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Critical Success Factors of Green Innovation in health sector: A Qualitative approach

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Abstract: The purpose of this study is to explore the critical success factors for implementing green innovations in Pakistani hospitals. Existing literature mostly uses quantitative methods, which restrict the ability to examine in-depth. To address this gap, the study adopts a qualitative research approach, and 10 semi-structured interviews were conducted with hospital administrators and healthcare providers. Resource-based view and stakeholder theory provide a framework for green innovation. The study identifies key factors that contribute to the successful implementation of green innovations through thematic analysis done on NVIVO and Tableau software. The research offers actionable recommendations for enhancing green innovation in hospitals. This study identifies diverse CSFs at different phases of the adoption of green innovation in the healthcare sector. Pre-implementation emphasizes budget and financial planning and leadership vision, implementation highlights training and operational challenges, and post-implementation highlights the importance of continuous monitoring, feedback from stakeholders, and cost efficiency for sustained success. These findings offer a strategic roadmap for the integration of green innovation in healthcare.

Key Words: Green Innovation, Effective leadership, sustainability, health care

Introduction:

Pakistan, the fifth most populous country in the world (Internet world stats, 2020), faces numerous influential challenges in the healthcare sector, particularly within the hospital industry. Pakistan faces many distinguished challenges in terms of global healthcare standards, including minimizing costs, enhancing patient comfort, and reducing waste. Today's dynamic period also requires enhanced safety and attention to environmental

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concerns. Just as the automobile industry must innovate to meet global demands and ensure sustainability (Osama et al., 2018). In Pakistan, the healthcare industry is under pressure to meet increasing global healthcare standards while addressing cost constraints and enhancing patient comfort. To meet the demand and trend, the adoption of green innovation (GI) has emerged as a critical area for development. GI in healthcare refers to the implementation of environmentally friendly practices, technologies, and policies aimed at reducing the environmental footprint of healthcare operations.

Recent studies have extensively documented the benefits of green innovations, such as improved energy efficiency, waste management, and sustainable procurement (Skubis et al., 2023). According to Khalid & Ali. (2017) hospitals in Pakistan must adopt green innovations to improve healthcare delivery while addressing environmental impact. The integration of green practices in hospitals, such as energy efficiency, waste management, and sustainable procurement, is essential for achieving these goals (Malik et al., 2019). Organizations worldwide face a critical challenge: balancing productive consumption with efficient resource use to drive growth and productivity, while also conserving the environment through the preservation of natural resources and biodiversity. To address this issue, the concept of corporate social responsibility is being implemented through green innovation at the organizational level. Green innovation enables organizations to comply with environmental laws and regulations, thereby enhancing operational efficiency. This involves reducing waste, improving energy efficiency, and implementing other measures (Zhang et al., 2020). Although the major part of the literature on GI has been quantitative, focusing on statistical analyses and broad trends, it often overlooks the detailed, experiential insights that qualitative research can provide.

This study has several theoretical and practical implementations. Theoretically, this study adds to the literature of the critical success factors of GI. It also adds to the theory of academic studies. By using a qualitative research method, the study uncovers the contextual factors that quantitative studies often miss, enriching the existing body of knowledge with a more nuanced perspective. While discussing practical implementations, this study contributes to helping hospital administrators, policymakers, and healthcare practitioners understand how to implement and sustain green innovations effectively.

Problem Statement:

GI has gained significant importance in hospitals, but most of the research on this topic has been done using quantitative research methods. While these studies help us to understand general patterns, they don't provide a deep understanding of the real-life experiences and challenges that healthcare professionals face when they implement green practices. Most of the existing research uses surveys, which can miss important details about what actually helps or hinders green innovation in hospitals (Arici & Uysal,.2022). Moreover, there's also a lack of studies that use qualitative methods, like interviews and case studies, which can give us richer, more detailed insights. By talking directly to hospital administrators, healthcare providers, and sustainability coordinators, we can learn about their personal experiences, motivations, and the obstacles they encounter. This approach can also help us understand how leadership within hospitals influences green practices at different levels. Therefore, this study uses qualitative research methods to fill this gap. By doing so, we provide a clearer and more comprehensive understanding of what makes green innovation successful in hospitals.

This deeper insight helps create more effective and sustainable green practices in the healthcare sector.

Research Questions:

This study is conducted to fill the gap in the literature and leads to the development of the following research questions:

RQ1: What are the critical success factors for the effective implementation of green innovations in Pakistani hospitals?

RQ2: How do healthcare professionals perceive and experience green innovation initiatives?

RQ3: What strategies can be recommended to improve the adoption and sustainability of green innovations in the healthcare sector?

Research objective:

The primary objective of this study is to identify the critical success factors that enable the effective implementation of green innovations in Pakistani hospitals and explore the experiences of healthcare professionals involved in green innovation initiatives. Further, provide general recommendations to the organization for the successful implementation of green initiatives.

