male	16	37%
Female	27	63%
Age		
31-40 years	13	30%
41-50 years	16	37%
51-60 years	14	33%

Interviews were conducted with 43 officials in government hospitals and middle managers in private hospitals, and as many as 70% were structural officials in government hospitals and 30% were middle managers in private hospitals (Table 6).

The first question, related to the existence of a department responsible for the implementation of environmentally friendly activities in hospitals, is shown in Figure 2. The results of the interviews showed that not all hospitals have a department that specifically handles this, and some are not even sure whether there is a department in their hospital. This indicates that some hospitals have not paid attention to the problems that lead to green hospitals.

Table 6. Distribution of key informants based on hospital ownership

Position	Ownership			
	Government	%	Private	%
Director/ Deputy Director	4	13%	0	0
Manager/ Division Head	9	30%	13	100%
Team Leader/Unit	17	57%	0	0
Total	30	100%	13	100%
Percentage	70%		30%	

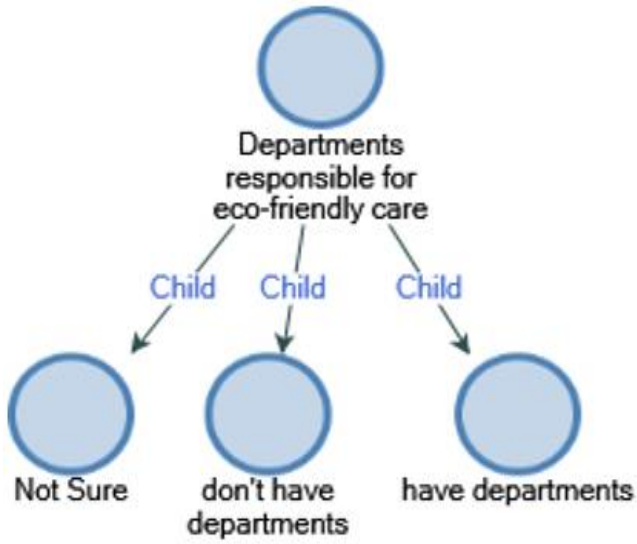

Figure 2. Departments responsible for eco-friendly care

The second question asked about eco-friendly health care activities showed that hospitals have carried out many activities that lead to being environmentally friendly, such as reduction of hospital waste disposal, reduction of energy consumption, disposal of infectious medical waste, disposal of food waste, use of environmentally friendly products, reducing PVC, and low-carbon food (Figure 3).

The third question relates to the efforts of hospitals to implement environmental friendliness. The results of the interviews show that there are hospitals that have made efforts towards being environmentally friendly, some that do not have a concept, some that have tried but have not been maximized, and some that have not done anything at all (Figure 4). The results of this investigation indicate that the concept of a green hospital has not been properly and thoroughly understood by the management. Therefore, it is important to improve literacy in the future.

