

Implementing Cleaner Production in Hospitals: A Leadership and Management Framework for Sri Lanka

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ABSTRACT:

Background: Hospitals are resource-intensive institutions that generate considerable environmental impacts and incur high operational costs. Cleaner Production (CP), originally developed for industrial sectors, offers a preventive strategy for improving resource efficiency while minimizing waste and environmental risks.

Objective: To present a leadership- and management-oriented framework for implementing Cleaner Production in hospitals, with particular relevance to the Sri Lankan health-care system.

Methods: This paper synthesizes national policies, World Health Organization guidance, published literature, and international best practices to develop a practical framework for Cleaner Production implementation in hospital settings.

Results: The proposed framework emphasizes leadership commitment, establishment of hospital Cleaner Production committees, staff engagement, operational audits, resource optimization, infrastructure improvements, and continuous monitoring using performance indicators. The framework supports phased implementation beginning with low-cost interventions and progressing to long-term sustainability investments.

Conclusion: Cleaner Production is an effective management strategy that improves operational efficiency, reduces costs, enhances environmental performance, and strengthens institutional resilience in Sri Lankan hospitals. Successful implementation depends on committed leadership, structured governance, staff participation, and continuous performance monitoring.

KEYWORDS: Cleaner Production, Hospital Management, Sustainable Health Care, Resource Efficiency, Environmental Management, Sri Lanka

1.INTRODUCTION

Hospitals are among the most resource-intensive organizations within the public sector, operating continuously and requiring substantial energy, water, chemicals, pharmaceuticals, and single-use consumables. These demands contribute to high operational costs, complex waste streams, and environmental burdens, challenging hospital managers to balance service quality with sustainability and cost-efficiency. The concept of Cleaner Production (CP)—originally developed for industrial sectors to prevent pollution at source and improve resource efficiency—has increasingly been recognized as a strategic management approach that can be applied in health-care settings to improve operational performance while reducing environmental impacts.

Sri Lanka formally recognized cleaner production through the National Cleaner Production Policy, with a dedicated Cleaner Production Policy for the Health Sector developed in 2007 to guide environmentally sustainable practices in health care institutions. Cleaner production in this context involves integrated preventive environmental strategies across hospital processes to increase efficiency and reduce both human and environmental risks. Despite this policy foundation, systematic implementation in Sri Lankan hospitals remains limited and uneven, often due to lack of managerial frameworks and institutional leadership to operationalize CP strategies in daily practice.

This article proposes a leadership-driven framework for implementing cleaner production at hospital level in Sri Lanka, situating it as an essential managerial strategy that enhances efficiency, reduces costs, strengthens institutional resilience, and supports broader sustainability goals.

2. CONCEPTUAL FRAMEWORK OF CLEANER PRODUCTION IN HOSPITAL MANAGEMENT

Cleaner production is defined as the continuous application of an integrated preventive strategy to processes, services, and organizational systems to improve efficiency and reduce risks to humans and the environment. In hospital management, cleaner production shifts focus from waste disposal to optimizing resource flows, examining how inputs such as energy, water, chemicals, and consumables move through hospital operations and where losses occur. CP aligns with managerial tools such as lean management and quality improvement, emphasizing elimination of waste, standardization of processes, and optimization of operational systems to reduce resource consumption and exposure to hazardous materials.

Studies in health services management highlight how sustainable leadership practices—often termed green leadership—can significantly improve environmental performance and organizational outcomes when coupled with internal accountability systems and environmental culture development.

3. Leadership and Governance for Cleaner Production

3.1 Role of Hospital Leadership

Successful cleaner production implementation hinges on strong leadership commitment. Hospital directors, medical superintendents, and senior administrators must champion CP as a strategic priority, integrating it into institutional planning, governance, and performance management rather than treating it as an externally imposed environmental requirement. Leadership sets the tone for organizational culture change, communicates strategic priorities, allocates resources, and ensures accountability through integration of CP targets into annual planning, budgeting, and staff performance evaluations.

3.2 Governance Structures

A practical governance model includes establishment of a Hospital Cleaner Production Committee with representation from administration, clinical services, nursing, engineering, pharmacy, laboratory services, infection control, and support services. This committee should develop a hospital-level CP policy and Standard Operating Procedures (SOPs), aligned with national policy and relevant environmental regulations under the National Environment Act and associated licensing requirements such as Environmental Protection Licenses (EPL) and Scheduled Waste Licenses (SWL).

Integrating CP responsibilities within existing committees—such as quality improvement or safety committees—helps avoid parallel structures and encourages organizational ownership.

4. STRATEGIC PLANNING FOR CLEANER PRODUCTION IMPLEMENTATION

4.1 Situational Analysis

Implementation should begin with a structured assessment using simple yet informative tools:

- Energy audits to determine major consumption areas and inefficiencies
- Water audits to identify consumption patterns and wastage
- Waste audits to categories waste streams and quantify disposal costs

These baseline assessments help priorities CP interventions based on feasibility, cost savings, and expected impact.

4.2 Phased Implementation

A phased approach encourages early successes and sustainable progression:

1. Immediate, low-cost actions: behavioral changes such as turning off unused equipment and reinforcing recycling practices.
2. Medium-term interventions: installation of energy-efficient fixtures, water-saving devices, and process adaptations.
3. Long-term investments: renewable energy systems (e.g., solar power), infrastructure retrofits, and automation systems.

This phased strategy is crucial for Sri Lankan public hospitals, which often operate under tight budget constraints.