Literature Review:

The study of green innovation (GI) is frequently grounded in several key theoretical frameworks that explain the drivers and mechanisms behind its adoption. The resource-based view (RBV) of the firm posits that a company's competitive advantage is derived from its unique and valuable resources and capabilities. In the context of GI, this theory suggests that by developing green capabilities such as expertise in sustainable technologies and efficient resource management, a firm can achieve a competitive edge. Another relevant framework is stakeholder theory, which argues that organizations should create value for all stakeholders, not just shareholders. This theory is particularly pertinent to GI, as it emphasizes the importance of addressing the environmental and social concerns of a wide range of stakeholders, including customers, employees, suppliers, communities, and regulatory bodies. By engaging with these stakeholders and responding to their demands for sustainability, organizations can enhance their legitimacy, build stronger relationships, and ultimately drive innovation. A recent study by Abdelfattah et al. (2025) integrates these perspectives, demonstrating that a combination of internal resources (dynamic capabilities) and external pressures (environmental regulations and customer demand) collectively drives the adoption of green innovation, highlighting the interconnectedness of these theoretical frameworks.

The concept of green innovation refers to the development and application of new products, technologies, or practices whose aim to reduce environmental impact, enhance sustainability, and address environmental challenges. This concept emphasizes innovations that not only meet market needs and enhance competitiveness but also minimize resource use, pollution, and other negative environmental impacts throughout their lifecycle (Tim et al., 2011). As the world faces ecological challenges, there is a dire need to adopt sustainable strategies in every sector, like manufacturing, services, the automotive industry, the health sector, and others. This concept plays an important role in the health sector, as it allows for the implementation of sustainable practices and

technologies aimed at reducing the ecological footprint of healthcare facilities while improving overall operational efficiency and patient outcomes. Hospitals significantly consume the number of resources like water and energy (Rahman & Shah., 2023). GI helps to reduce the consumption of resources and waste generation. For example, hospitals can adopt energy-efficient lighting and HVAC systems, install renewable energy sources such as solar panels, and implement water-saving technologies to reduce their environmental impact. By embracing green practices, hospitals contribute to sustainable development by conserving resources and minimizing pollution. By reducing hazardous waste and emissions, hospitals create a healthier environment for patients, staff, and surrounding communities. Green building designs with proper ventilation and non-toxic materials can enhance indoor air quality, which is crucial for patients with respiratory conditions and overall comfort (World Health Organization, 2023). Hospitals that engage in sustainable practices often influence community health perceptions positively and can even lead community initiatives toward healthier lifestyles. GI can lead to significant cost savings through lessened energy usage and water bills, reduce waste disposal costs, and offer potential financial incentives for adopting sustainable technologies.GI is very important for balancing environmental sustainability with operational efficiency. Through literature, several critical success factors (CSFs) have been identified.

Effective Leadership:

Effective leadership is very important for driving green initiatives in the organization. Leaders play a crucial role in setting the goal, fostering a positive environment and efficiently allocating resources. Ishak and Ahmad (2011), highlighted that the leadership must be sensitive and must understand the green demand and situation around the world. Javed et al (2023), found reliable evidence that female CEOs have positive impact on firms' green innovation. Additionally, Yousuf et al. (2023) examined the effect of board competencies, including structure, composition, intellectual capital, and process, on green innovation**.** Similarly, Arici and Uysal (2022) also highlight the significant impact of leadership practices on fostering sustainable innovation. Skubis et al. (2023) found that responsible leadership in driving the adoption of green innovations in Nigerian healthcare facilities.

Stakeholder engagement:

The engagement of all relevant stakeholders, including employees, patients, suppliers, and the community, is important to implement green initiatives in the organization. Chen and Liang (2023) highlight the role of external stakeholders such as customers and regulatory bodies in driving green innovation. Stakeholders' engagement ensures harmony of interests and enhances the adoption of green practice.

Financial Incentives:

GI can be economically viable and attractive through incentives like subsidies, tax breaks, and grants. In the recent research, Qadeer et al. (2023), we discussed how state participation and financial incentives can promote green innovation, emphasizing the importance of supportive policies and economic mechanisms. Hao et al. (2023) found that corporate environmental responsibilities (CER) have both positive and negative effects on corporate green innovation (CGI) over time, with financing constraints playing a critical mediating role. Similarly, Haung & Ren (2024), found that green finance reform coupled with digital transformation significantly enhances the level of corporate green innovation.