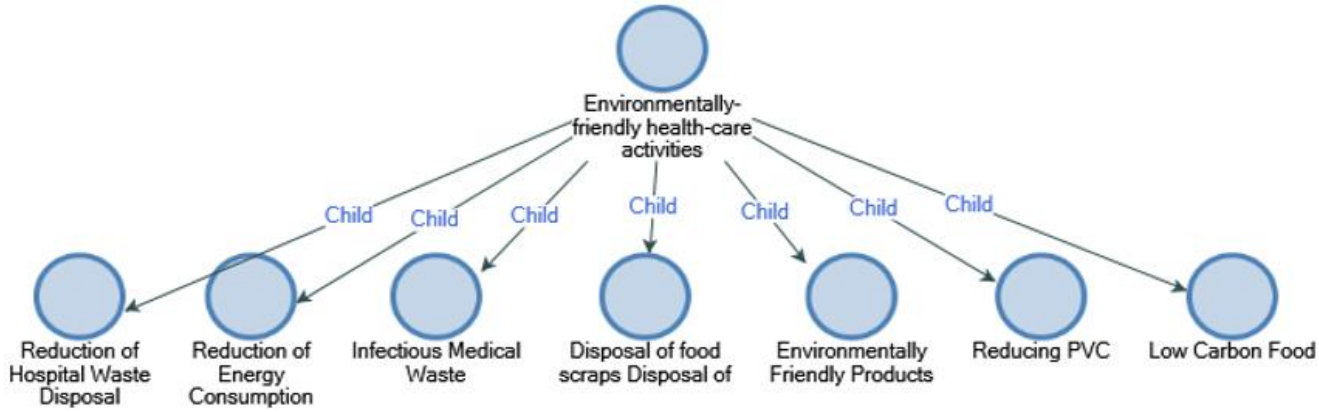

Figure 3. Implementation of eco-friendly activities

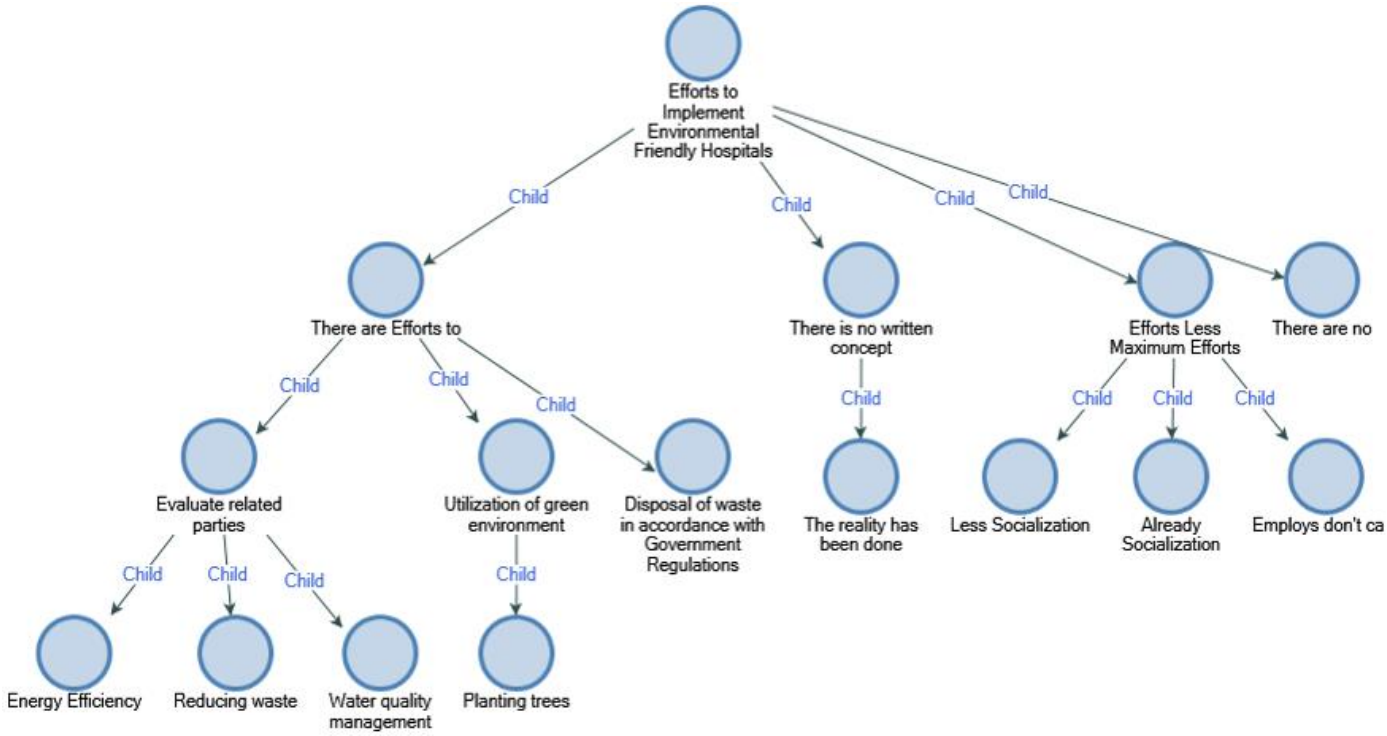

Figure 4. Efforts to implement environmental friendly hospital

4.4 The results of field study in Malaysia

Hospital data that implement the Green Hospital are from 250 private and public hospitals spread across Malaysia. There were 136 private and 113 public hospitals. The indicators needed to meet the Green Hospital criteria, which must be owned by the hospital, include the following.

1. Location and landscape
   a. There are no special bicycle parking facilities/areas
   b. There are no rainwater catchment wells
   c. There is no bio-pure infiltration hole facility
2. Hospital building
   a. Haven't used/recycled ceramics yet
3. Management of chemicals and B3
   a. Haven't made any effort to reduce battery usage
4. Waste management
   a. Haven't done organic waste composting yet
   b. Does not have a recycling bin facility
5. Energy efficiency
   a. Haven't used a bank capacitor yet
   b. Haven't used solar PJU (solar energy)
   c. Not utilizing other renewable energy

The following is the result of data from several hospitals in Malaysia, namely, Public and Private Hospitals for Hospital Services and Management that are suitable for Green Hospitals:

1) Results of the Malaysia Hospital Services Questionnaire Data

Some of the questions asked to produce questionnaire data from Hospital Services were as follows.

