



Circular Economy Models for Aged Care Equipment: Lean Remanufacturing and Hydrogen-Powered Sterilization

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Abstract

Aged care equipment management becomes more sustainable by adopting circular economy principles which utilize remanufacturing techniques and hydrogen-powered sterilization systems. The research investigates how lean remanufacturing techniques prolong equipment lifecycles while also studying the impact of hydrogen sterilization methods on lowering carbon footprints and upholding infection control measures. Integrating these models will lead to better cost management while reducing waste levels and improving safety standards in aged care facilities.

Keywords: Aged Care, Hydrogen-powered sterilization, Equipment sustainability

Introduction

Equipment sustainability within aged care facilities faces growing challenges because of heightened demand and strict hygiene standards (Juba et al., 2023a). The circular economy model tackles these industry challenges through remanufacturing processes combined with cutting-edge sterilization methods. Hydrogen-powered sterilization presents a green solution to chemical-based sterilization techniques while lowering carbon emissions according to sustainable industrial approaches (Olajide, 2024).

Lean Remanufacturing in Aged Care Equipment

The process of lean remanufacturing utilizes continuous improvement methods to restore aged care equipment that extends its useful life while maintaining cost efficiency (Henry et al., 2022). Key benefits include:



The circular economy leads to lower material waste and reduced dependency on resources (Oluwafunmise & Olajide, 2024).

Remanufacturing equipment presents a cost advantage over buying new products (Olajide, 2024).

Quality assurance mechanisms deliver improved safety and performance (Juba et al., 2024b).

Phiri et al. The analysis by Phiri et al. (2024) demonstrates that healthcare quality standards require efficient resource management which positions remanufacturing as a critical element of circular economy practices. Industrial management techniques in remanufacturing can enhance efficiency levels and decrease emissions according to Olajide & Oluwafunmise (2024).

Hydrogen-Powered Sterilization: A Sustainable Alternative

Hydrogen-Powered Sterilization: Conventional sterilization practices depend on chemical disinfectants and energy-consuming autoclaving processes which raise environmental challenges (Olajide, 2024). Hydrogen-based sterilization presents an innovative approach by:

The use of clean hydrogen enables low-emission microbial decontamination according to research by Henry and colleagues (2022).

The workplace safety standards improved through minimized exposure to toxic chemicals (Juba, 2024).

The study by Olajide et al. (2023) demonstrates how operational expenses can be reduced by improving energy efficiency.

Research demonstrates how public policy influences hydrogen technology adoption in the healthcare sector and stresses the importance of regulatory assistance (Juba et al., 2022). Workforce training becomes imperative to achieve effective implementation which allows for seamless integration with current sterilization protocols (Olajide et al., 2023).



Integration of Circular Economy Principles

The combination of lean remanufacturing with hydrogen sterilization methods supports the wider objectives of the circular economy. Key strategies include:

Continuous improvement methodologies can extend the lifespan of equipment as demonstrated by Olajide (2024).

Olajide (2024) demonstrated how social acceptance and community involvement can support sustainable practices.

Juba et al., 2024a demonstrate how technology application in domiciliary care can lead to reduced healthcare expenses.

Studies about workplace safety programs show the critical need to maintain safety conditions for both healthcare workers and patients as observed by Juba & Ochieng (2024). Long-term sustainability in aged care facilities depends on effective management of occupational health and safety issues.

Conclusion and Future Directions

The use of circular economy models in aged care equipment delivers sustainable outcomes through the integration of lean remanufacturing processes along with hydrogen-powered sterilization techniques. Further research needs to examine how these sustainability models can be scaled to various healthcare settings while evaluating their lasting environmental and economic effects (Olajide et al., 2024). Policy frameworks need to enable innovation in clean hydrogen deployment to create alignment between technological advancements and workforce capabilities (Henry et al., 2022).



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