Laws and compliance:

Environmental laws and technology provide a framework and motivation for organizations to adopt green practices. Zhang et al. (2020) discuss that the key driver of GI is ecological laws and regulations, as regulatory compliance ensures that organizations meet the necessary environmental standards. They also confirmed that different aspects of technological, organizational, and ecological readiness each significantly contribute to the success of GI in different ways, as technology is important for improving energy efficiency and reducing waste. Khan et al. (2023) discusses the role of green entrepreneurship orientation and organizational resilience capacity in promoting green innovation in Pakistani manufacturing firms. Zhang et al. (2024) examined a significant positive relationship between ESG ratings and corporate green innovation structure, indicating that higher ESG ratings promote the shift from symbolic to substantive green innovation. Similarly, Wu et al. (2023) discuss that Environmental Social Governance (ESG) performance has a significant effect on promoting firm green innovation.

Staff involvement:

Knowledge about GI and involvement of staff in green initiatives ensures that they understand and actively participate in sustainability efforts. Shah and Soomro (2020) emphasize the role of Green Human Resource Management (Green HRM) in promoting pro-environmental behaviors among employees, highlighting the importance of green training, recruitment, and development. Aboramadan,M. (2022), discuss that GHRM significantly predicts employee in-role green behavior, extra-role green behavior, and GIWB.

Public awareness:

Public awareness and media coverage can influence the adoption and success of green innovation by creating social pressure. Gao et al. (2024) found a positive relationship between green media coverage and green innovation, indicating that public awareness and media attention can drive environmental initiatives. Huang et al. (2022) discuss that effective information management processes significantly enhance sustainable development practices, which in turn drive digital green innovation.

Research Methodology:

The study uses a qualitative research design with 10 in-depth interviews to explore the critical success factors of green innovation in hospitals. It helps us in-depth understanding of the experiences, motivations, challenges, and strategies of healthcare professionals involved in green innovation initiatives. Interview is conducted as a source of data collection method. Semi-structured interviews conducted with key stakeholders, including hospital administrators and healthcare providers. The interviews lasted 20-30 min and aimed for depth while maintaining focus. Relevant documents such as hospital sustainability reports, policy documents, and project plans be analyzed to supplement the interview data. The study used purposive and snowball sampling to select hospitals and participants. Hospitals known for their green innovation practices be chosen to ensure rich and relevant data.

Table 1 represent the demographic profile of respondents, showing that 60% of respondents were male and 40% were female working in both public and private hospitals of Pakistan. The respondent holds various medical positions, including those of nephrologists, administrators, anesthesiologists, gynecologists, neurologists, general

medicine practitioners, and cardiologists. The age range is 29 to 40 years, with professional experience ranging from 4 to 22 years. They are based in cities like Lahore, Islamabad, Multan, and Pattoki, with the majority residing in Lahore. The collected data is analyzed using thematic analysis, a method for identifying, analyzing, and reporting patterns (themes) within qualitative data (Braun & Clarke., 2006). This involves coding the data, identifying significant themes, and interpreting these themes to understand the critical success factors of green innovation in hospitals by using NVIVO software and TABLEAU software.

Table 1: Respondent Profile

Respondent	Gender	Public/Private	Designation	Age	Experience (Yrs)	City
R1	Male	Public	Nephrologist	35	13	Lahore
R2	Male	Private	Administrative	34	15	Lahore
R3	Male	Private	Managing Director & Nephrologist	41	22	Islamabad
R4	Male	Public	Anesthesiologist	31	5	Lahore
R5	Female	Public	Gynecologist	29	4	Multan
R6	Male	Private	Nephrologist	30	4	Islamabad
R7	Male	Public	Neurologist	32	5	Pattoki
R8	Female	Private	General Medicine	31	4	Lahore
R9	Male	Public	Cardiologist	36	6	Lahore
R10	Female	Public	Nephrologist	34	6	Lahore

Findings:

Thematic analysis is done to analyze the data. Braun & Clark (2006) provide six points for analyzing qualitative results, offering a flexible and systematic approach to data analysis.

Familiarizing yourself with the data:

According to Braun and Clark (2006), it is essential to thoroughly understand the data and its meaning when starting analysis, as having a strong grasp of your data is crucial. It is usually achieved through reading and re-reading your data multiple times to understand the pattern and insights before starting the formal coding process. If you are conducting interviews, you'll need to transcribe it into written form. It helps you to get familiar with the content and is an important part of analysis. Maguire and Delahunt, (2017) also suggest that reading and re-reading the data is considered as the first step in qualitative analysis.

Generate preliminary codes:

After familiarizing yourself with the data, you are required to generate initial codes. It's usually smaller than the main theme and helps you to identify the pattern and interesting feature within the data. It can be done manually with notes or with software as well (Kelle, 2004). Table 2 explains the coding process by illustrating how codes are applied to short segments of the data set.

Searching for themes:

According to Braun and Clark (2006), in stage 3, after coding the data, you group similar codes into one theme and look at how these codes fit together and related to theme. This step helps you to create main themes and sub-themes, while some codes might not fit and can be put in a "miscellaneous" group for now. The main goal of this stage is to find patterns and connections throughout the whole data set (Dawadi., 2021). Figure 1 shows how all the codes (created in Step 2) were divided into three main implementation phases. In the subsequent step of the process, these basic themes underwent further refinement.