A. Location and Landscape

1. Ease of Reaching Hospital Locations by Using Public Transportation
2. Availability of public transportation to and from the Hospital
3. Availability of green trees in the Hospital
4. Availability of gardens at the Hospital
5. Availability of water absorption holes in the Hospital
6. Availability of green open areas in the Hospital
7. Cleanliness, tidiness, and beauty of the environment in the Hospital

B. Energy

1. Lighting without lights in the Hospital during the day
2. Availability of ventilators in the toilet and stairwell areas in the Hospital
3. Availability of instructions for saving electricity in the Hospital area
4. Hospital coolness without air conditioning

C. Water
1. Availability of clean and odorless water in the Hospital
2. Availability of water energy-saving instructions in the Hospital area
3. Availability of automatic water faucets in the Hospital area

D. Environment
1. The entire hospital area is smoke-free
2. Air circulation in the hospital is good and doesn't feel stuffy/humid
3. Calm in the hospital environment which is free from the sound pollution of motorized vehicles
4. The air coolness of the hospital environment

E. Air Quality
1. The air quality is odorless in the hospital environment
2. Quality of fresh air in the hospital environment
3. The hospital environment is free from air pollution
4. Availability of a smoking ban campaign in the Hospital area

F. Waste
1. Availability of trash cans in sufficient quantities in the Hospital area
2. All areas of the Hospital are free of garbage
3. All areas of the hospital are odor free
4. All areas of the Hospital are free from chemical odors

G. Food
1. Food hygiene in the Hospital
2. The quality of food packaging is good and harmless
3. Food packaging is eco-friendly and reusable

H. Community Needs
1. Routine lung exercise is needed to prevent lung disease
2. There needs to be socialization and education to prevent lung disease
3. The specialist doctors available at the hospital are very helpful in treating lung diseases
4. Medicines provided by the Hospital are quite affordable
5. The treatment that has been given by the hospital provides healing
6. Need regular control for post-treatment rehabilitation
7. Availability of a swimming pool for post-treatment rehabilitation (Table 7)

Figure 5 shows the results of the Malaysian hospital service and management observations.

Table 7. Totals of public and private hospitals in Malaysia based on region

No.	Region/District (Public)	Public Hospitals	Region/District (Private)	Private Hospitals
1	PERLIS	2	KEDAH	4
2	KEDAH	8	PENANG	13
3	PULAU PINANG	6	PERAK	10
4	PERAK	15	SELANGOR	27
5	SELANGOR	11	NEGERI SEMBILAN	5
6	NEGERI SEMBILAN	6	MELAKA	3
7	MALAKA	3	JOHOR	8
8	JOHOR	12	PAHANG	2
9	PAHANG	10	TERENGGANU	1
10	TERENGGANU	2	KELANTAN	3
11	KELANTAN	9	SARAWAK	7
12	SARAWAK	21	SABAH	3
13	SABAH	23	WP KUALA LUMPUR	27
14	KUALA LUMPUR	12		
15	WP PUTRA JAYA	1		
16	WP LABUAN	1		