5. OPERATIONALIZING CLEANER PRODUCTION ACROSS HOSPITAL UNITS

5.1 Administration and Office Operations

Administrative functions offer quick wins in cleaner production:

- Reducing paper use through digital documentation
- Promoting double-sided printing and reuse of paper for drafts
- Switching off idle lights, fans, computers, printers, and air conditioners
- Maximizing natural lighting and ventilation

These practices improve operational efficiency while building a culture of resource mindfulness among staff.

Implementing Cleaner Production in Hospitals: A Leadership and Management Framework for Sri Lanka

5.2 Clinical Areas and Waste Management

Clinical services generate high volumes of consumable waste. Cleaner production encourages rational evaluation of disposable versus reusable items without compromising infection control, and bolstered inventory practices reduce expired stock and minimize hazardous waste. Sri Lankan hospitals generate significant quantities of infectious, laboratory, and pharmaceutical waste, necessitating robust segregation, containment, and disposal systems. Clear leadership and consistent monitoring are essential to maintain compliance and reduce environmental risks associated with improper waste handling.

5.3 Pharmacy and Inventory Management

Effective procurement and inventory management are central to cleaner production. Use of first-in, first-out (FIFO) protocols, precise annual forecasting, and clear labelling practices reduce expiries and minimize financial losses while supporting environmental objectives.

5.4 Support Services: Kitchen, Laundry, and Cleaning

Support services offer additional cleaner production potential:

- Energy-efficient cooking practices and waste minimization
- Composting or biogas generation from organic waste
- Water-efficient laundry practices that reduce unnecessary cycles
- Rational use of cleaning chemicals at recommended concentrations

These measures contribute simultaneously to cost savings and operational safety.

5.5 Infrastructure, Energy, and Water Systems

Infrastructure interventions include:

- Replacing incandescent lighting with energy-efficient alternatives
- Installing solar energy systems where feasible
- Rainwater harvesting for non-potable uses
- Regular maintenance of plumbing to reduce water losses

Even modest investments in such infrastructure can yield significant long-term savings and improve service reliability.

6. HUMAN RESOURCE MANAGEMENT AND CHANGE LEADERSHIP

Cleaner production represents a behavioral change process. Resistance often arises from perceived additional workloads or concerns over service quality. Effective change leadership involves:

- Training and awareness programs for staff at all levels
- Identification of “green champions” within departments
- Recognition and reinforcement of successful initiatives
- Clear communication linking CP to improved working conditions and institutional pride

Engaging staff in goal-setting and continuous feedback enhances ownership and sustainability of CP practices.

7. MONITORING, EVALUATION, AND PERFORMANCE MANAGEMENT

Monitoring progress is essential to demonstrate benefits and maintain momentum. Suggested indicators include:

- Energy consumption per bed
- Water consumption per patient-day
- Waste generation per bed
- Cost savings from specific CP interventions

Regular performance reviews using these metrics promote transparency, data-driven decisions, and continuous improvement.

8. CHALLENGES AND PRACTICAL SOLUTIONS IN SRI LANKA

Common challenges include limited financial autonomy, ageing infrastructure, procurement rigidities, and competing service delivery priorities. Solutions include:

- Prioritizing low-cost interventions that yield quick returns
- Leveraging documented cost savings to negotiate funding for larger investments
- Partnerships with local authorities, private sector entities, and national programs supporting resource efficiency

Implementing Cleaner Production in Hospitals: A Leadership and Management Framework for Sri Lanka

- Leveraging external capacity building from organizations such as the National Cleaner Production Centre of Sri Lanka (NCPC) to access technical support and training.

9. LESSONS LEARNED AND BEST PRACTICES

Insights from international and local experience highlight that:

- Leadership commitment is more important than funding alone
- Small, visible improvements can build organizational momentum
- Cleaner production enhances not only environmental outcomes but also institutional performance and workplace culture

For example, several Sri Lankan hospitals have implemented renewable energy solutions, composting, biogas systems, and green productivity cycles, demonstrating operational and environmental benefits.

10. CONCLUSION

Cleaner production is not an optional environmental agenda but a strategic management tool for hospitals seeking enhanced efficiency, cost savings, and sustainability. In Sri Lanka, where public hospitals operate under resource constraints and face increasing service demands, cleaner production offers a practical framework to strengthen institutional resilience. Implementation depends on visionary leadership, structured governance, staff engagement, and continuous monitoring. By embedding cleaner production within hospital management practices, Sri Lankan hospitals can lead by example in operational excellence and environmental stewardship.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the Ministry of Health, Sri Lanka, and the National Cleaner Production Centre of Sri Lanka (NCPC) for their policy guidance and publicly available resources that informed the development of this manuscript. The authors also recognize the World Health Organization (WHO) for its global guidance on sustainable health-care systems and environmentally responsible hospital management, which provided valuable background for this work.

The views and recommendations presented in this article are those of the authors and do not necessarily reflect the official policies or positions of their affiliated institutions.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest regarding the publication of this manuscript.

FUNDING

This study received no external funding. All activities related to data collection, analysis, and manuscript preparation were undertaken as part of routine institutional public health activities.

AUTHOR CONTRIBUTIONS

Sukunan G.: Conceived the study, developed the manuscript concept and framework, conducted the literature review, drafted the manuscript, and coordinated revisions.

Dharshini M.: Contributed to the literature review, provided critical input on hospital management and public health perspectives, assisted in manuscript writing, and critically revised the manuscript for important intellectual content.

Thileeban A: Contributed to the conceptual development of the implementation framework, reviewed the manuscript for clinical and operational relevance, provided technical feedback, and approved the final version of the manuscript.

All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

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Implementing Cleaner Production in Hospitals: A Leadership and Management Framework for Sri Lanka

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