Table 2: Main theme sub theme and frequency

Pre- Implementation

Main Themes	Sub-Themes	Frequency
1.Budget and Financial Planning	Project-specific funding challenges Inadequate financial resources Insufficient funds Exploration of external funding opportunities	6 7 8 4
Planning and Policy Development	Lack of consistent policies Limited government recognition Development of sustainability policies Regulatory compliance	4 7 5 6
Resistance and Capacity Building	Resistance to change among staff Limited training Employee engagement Staff readiness for change	8 9 2 6
Leadership Commitment & Vision	Defining sustainability goals Leadership support Strategic goals for environmental practices Supportive organizational culture	3 4 6 8

Implementation

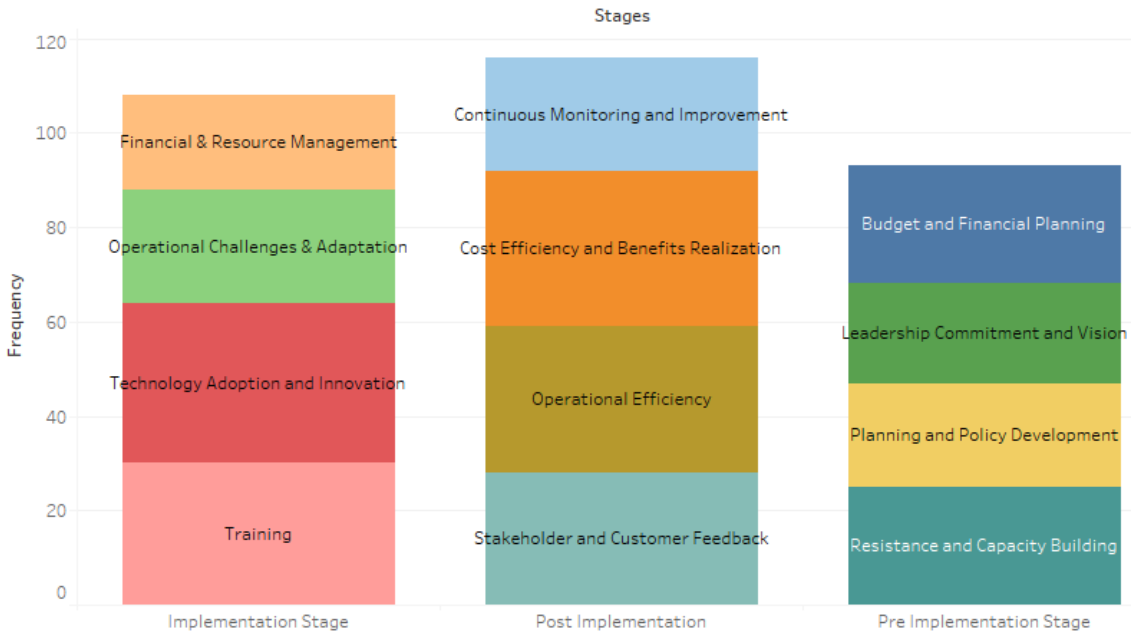
Main Themes	Sub-Themes	Frequency
1. Financial & Resource Management	- Gradual progress in green practices - Dependency on government - Resource allocation strategies - Budgeting for sustainable technologies	4 6 3 7
2. Training	- Ongoing employee training - Hybrid model of process adoption - Creating educational resources and workshops - Monitoring training effectiveness	6 8 7 9
3. Operational Challenges & Adaptation	- Political hurdles - High patient load & insufficient staffing - Management strategies for operational disruptions - Responding to emerging challenges	5 8 5 6
4. Technology Adoption & Innovation	- Adoption of energy-efficient technologies - Implementation of smart healthcare solutions - Evaluation of technology effectiveness - Addressing technological barriers	10 9 8 7

Post Implementation

Main Theme	Sub-Themes	Frequency
1. Operational Efficiency	- Implementation of waste management practices - Adherence to environmental SOPs - Regular review of compliance standards - Assessment of operational improvements	10 8 5 8
2. Cost Efficiency & Benefits Realization	- Reduction in utility costs - Improvement in operational efficiency - Financial savings - Long-term economic benefits	10 8 9 6
3. Stakeholder & Customer Feedback	- Positive feedback from stakeholders - Increased staff satisfaction - Gathering patient insights on sustainability efforts - Engaging stakeholders in feedback mechanisms	8 9 6 5
4. Continuous Monitoring & Improvement	- Regular environmental audits - Feedback for continuous enhancement - Adjusting strategies based on performance data - Transparency in reporting outcomes	7 5 4 8

Fig1: Visualization of codes

Validity and reliability of themes:



In this stage, we review the initial themes generated earlier to ensure they are coherent, distinct, and accurately represent the data. When we read and re-read the data, we can evaluate whether the data genuinely supports the themes or not. Some themes may collapse, split, or be discarded. If needed, adjust or create new themes, but avoid overdoing it. Once you're happy with the themes, you can move on to the next phase.