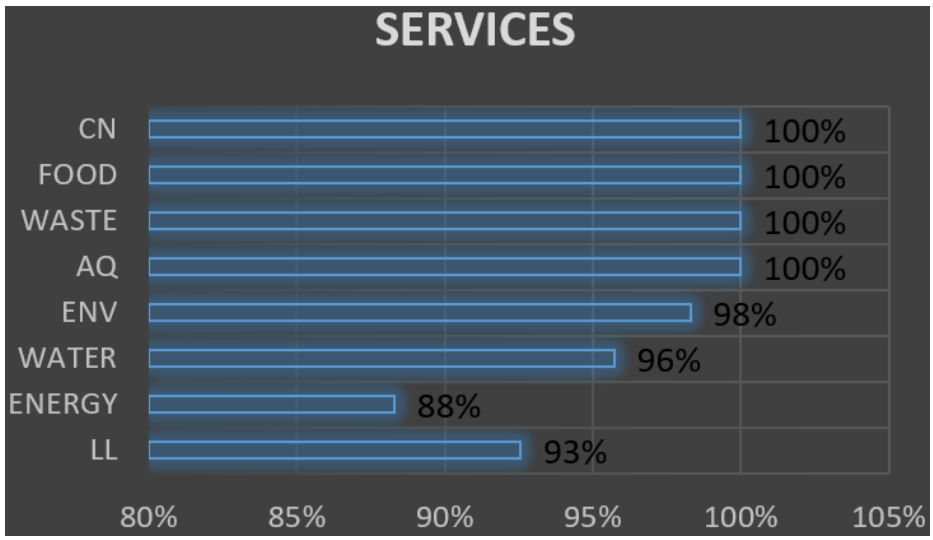

Figure 5. Results of the Malaysian green hospital service

Community needs (CN) consist of carrying out routine pulmonary exercises, socialization and education, availability of specialist doctors, drugs at affordable prices, treatments that provide healing, and need for routine control. All indicators qualified as 100% available. Food aspects include hygiene, good and harmless food packaging, and environmentally friendly food packaging (FOOD). All indicators qualified as 100% available. Waste (WASTE) includes a trash can, free of garbage, free of garbage odors, and free of chemical odors. All indicators qualified as 100% available. Air Quality (AQ) aspects included odorless air quality, fresh air quality, free air pollution, and the existence of a smoking ban campaign. All indicators qualified as 100% available.

Environmental (ENV) aspects include the following: the entire hospital area is smoke-free, air circulation in the hospital is good, not damp/humid terraces, calm in the hospital environment is free from noise pollution from motorized vehicles, and the air is maintained in the hospital environment. Of all the indicators, 98% qualified. Water (WATER), an aspect of Green Hospital, consists of clean and odorless water, energy-saving instructions, and automatic water faucets. Of all indicators, 96% were available. Energy (ENERGY) consists of the availability of lighting without lights during the day, ventilators in the toilet and stair areas, instructions for saving electricity, and hospital cooling without air conditioning. Of all the indicators, 88% qualified. Location and landscape (LL) consist of the availability of public vehicles, public transportation, green trees, parks, water catchment holes, green open areas, cleanliness, tidiness, and beauty of the environment. Of all the indicators, 93% qualified (Figure 6).

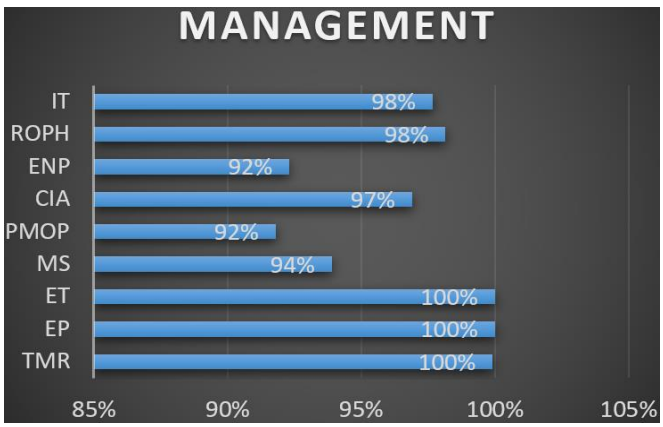

Figure 6. Results of the Malaysia green hospital management observation

Information Technology (IT) produces reports according to various needs: 1) The time required to process the data, 2) Information can be available when it is needed, 3) Information from information technology can be accessed by users, and 4) Obtaining complex data using information technology. Of all the indicators, 98% qualified. Organizational Performance in Health Care (ROPH) consisted of 1) Inpatient care at the hospital was not long considered, 2) The hospital can restore the functional status of the patient after treatment, 3) Patient compliance with the standard care patterns provided by the hospital, 4) The hospital contributes to public health programs, and 5) The financial performance of the hospital is getting better from year to year of all indicators, 98% qualified.

Environmental Performance (ENP) includes 1) lower use of water in hospital facilities, 2) A reduction in energy (power), 3) Lower consumption of hazardous and toxic substances, 4) Lower waste emissions in hospital facilities, and 5) Purchasing products used by hospitals is more environmentally friendly. Of all the indicators, 92% qualified. Continuous Improvement Activities (CIA) consisted of 1) continuous reassessment and revision of green healthcare activities, 2) improvement of operational plans to enhance green healthcare activities, 3) Development of programs for green health improvement activities, and 4) Reflection of customer needs for improvement. From all the indicators, 97% qualified. Process Management and Operational Procedures (PMOP) consist of: 1) The hospital develops and innovates its overall work system, 2) Creating and changing work processes to meet requirements, 3) Designs to prevent rework and errors, and 4) Integrated care/service design process to ensure efficiency. Of all the indicators, 92% qualified. Monitoring System (MS) in the implementation of Green Hospital consists of 1) developing and maintaining clear work guidelines for monitoring activities, 2) providing assurance of an appropriate level of work related to monitoring activities, 3) ensuring compliance with environmental regulations and the level of monitoring required for operations, and 4) Continuous monitoring of green healthcare activities: All indicators qualified as 94% available.

