Project Title

Upcycling & Repurpose of Damaged Linen by Embroidery Methods to achieve Waste Reduction & Environmental Sustainability

Project Lead and Members

Project members: Connie Wong, Joey Chua Sok Hoon, Wendy Chan

Organisation(s) Involved

Sengkang General Hospital

Healthcare Family Group(s) Involved in this Project

Healthcare Administration

Applicable Specialty or Discipline

Supply Chain Management

Project Period

Start date: June 2021

Completed date: December 2021

Aims

The project aimed to drive sustainability goals and reduce the amount of textile waste. The objectives were:

- Upcycle and repurpose 30% of damaged linen.
- Extend the expected lifespan of damage linen beyond 3 years.
- Reduce disposed damage linen by 30%.
- Generate significant cost savings from linen replacement.

Background

See poster appended/ below

Methods

See poster appended/ below

Results

See poster appended/ below

Conclusion

See poster appended/ below

Project Category

Care & Process Redesign

Operation Management, Inventory Management

Keywords

Damaged Linen, Upcycle, Repurpose, Waste Reduction, Sustainability

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Upcycle & Repurpose of Damaged Linen by Embroidery Methods to achieve Waste Reduction & Environmental Sustainability

Singapore Healthcare Management 2023

Sengkang General Hospital
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1. Introduction

Inspired by Sengkang General Hospital (SKH) being honoured with the Global Human Settlements Model Building Award in 2020 for excellent sustainability design, the Linen Supply Unit (LSU) under the Environmental Services Department aspires to be more than a highly effective, operational outfit but also an environmentally sustainable one.

Given that hospital linens are subject to heavy usage, misuse, staining as well as effect of strong disinfectants & high temperature during frequent washes, many are damaged via small tears and irremovable stains, which can translate to 6% of total linens in circulation. In 2021, there were about 12,778 pieces of damaged linen and many had been in use for less than 3 years of expected lifespan. These damaged linens would be condemned and disposed as general waste, weighing up to 3.58 tons.

2. Aim & Objectives

The project aimed to drive sustainability goals and reduce the amount of textile waste. The objectives were:

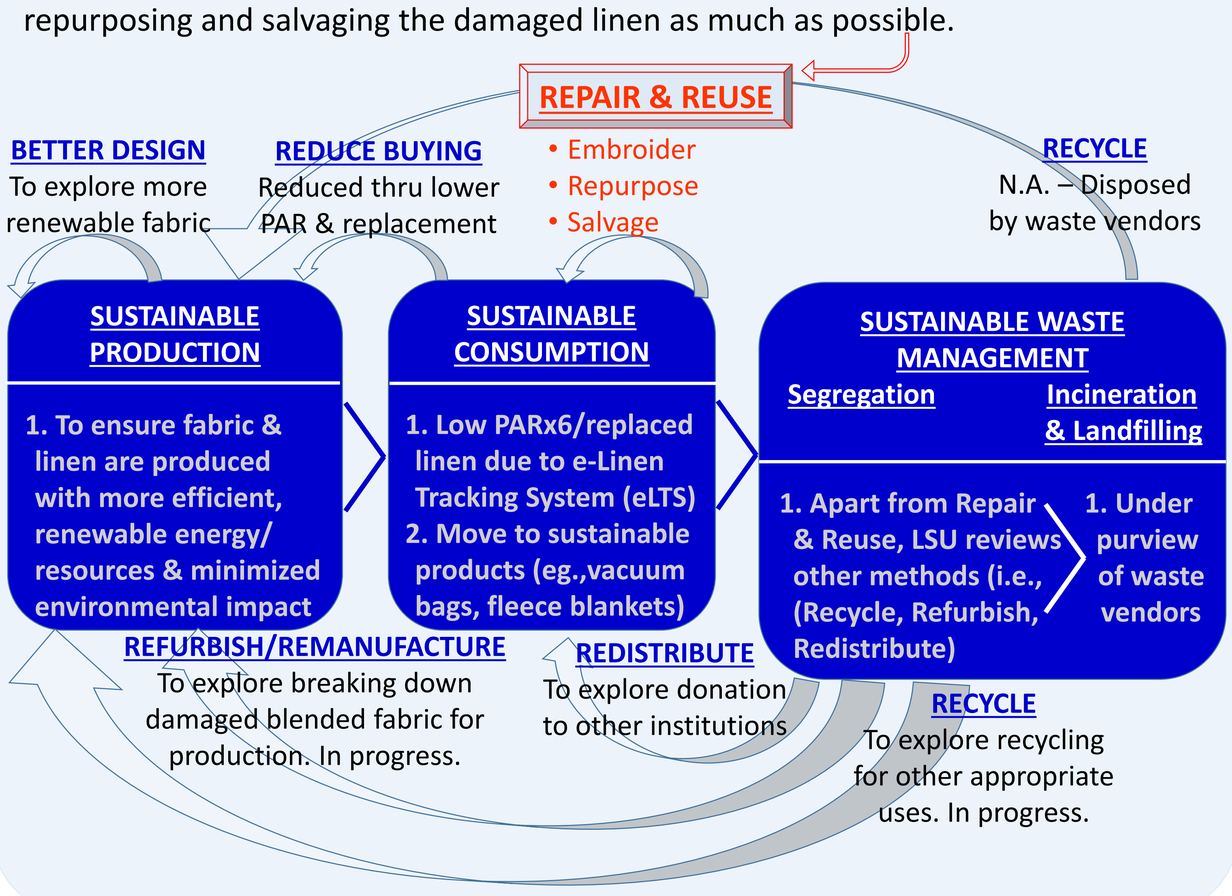
- ♺ Upcycle and repurpose 30% of damaged linen.
- ♺ Extend the expected lifespan of damage linen beyond 3 years.
- ♺ Reduce disposed damage linen by 30%.
- $ Generate significant cost savings from linen replacement.