Defining themes:
In this stage, we define the main theme, and the purpose is to identify the 'essence' of what each theme is about (Braun & Clarke, 2006, p.92). In this stage, we answer questions about what each theme conveys and explore how subthemes interact and relate to the main theme. How do the themes relate to each other? Table 3 presents the outcomes of Step 5, showcasing the refined and defined themes that have emerged from the thematic analysis.

Report Writing:
In the final stage we develop a report and final analysis of the study. The analysis should be concise, logical and engaging, providing enough evidence with data extracts to support each theme (Braun and Clark,2006).

Analysis:
This study explored themes from interviews to provide detailed insights into the challenges, opportunities, and best practices for green innovation adoption. Table 2 summarizes these findings, showing main themes and subthemes across pre-implementation, implementation, and post-implementation stages.

Table 3: Definition of Themes

Rank Theme	Definition
Pre-Implementation Phase	
1. Budget and Financial Planning	This theme focuses on securing and managing financial resources for green initiatives, addressing challenges like inadequate funding and exploring external opportunities.
2. Planning and Policy Development	This theme covers the creation of clear sustainability policies and ensuring regulatory compliance to provide a strong, consistent framework for green practices.
3. Resistance and Capacity Building	This theme addresses the human elements of change, including overcoming staff resistance through targeted training, engagement, and addressing concerns to build support.
4. Leadership Commitment and Vision	This theme highlights the crucial role of leadership in driving green innovation by setting clear sustainability goals, providing support, and fostering a positive organizational culture.
Implementation Phase	
1. Financial & Resource Management	This Focuses on effectively managing money and resources during the project to achieve the best results.
2. Training	Ongoing education for staff is crucial. Highlights the importance of training programs to help employees learn new skills and adapt to changes.
3. Operational Challenges & Adaptation	This theme involves navigating the practical difficulties that arise during implementation, such as high patient loads and political hurdles, requiring flexibility and adaptive strategies.

4. Technology Adoption and Innovation	
Post-Implementation Phase	
1. Operational Efficiency	This theme relates to improving day-to-day operations by adhering to environmental SOPs, managing waste effectively, and ensuring compliance with standards.
2. Cost Efficiency & Benefits Realization	This theme is about evaluating the financial outcomes of green initiatives, such as cost savings from reduced utility use, to demonstrate long-term economic benefits.
3. Stakeholder and Customer Feedback	This theme underscores the importance of gathering and acting on feedback from staff, patients, and the community to refine and improve sustainability efforts.
4. Continuous Monitoring and Improvement	This theme highlights the ongoing process of tracking performance through regular audits and feedback to make necessary adjustments and ensure long-term success.

Pre-implementation phase of green innovation adoption:

This phase involves a deep understanding of leadership commitment, financial planning, policy development and capacity building. The healthcare department must focus on these critical success factors before implementing the green innovation practices(Fig. 1)

Budget and Financial Planning:

For implementing green practices in hospitals or in every sector effective budget and financial planning is very important. Inadequate resources, insufficient funds, and project-specific funding challenges are the main factors that the organization faces while implementing green practices. To overcome this issue external funding opportunities is the best way, it helps for better resource allocation and the budgeting of sustainable technologies. Through building a solid financial basis, sustainability goals can be achieved without placing an excessive demand on available resources. The following is an explanation of one respondent's claims in relation to these themes: "The government allocates a budget, but funding is project-specific and often dependent on immediate needs. Unfortunately, ministers often focus on short-term projects rather than long-term sustainability. The budget is frequently insufficient for the requirements of green practices. We have converted 50% of our capacity to solar energy, but the available funds are inadequate for further green conversions (R1)."

Fig 2: Pre-implementation phase

Planning and Policy Development:

During the implementation phase, it is very important to develop clear and consistent sustainability policies. Lack of consistent policies and limited government compliance is a major issue that most organizations face, which may affect their progress. Organizations can create strong sustainability policies and priorities regulatory compliance to set a strong foundation for their efforts. This planning helps us to make sure that the implementation process is going smoothly to achieve the environmental goals. This planning supports the implementation process smoothly and ensures alignment with ecological goals.

Resistance and Capacity Building:

Capacity building and resistance to change are the most common problems faced by organizations when implementing sustainable practices. Employees' readiness and limited training are factors that can exacerbate this resistance. To resolve this issue and promote a culture of sustainability, organizations must engage people through focused training and capacity-building. Employee engagement and addressing concerns helps create a supportive environment that embraces change, ultimately leading to more successful implementation of sustainability initiatives.