Education and Training (ET) includes: 1) training employees to develop their knowledge and skills, 2) training employees to convey environmentally friendly values, 3) evaluating the effectiveness of education and training, and 4) providing the human and material resources needed for education and training. All indicators qualified as 100% available. Employee Participation (EP) comprised 1) active participation of employees in healthcare practices, 2) employee opinions regarding the implementation of environmentally friendly hospitals are needed by management to make decisions, and 3) environmentally friendly activities carried out by employees in a compact manner are meaningful for hospital management. All indicators qualified as 100% available. Top Management Roles (TMR) consist of 1) developing and committing to hospital policies, 2) representing various departments and professions to help guide and implement green strategies, 3) strategic and operational plans and budgets reflect commitment, 4) setting green goals for employees, and 5) creating a conducive work environment. All indicators qualified as 100% available.

5. DISCUSSION

This finding indicates that the implementation of green hospitals is still minimal, and the results are significantly below 70% expectations. There is a substantial disparity between expectations and reality in hospitals regarding the perceived results [25]. Dimensions such as Location and Landscape, Energy, Water, Environment, Air Quality, Waste, Food, and Community Needs exhibited a real value of less than 40%, in contrast to the expectation of 70%. This discrepancy underscores the limited implementation of green hospitals, with the outcomes falling below the anticipated 70%. Our research demonstrated that only 0.87% of hospitals in Indonesia have implemented the concept of green hospitals. Nevertheless, we observed a promising trend wherein numerous hospitals initiated the implementation of environmentally sustainable procedures, as evidenced by the establishment of departments specifically dedicated to environmentally friendly activities [24].

By contrast, Malaysia has demonstrated significant progress in this regard, with an average of 96.87% in services and 96.78% in management implementing the green hospital concept. This suggests the potential for more widespread adoption of these practices. From the patients' perspective, our interviews revealed a preference for green hospitals when choosing healthcare facilities [2]. Patients and visitors acknowledged only partial benefits from the implementation of the new green hospital, but overall, they expressed satisfaction with the hospital's eco-friendly services [20]. Hospital management also indicates a shift towards green practices [37]. Current efforts are focused on waste reduction, energy conservation, minimizing infectious medical waste disposal, reducing PVC usage, procuring environmentally friendly products, purchasing low-carbon foods, and reducing food waste [26].

6. CONCLUSION, LIMITATION, AND SUGGESTION

6.1 Conclusion

The findings of this qualitative research suggest immediate feasibility for the hospital's policy direction to become a green hospital in the future. Given the community's relatively high demand for green hospitals and the positive responses from management, it is crucial to design a sustainable hospital business model [31, 32]. The development of a strategic roadmap for green hospitals is the top priority for alternative hospital management strategies in Indonesia, followed by budget policy strategy, green team formation, fostering an environmentally friendly work culture, resource optimization strategy, technology and R&D strategy, and medical technology improvement strategy [37]. This study was limited by the number of hospitals willing to participate, likely due to the ongoing pandemic. As many hospitals were preoccupied with patient care, future research could employ a case study approach at selected open hospitals during data collection. Such research would be invaluable in ensuring the successful design of future hospital business models.

6.2 Limitation

The participants of this study were confined to patients present in the hospital environment at the time of the questionnaire distribution; thus, they may not represent all customer levels within the hospital. It should be noted that the health condition of patients and their families, if unwell or uncomfortable, could potentially impact their receptivity to information about the Green Hospital, thereby influencing their responses to the questionnaire. Additionally, the study was conducted within a limited timeframe under specific research permits in Malaysia.

6.3 Suggestion

Hospital management support is essential for the successful implementation of the Green Hospital Initiative. This can be achieved by establishing policies that serve as a guide for all elements within the hospital to adhere to Green Hospital practices. Additionally, the creation of a Green Hospital Team composed of representatives from various hospital work units would serve as a catalyst for this movement. Moreover, hospital management should strive to enhance the execution of Green Hospital dimensions in line with the Green Hospital Guidelines in Indonesia, some aspects of which have yet to be implemented. This would involve revisiting and updating several infrastructural facilities that support Green Hospital's dimensions. For instance, reviving the less-visible smoking ban campaign owing to fading signs, instructing on water and electricity conservation, assessing the number and condition of biopores, and maximizing the use of hospital media to promote the Green Hospital Program.