3. Methodology

The project team adopted the PDSA model to facilitate the accomplishment of sustainability objectives.

PLAN

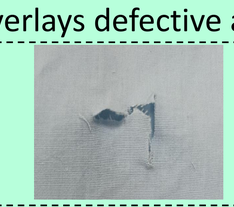
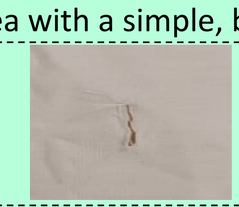
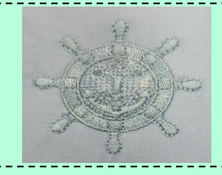
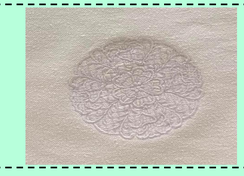
1. The LSU undertakes a holistic planning framework in managing the generated textile waste. Under Singapore's Zero Waste Masterplan announced in 2019, the overall recycling rate would increase to 70 per cent by 2030. In line with SKH's direction of developing a more sustainable culture of reduction, reuse & recycling, the planning process adopted the circular economy approach [refer to below model as published by the National Environment Agency (NEA)].
2. After a comprehensive review of this model with accompanying input, the project's focal point was to strengthen the Repair & Reuse thrust by embroidering, repurposing and salvaging the damaged linen as much as possible.



DO

1. LSU has a qualified seamstress who is tasked to perform mending duties (as part of establishment). The seamstress can also support the purpose of Repair & Reuse of damaged linen. To strengthen its capacities, LSU had also worked out sustainability arrangements with its laundry suppliers to support this shared purpose at no cost. Damaged linen identified during weekly quality checks or reported by users or laundry suppliers is assessed whether it can be repaired via any of the three methods:

(A) Embroidery – Overlays defective area with a simple, beautiful pattern:

Torn/ Damaged Area			
After Embroidery			

(B) Repurpose – Beyond embroidery repair, the damaged part is removed, and the original linen is being altered to become the next smaller linen(s):

Damaged Linen	Wrapper 1 or Dressing Towel	Wrapper 2/3 or Trolley Towel	Abdominal General Towel
Repurposed Linen	Tetra Towel	Wrapper 1 or Dressing Towel	Wrapper 1/2/3 or/& Dressing/Trolley Towel

(C) Salvage – Beyond embroidery & repurpose, two pieces of same linen (i.e., flannel blankets or drawsheet are cut & joined with 1 joint seam & sewn down.

STUDY

1) The trial on the three methods of repair & reuse was conducted in June 2021.
2) After 6 months of repair work, the embroidered, repurposed & salvaged linen remained functional & durable. Linen quality was good.

ACT

1) The three trial methods were reviewed and found to be feasible, practical, fast and free. In addition, patients had also provided numerous compliments on the embroidery design stitched on the linen. Thus, the team decided to ***accept*** and implement the tested solution.

4. Results

	Pieces	Weight (tons)	Haul Cost ($170/ton)	Replacement Cost	Total Cost
Total Damaged Linen (A)	12,778	3.58	$680	$31,990	$32,670
Total Repaired Linen (B)	4,450	1.25	Est $170	$11,141	$11,311
Net Damaged Linen	8,328	2.33	$510	$20,849	$21,359
Percent Change (B/A)	**34.8%**	**34.9%**	25.0%	34.8%	**34.6%**

5. Conclusion

The extensive embroidery, repurpose & salvage work managed to repair 34.8% of damaged linen, increase patient satisfaction with embroidered linen, extend the expected lifespan of repaired linen beyond 3 years, minimize operational disruption, reduce 34.9% of textile waste, and generate an annual cost savings of $11,311 (equivalent to 34.6% of total replacement cost). These sustainability outcomes constitute an important milestone in achieving alignment with Singapore's Zero Waste Masterplan.

This project is scalable not only for other LSU and textile industry but also the entire community in repairing and reusing their damaged apparel. Future research can focus on the improvement areas identified in the circular economy model presented in the Methodology section.