Leadership Commitment and Vision:

Leadership is very important for an organization to achieve its sustainability goals. Leadership support and clear sustainability goals promote a culture that prioritizes environmental practices. Leaders can inspire employees to embrace sustainable initiatives by establishing strategic goals and fostering a supportive organizational culture. A vision from leadership motivates the entire organization to work collectively toward achieving sustainability objectives.

Implementation stage:

In this phase, the focus shifts from planning to preparation for the actual execution of the project. The key CSFs of this phase are financial and resource management, training, operational challenges, and technology adoption. These factors play an important role in the success of the green innovation practices as they change from theory to practice.

Financial & Resource Management:

The progressive integration of sustainable practices depends on effective financial and resource management during the implementation phase. Strategies for resource allocation and dependency on government support are the challenges that most organizations face in the implementation process. Organizations can achieve a more efficient resource distribution through financial planning and budgeting for sustainable technologies. This ongoing financial management ensures that sustainability efforts are both effective and sustainable over the long term. An explanation of one respondent's comments with respect to these themes may be found below

"In the interview, the doctor highlighted a significant challenge: while stakeholders, including directors, outline decisions and strategies in meetings, the practical implementation of these plans in a real-world hospital setting can be complex and challenging. This transition from planning to execution requires careful coordination, resource allocation, and adaptation to the hospital's operational realities (R5)."

Fig 3: Implementation phase

Training:

Training plays an important role during the implementation process, as it ensures that staff are well-equipped to implement sustainable practices effectively. Most organizations follow a hybrid model process, which allows an organization to blend traditional methods with innovative practices to promote a more adaptable workforce. Workshops and creating educational resources are highly recommended; these activities not only enhance staff skills but also allow for the monitoring of training effectiveness. This investment in training ensures that employees remain informed and engaged throughout the implementation process.

Operational Challenges & Adaptation:

Many operational issues are exposed during the implementation process, requiring quick adaptation. High patient load and political hurdles can create complications; thus, management strategies that deal with these disturbances are needed. An organization can mitigate the impact of unforeseen problems by adopting new strategies and fostering a culture of flexibility. This approach helps organizations to ensure that sustainability initiatives remain on track.

Technology Adoption and Innovation:

Innovative technologies adoption is a key factor of successful implementation. Advanced technology, such as energy-efficient equipment and smart healthcare solutions, can significantly improve operational efficiency and reduce environmental impact. Organizations must evaluate the effectiveness of these technologies while addressing any technological barriers that arise. Acceptance of innovative technologies not only helps organizations achieve sustainability goals but also contributes to a greener future.

Post-Implementation:

This stage is crucial for ensuring the system operates smoothly, delivers the expected benefits, and is continuously improved to meet organizational needs. This phase focuses on continuous monitoring and improvement, cost efficiency, operational efficiency, and stakeholder feedback.

Operational Efficiency:

This stage specifically focuses on measuring and enhancing operational efficiency through sustainable practices. The key factor of this phase is implementing effective waste management practices and following environmental Standard Operating Procedures (SOPs). Assessments of operational improvements and review of compliance standards help organizations to improve their strategies, ensuring continuous alignment with sustainability objectives while maximizing resource utilization.

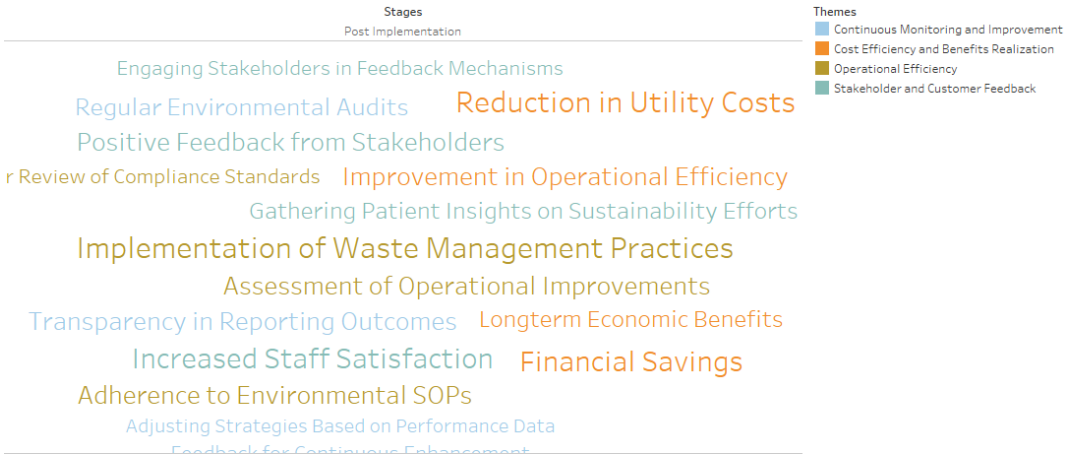


Fig 4: Post-implementation phase

Cost Efficiency and Benefits Realization:

After implementation, it is important to evaluate cost-effectiveness and realize the benefits of sustainability initiatives. Most organizations experience a reduction in utility costs and enhancements in overall operational efficiency. Organizations can reveal that environmental responsibility and financial feasibility can coexist by evaluating the long-term economic benefits of sustainability and using this information to inform future investments in sustainability.