While the initial cost of implementing a Green Hospital may be substantial, the long-term impact on the safety, satisfaction, and comfort of hospital residents, as well as environmental safety, is immense. This initiative not only adds value to customers but also benefits hospitals, reinforcing the importance of implementing Green Hospital practices. Finally, regular evaluations of customer perceptions are crucial, particularly for the seven dimensions that customers or patients perceive as lacking. This will provide valuable insights for continuous improvement and will ensure the success of the Green Hospital initiative.

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AUTHOR CONTRIBUTIONS

Fajar Gustiawaty Dewi was primarily responsible for the conceptualization, methodology development, data collection, data analysis, and drafting of the manuscript. Yuliansyah supervised the study, contributed to the theoretical framework, and critically revised the manuscript to ensure its academic rigor. Retno Ariza Soeprihatini assisted in data analysis, provided insights for interpreting the findings, and contributed to editing the manuscript. Jamaliah Said brought her expertise in sustainable healthcare practices, enriching the discussion of results and reviewing the manuscript to ensure its alignment with contemporary issues in sustainability. Andhyka Muttaqin and Arfendo Propheto provided technical support in the use of NVIVO software, contributed to the methodological framework, and assisted with data visualization. All authors actively participated in reviewing and approving the final manuscript, with Fajar Gustiawaty Dewi taking the lead role as the coordinating the research activities throughout the project.

DATA AVAILABILITY

The dataset supporting this study is available at https://doi.org/10.6084/m9.figshare.29922572.

REFERENCES

[1] Shaabani, Y., Vafaee Najar, A., Shafiee, M.N., Meraji, M., Hooshmand, E. (2020). Designing a green hospital model: Iranian hospital. International Journal of Healthcare Management, 13(sup1): 427-433. https://doi.org/10.1080/20479700.2019.1572265

[2] Wood, L.C., Wang, C., Abdul-Rahman, H., Abdul-Nasir, N.S.J. (2016). Green hospital design: Integrating quality function deployment and end-user demands. Journal of Cleaner Production, 112: 903-913. https://doi.org/10.1016/j.jclepro.2015.08.101

[3] Zhu, Q., Johnson, S., Sarkis, J. (2018). Lean six sigma and environmental sustainability: A hospital perspective. Supply Chain Forum: An International Journal, 19(1): 25-41. https://doi.org/10.1080/16258312.2018.1426339

[4] Fadda, J. (2020). Green healthcare system: Main features in supporting sustainability of healthcare system—A review. In Green Buildings and Renewable Energy: Med Green Forum 2019-Part of World Renewable Energy Congress and Network. Springer International Publishing, USA, pp. 113-128. https://doi.org/10.1007/978-3-030-30841-4_8

[5] Ardini, L., Fahlevi, M. (2024). Circular economy from an environmental accounting perspective: Strengthening firm performance through green supply chain management and import regulation in Indonesia's plastic recycling industry. Uncertain Supply Chain Management, 12(3): 1633-1646. http://doi.org/10.5267/j.uscm.2024.3.017

[6] Marshal, O., Sunaryo, N.C., Kurniawan, S.J., Herwendanasari, D., Hariyanto, E., Andarini, S. (2021). Green hospital implementation in Indonesia: A literature review. Journal of Community Health and Preventive Medicine, 1(2): 32-42. https://doi.org/10.21776/ub.jochapm.2021.001.02.5

[7] Asiri, F.K., Al Harbi, N.S., Alanazi, M.A., Aljuaid, M.M., Fahlevi, M., Heidler, P. (2023). A cross-sectional study factors associated with resilience among medical staff in radiology departments during COVID-19, Riyadh, Kingdom of Saudi Arabia. BMJ Open, 13(5): e068650. https://doi.org/10.1136/bmjopen-2022-068650

[8] Fahlevi, M., Alharbi, N. (2021). Adoption of e-payment system to support health social security agency. International Journal of Data and Network Science, 5(4): 737-744. http://doi.org/10.5267/j.ijdns.2021.7.007

[9] Kayani, U.N., Mumtaz, R., Fahlevi, M., Nasseredine, H., Hadinata, A. (2024). Unbridling the economic growth and environmental nexus in Pakistan. International Journal of Energy Economics and Policy, 14(1): 488-495. https://doi.org/10.32479/ijeep.15528

[10] Mushtaq, M., Hameed, G., Ahmed, S., Fahlevi, M., Aljuaid, M., Saniuk, S. (2024). How does economic policy uncertainty impact CO2 emissions? Investigating investment's role across 22 economies (1997-2021). Energy Reports, 11: 5083-5091. https://doi.org/10.1016/j.egyr.2024.04.069