Stakeholder and Customer Feedback:

Feedback from stakeholders and customers is crucial for understanding the impact of sustainability initiatives. Positive feedback from customers and stakeholders indicates successful engagement, helping organizations enhance their efforts. It is very important to engage stakeholders in feedback mechanisms and promote a collaborative environment, enabling organizations to adjust their strategies based on community and customer needs, thus enhancing overall satisfaction and support for sustainability initiatives.

Continuous Monitoring and Improvement:

Continuous monitoring and improvement are essential for long-term success. Feedback mechanisms and regular environmental audits help organizations assess performance and compliance. Organizations can enhance transparency in reporting outcomes and ensure that their sustainability efforts progress in response to changing needs and challenges by adjusting strategies based on performance data. This iterative process promotes a culture of accountability and continuous improvement.

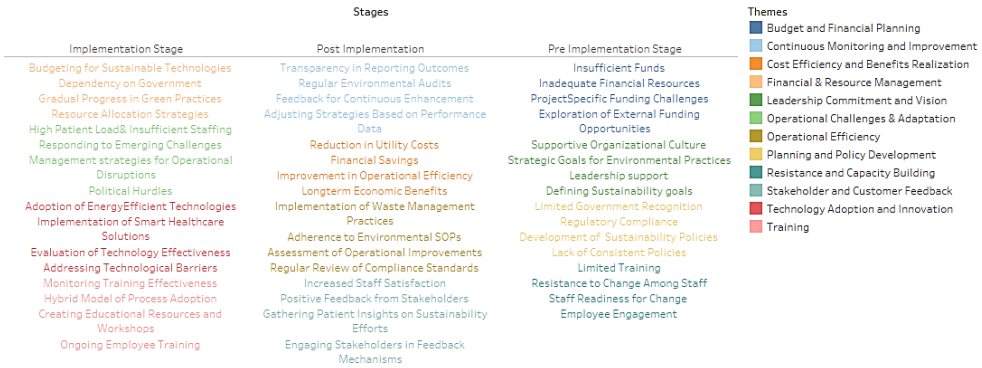


Fig 5: Final model for the adoption of green innovation practices

Conclusion:

The study is qualitative and explores the CSFs of adoption of green innovation in the healthcare sector, using the perspective of 10 respondents who belong to different professions in the healthcare sector, including nephrologists, administrators, anesthesiologists, gynecologists, neurologists, general medicine practitioners, and cardiologists. They provided useful insights into the pre-implementation, implementation, and post-implementation phases of green innovation. The study's findings contribute to understanding the key factors driving effective green innovation implementation in the healthcare sector. During the pre-implementation phase, the study highlighted the necessity for planning and policy development, budget and financial planning, resistance and capacity building, as well as leadership commitment and vision. The focus then shifted to training, financial & resource management, operational challenges, and technology adoption and innovation, with subthemes highlighting the importance of training, resource allocation, and the adoption of energy-efficient technologies. The post-implementation phase highlighted continual improvement measures, such as financial savings, increased staff satisfaction, and long-

term economic benefits. By revealing the CSFs underpinning the adoption of the health care sector across its operational phases, this study summarizes a strategic roadmap for ensuring sustained success in green innovation integration, also highlighting the significance of continual improvement mechanisms.

Theoretical implications:

A study developed a model for successful green innovation practices adoption in the healthcare sector. Theoretically, the study proposed several contributions. The model provided in the survey helps organizations understand how CSF plays an important role in identifying and managing the important components to achieve project goals. Furthermore, our model identifies the key components crucial for implementing green innovation practices in the healthcare sector. These elements are arranged in multiple stages into themes and subthemes (Figure 5). During the pre-implementation stage, financial planning, policy development, resistance, capacity building, and leadership commitment emerge. While resource management, training, operational challenges, and adoption emerged during the implementation stage. Finally, operational efficiency, cost efficiency, stakeholder and customer feedback, and continuous monitoring were identified as critical themes during the post-implementation stage.

Managerial implications:

The study also offers practical implications to managers. Planning, employee training, feedback, continuous improvement, and performance assessment are crucial elements for the adoption of green innovation in healthcare. Also, the study was held in three stages, including pre-implementation, implementation, and post-implementation. These stages help the managers to implement strategies throughout the adoption of green innovation. Furthermore, the study provides guidance on incorporating green innovation in healthcare, which is helpful for government officials, administrators, and physicians to improve their operational activities. The study is useful in the case of new implementation of green innovation practices in the current system. It suggests that `factors like project planning, project goal, evaluation of resources, satisfaction of resources, assessment of risk, and feedback from stakeholders are crucial for implementation. These components help the practitioner to implement the new project with more awareness by facilitating proper planning, operational decision analysis, and stakeholder alignment among staff, suppliers, and potential customers. During the process of green innovation implementation, stakeholder interaction and training are all important factors for developing technical competencies. Furthermore, once green innovation is put into use, it needs continuous monitoring, including efficiency of software, user satisfaction, and acceptance, and economic performance through constant evaluation of costs and returns of investments.

Discussion

This study aimed to explore the critical success factors (CSFs) for implementing GI in Pakistani hospitals, utilizing a qualitative approach to gain in-depth insights. The findings, structured across pre-implementation, implementation, and post-implementation phases, offer a comprehensive roadmap for healthcare institutions. This discussion will interpret these findings in the context of existing literature and the theoretical frameworks of the Resource-Based View (RBV) and Stakeholder Theory. The pre-implementation phase findings underscore the indispensable roles of leadership

commitment and financial planning. Participants consistently highlighted that without a clear vision and tangible support from senior management, green initiatives struggle to gain traction. This aligns perfectly with the literature, where effective leadership is cited as a primary driver for organizational change and innovation (Arici & Uysal, 2022; Skubis et al., 2023). The emphasis on a leadership vision that prioritizes long-term sustainability over short-term projects directly supports the core tenets of stakeholder theory, which posits that leaders must balance the interests of all parties, including the community and environment, not just immediate financial returns.

Furthermore, the challenge of securing adequate and consistent funding, as articulated by respondent R1, reflects a significant real-world barrier. This finding resonates with studies by Qadeer et al. (2023) and Hao et al. (2023), which identify financial incentives and constraints as pivotal in the green innovation process. From an RBV perspective, securing and strategically allocating financial resources can be seen as developing a critical capability that enables the hospital to invest in green technologies and practices, thereby building a competitive advantage. The struggle between project-specific funding and the need for a long-term, integrated budget reveals a systemic issue in Pakistani healthcare that hinders sustainable development. The implementation phase revealed a critical tension between planning and execution, particularly concerning operational challenges and technology adoption. The insight from respondent R5 that strategies decided in boardrooms are difficult to implement in a real-world hospital setting is a powerful illustration of this gap. This highlights the necessity of a dynamic and adaptive approach, where strategies are not rigid but can be modified in response to the complex realities of patient care and political hurdles. The emphasis on training and staff involvement during this phase is also crucial. This directly connects to the work of Shah and Soomro (2020) and Aboramadan (2022) on Green Human Resource Management (GHRM). For GI to be successful, they must be integrated into the daily routines and mindset of the staff. This supports the RBV by suggesting that a well-trained, environmentally conscious workforce is a valuable, inimitable resource. Resistance to change, another key theme, can only be overcome through effective communication, education, and demonstrating the tangible benefits of new practices to the staff who must adopt them.

The post-implementation findings emphasize that green innovation is not a one-time project but an ongoing process. The focus on continuous monitoring, cost efficiency, and stakeholder feedback is essential for long-term success. The realization of benefits, such as reduced utility costs, provides a powerful incentive for sustaining and expanding green initiatives. This economic validation is critical, as it demonstrates that environmental responsibility and financial prudence are not mutually exclusive, a point often highlighted in green finance literature (Huang & Ren, 2024). The importance of stakeholder and customer feedback aligns strongly with stakeholder theory. By actively seeking and responding to feedback, hospitals not only improve their green practices but also strengthen their relationship with the community, enhance their public image, and build trust. This feedback loop is a vital mechanism for ensuring that the implemented innovations remain relevant and effective. Furthermore, the theme of continuous improvement through regular audits and transparent reporting creates a culture of accountability, which is fundamental for driving lasting organizational change.

Limitations and future research:

Although the study provides valuable insights into the implementation of green innovation in healthcare, it has limitations too. First, the study has a small sample size and collects data only from Pakistan, which limits the generalizability of results.

Secondly, the study employs a qualitative approach, collecting data from interviews, which may introduce biases due to subjective responses. Lastly, the collection of data at different stages, pre-, during, and post-implementation, doesn't capture the long-term effect, particularly the impact of post-implementation, which can be resolved over time. Future studies might consider a more detailed investigation of the cost-benefit analysis, return on investment (ROI), and economic sustainability of green innovations.

Although this study explores the critical success factors related to green innovation practices, themes and sub-themes have been identified at three different stages. Future research can be conducted to examine further sub-factors behind these critical success factors. For example, in the pre-implementation stage, we have the theme of budget and financial planning along with themes of policy development, resistance, and leadership. A future study can be conducted to explore the critical success factors behind these themes and identify the key factors important for financial planning that facilitate the successful implementation of this specific Factor. Further exploratory studies examining the factors that contribute to the success of every step will contribute more to this literature. It will not only help identify the root causes and challenges behind these factors but also provide an in-depth understanding of them.

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