[11] Allen, J.G., MacNaughton, P., Laurent, J.G.C., Flanigan, S.S., Eitland, E.S., Spengler, J.D. (2015). Green buildings and health. Current Environmental Health Reports, 2: 250-258. https://doi.org/10.1007/s40572-015-0063-y

[12] Zouine, M., El Adnani, M.J., Salhi, S.E., Fahlevi, M. (2024). Harnessing education to combat chronic and fatal diseases: A comprehensive empirical study of cardiovascular diseases, cancer, diabetes, and respiratory illnesses in MENA countries. Social Sciences & Humanities Open, 10: 101133. https://doi.org/10.1016/j.ssaho.2024.101133

[13] Dhillon, V.S., Kaur, D. (2015). Green hospital and climate change: Their interrelationship and the way forward. Journal of Clinical and Diagnostic Research, 9(12): LE01. https://doi.org/10.7860/JCDR/2015/13693.6942

[14] Marhaeni, A.A.I.N., Jermsittiparsert, K., Sudarmo, Indrawati, L.R., Prasetyo, A., Fuada, N., Rachmadhani, A., Raharjo, T.W., Wahyudianto, H., Harwijayanti, B.P., Sitorus, J., Fahlevi, M., Aljuaid, M. (2023). Adoption of the green economy through branchless rural credit banks during the COVID-19 Pandemic in Indonesia. Sustainability, 15(3): 2723. https://doi.org/10.3390/su15032723

[15] Fahlevi, M., Aljuaid, M., Saniuk, S. (2022). Leadership style and hospital performance: Empirical evidence from Indonesia. Frontiers in Psychology, 13: 911640. https://doi.org/10.3389/fpsyg.2022.911640

[16] Fahlevi, M., Asdullah, M.A., Raza, F.A., Watto, W.A., Aljuaid, M., Aziz, A.L. (2024). The influence of information and communication technology on trade in developing countries and partners. Cogent Business & Management, 11(1): 2320814. https://doi.org/10.1080/23311975.2024.2320814

[17] Alkaabi, A., Aljaradin, M. (2022). Green hospitals for the future of healthcare: A review. Al-Kitab Journal for Pure Sciences, 6(2): 31-45. https://doi.org/10.32441/kjps.06.02.p4

[18] Kuldasheva, Z., Ahmad, M., Salahodjaev, R., Fahlevi, M. (2023). Do tourism and renewable energy influence CO2 emissions in tourism-dependent countries? International Journal of Energy Economics and Policy, 13(6): 146-152. https://doi.org/10.32479/ijeep.14410

[19] Kayani, U.N., Fahlevi, M., Mumtaz, R., Al Qaruty, R., Asad, M. (2023). The nexus between carbon emissions and per capita income of households: Evidence from Japanese Prefectures. International Journal of Energy Economics and Policy, 13(6): 567-572. https://doi.org/10.32479/ijeep.15042

[20] Sahamir, S.R., Zakaria, R. (2014). Green assessment criteria for public hospital building development in Malaysia. Procedia Environmental Sciences, 20: 106-115. https://doi.org/10.1016/j.proenv.2014.03.015

[21] Hayati, R., Ansarizadeh, M., Yousefi, M., Moein, H., Alinejad, N., Jasour, A., Aryakian, Z., Alighardashi, M. (2024). Effects of medical tourism on hospital waste as an important criteria of the green hospital. Case Studies in Chemical and Environmental Engineering, 11: 101051. https://doi.org/10.1016/j.cscee.2024.101051

[22] Fahlevi, M. (2021). Mediating effect of motivation on employees' performance in a private hospital, Indonesia. IOP Conference Series: Earth and Environmental Science, 729(1): 012001. https://doi.org/10.1088/1755-1315/729/1/012001

[23] 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. https://doi.org/10.1108/JEDT-04-2022-0200

[24] Ilin, I., Iliyaschenko, O., Konradi, A. (2018). Business model for smart hospital health organization. SHS Web of Conferences, 44: 00041. https://doi.org/10.1051/shsconf/20184400041
[25] Azar, F.E., Farzianpour, F., Foroushani, A.R., Badpa, M., Azmal, M. (2015). Evaluation of green hospital dimensions in teaching and private hospitals covered by Tehran University of Medical Sciences. Journal of Service Science and Management, 8(2): 259-266. http://doi.org/10.4236/jssm.2015.82029
[26] Garg, A., Dewan, A. (2022). Manual of Hospital Planning and Designing: For Medical Administrators, Architects and Planners. Springer Nature, Germany.
[27] Barnes, P.J. (2016). Inflammatory mechanisms in patients with chronic obstructive pulmonary disease. Journal of Allergy and Clinical Immunology, 138(1): 16-27. https://doi.org/10.1016/j.jaci.2016.05.011
[28] Fahlevi, M., Hasan, F., Islam, M.R. (2023). Exploring consumer attitudes and purchase intentions: Unraveling key influencers in China's green agricultural products market. Corporate and Business Strategy Review, 4(3): 74-87. https://doi.org/10.22495/cbsrv4i3art8
[29] Lin, Z., Gu, H., Gillani, K.Z., Fahlevi, M. (2024). Impact of green work—life balance and green human resource management practices on corporate sustainability performance and employee retention: Mediation of green innovation and organisational culture. Sustainability, 16(15): 6621. https://doi.org/10.3390/su16156621
[30] Mintah, C., Gabir, M., Aloo, F., Ofori, E.K. (2022). Do business records management affect business growth? PLoS ONE, 17(3): e0264135. https://doi.org/10.1371/journal.pone.0264135
[31] Osterwalder, A., Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons, USA.
[32] Temnyshov, I.A., Belyaev, A.M. (2020). Business modeling in business operations of manufacturing company. IOP Conference Series: Materials Science and Engineering, 753(8): 082027. https://doi.org/10.1088/1757-899X/753/8/082027
[33] Xia, X., Ma, Y.L., Luo, Y., Lu, J.W. (2021). Research of a green hospital evaluation index system based on analytic hierarchy process. Forest Chemicals Review, 1702-1714.
[34] Shah, S.H.A., Fahlevi, M., Jamshed, K., Aman, N., Rafiq, N., Jermsittiparsert, K., Aljuaid, M. (2023). Sustaining the earth: Unraveling the synergy of workplace spirituality, responsible leadership, and pro-environmental behavior in Pakistan's SMEs. Psychology Research and Behavior Management, 16: 3075-3093. https://doi.org/10.2147/PRBM.S413606
[35] Sunarto, S. (2018). Environmental strategic planning rumah sakit persahabatan menuju green hospital. Indonesian Journal of Environmental Education and Management, 3(2): 101-114. https://doi.org/10.21009/jgg.032.0101
[36] Suwasono, E., Suman, A., Yanuwiadi, B. (2013). Creating a green hospital concept through the management of non-medical waste. International Journal of Advances in Engineering & Technology, 6(5): 1988.
[37] Shen, S.T. (2020). The study of construction on indicators in Taiwan green hospitals. International Journal of Organizational Innovation, 12(3): 157-174. https://www.ijoi-online.org/attachments/article/200/1005%20final.pdf.
[38] Danilov, A., Benuzh, A., Yeye, O., Compaore, S., Rud, N. (2020). Design of healthcare structures by green standards. E3S Web of Conferences, 164: 05002. https://doi.org/10.1051/e3sconf/202016405002
[39] Baxter, P., Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. The Qualitative Report, 13(4): 544-559. https://doi.org/10.46743/2160-3715/2008.1573
[40] Emita, I., Sugeng, I.S. (2021). The effect of professional competence and organizational culture on performance English teacher. Priviet Social Sciences Journal, 1(2): 1-6. https://doi.org/10.55942/pssj.v1i2.102
[41] Husnah, H., Aryati, A., Ramlawati, R., Fahlevi, M. (2023). The relationship between corporate governance and firm performance: An empirical analysis of Indonesian companies. Journal of Economics and Business Letters, 3(3): 49-52. https://doi.org/10.55942/jebl.v3i3.224
[42] Marhaeni, A.A.I.N., Sudibia, I.K., Andika, G., Fahlevi, M. (2024). Impacts of village funding on community empowerment and poverty in Klungkung, Bali. International Journal of Sustainable Development and Planning, 19(3): 981-990. https://doi.org/10.18280/ijsdp.190316
[43] Izza, N.N., Rusydiana, A.S., Avedta, S. (2021). A qualitative review on halal tourism: NVivo approach. Halal Tourism and Pilgrimage, 1(1). https://doi.org/10.58968/htp.v1i1.87
[44] Hariyono, H., Purwono, R., Sukartini, N.M., Madyawati, S.P., Chrisnahutama, A. (2025). Post-eruption economic recovery: Strengthening livelihoods in Lumajang Indonesia after Mount Semeru disaster. Central Community Development Journal, 5(1): 1-13. https://doi.org/10.55942/ccdj.v5i1.351