SAVING CONNECTICUT ONE MATTRESS AT A TIME: A REAL-LIFE CASE STUDY TO IMPROVE MATTRESS RECYCLING PROCESS AT PARK CITY GREEN

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Abstract

UB School of Engineering has partnered with the PCG to increase their operational efficiency in addition to finding alternative markets for their raw materials. Possible expansion plans are also discussed and included in addition to other improvement opportunities. This study introduces the motivation behind the study while reporting on the findings of this collaborative research.

Introduction

Background: Park City Green (PCG)

In 2013, Connecticut became the first state to enact a legislation requiring mattress manufacturers to establish a mattress recycling program (GBCE, 2018). As a result, Greater Bridgeport Community Enterprises (GBCE) has founded Park City Green (PCG), **the only nonprofit mattress deconstruction and materials recycling business of its kind in the Northeast**.

Motivation: End-of-Life Mattress Recycling

End-of-life (EOL) mattresses are one of major contributors to the growing waste stream with an estimated range of **1.6-1.8 million annual disposal rate** (RRA, 2017). EOL mattress recovery provides significant financial gain and various environmental and social benefits. Components of a typical mattress are shown in Exhibit 1.

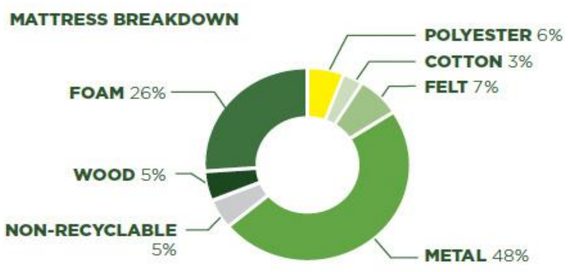

Exhibit 1. Weight distribution of mattress material content

Commonly used EOL mattress recovery options include:

- **Recycling and Reuse** which aim at regaining the value embedded in EOL products and extending their life spans by providing solutions for their utilizations in the market place. It is proven that over 90 percent of the materials in a typical mattress is recyclable.
- **Energy recovery** which is the combustion of polyurethanes and other plastics found in a typical mattress. Generated energy is proven to be much higher than the most other components of municipal solid waste (ACC, 2017).

PCG has a several suppliers including various local transfer stations, hospitals, universities, prisons, and hotels, in addition to private companies such as Bob's Discount Furniture, Jordan's Furniture, PC Richard & Son, Raymour & Flanigan, and IKEA.

Objectives

Today, PCG is faced with a mismatch between its supply and demand in its supply chain. As a result of difficulties in their transportation and the decline in their demand, GCB has initiated a study to investigate alternative markets for the recovered material content. **UB School of Engineering faculty members and students partnered with the organization to conduct in-depth analysis and to offer alternative methods, products and markets to increase the efficiency of operations and to create additional demand for the mattress recycling products.**

Mattress recycling is a complex process that involves the stages of separation and dismantling that requires capital investment to carry out safely (Ho et al., 2012). However, an "echo fee" of $9 allows PCG to recycle around 40 thousand EOL mattresses annually with no additional cost to the EOL mattress providers.

Exhibit 2. Dismantling process of an EOL mattress and vertical baler in PCG

Among the components of EOL mattresses, metal and wood are the two most profitable materials. GBCE recently purchased a vertical metal baler to crush the metal, which raise the price from $30/ton to $145-200/ton. However, foam is the most challenging material due to the difficulties in economies of scale.

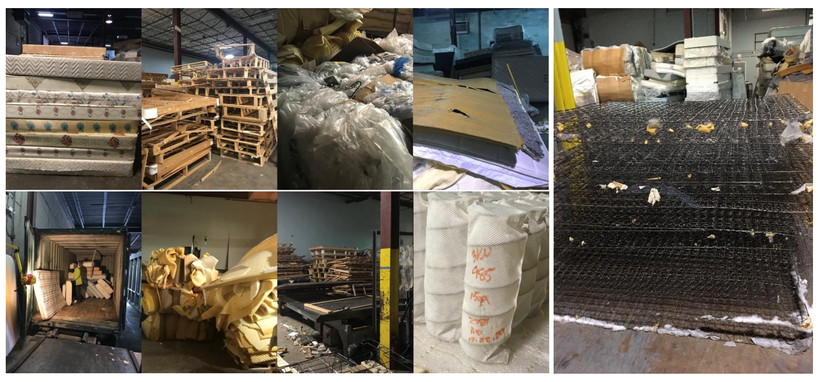

Exhibit 3. Recovered foam, wood, and metal content in PCG

Through several site visits and personal communications, the steps of EOL mattress recovery in PCG starting from the delivery of mattresses to the resale of the extracted material have been monitored and recorded. Based on the data and information collected in addition to the feedback received, foam has been identified as the most problematic content.

Exhibit 4. Recovered foam and cotton content

Main objectives are defined as:

- **Finding additional markets for recycled foam that utilize foam for the business.**
- **Determining the best suitable recycling method for foam, viz. mechanical or chemical.**
- **To create a more appealing material/product for the customers through low-technology low-cost solutions.**

Methodology

This real-life case study is explored via in-depth analysis with the following methods:

Semi-structured Interviews: Key informants have been interviewed face-to-face with a series of open-ended questions in order to fully examine the business processes.

Observations: Business environment has been monitored on site to verify information provided by informants and to comprehend other aspects of the study, and photographs, video-recordings, and artefacts are collected.

Systematic Data Collection and Analysis: Data collected through interviews and observations have been carefully analyzed in order to obtain meaningful insights, and the findings have been documented.

Results

The following results are emerged from the data analysis in order to accomplish each objective of the study:

- **Development of a smart transportation model** to achieve a cost-effective shipping of supplies to the destination points.
- **Application of geographical grid system** to accurately obtain key places to look for customers and suppliers within 100 mile radius of Bridgeport, CT.
- **Establishment of online channels** to create new customer profiles from individuals to wholesalers.
- **Identification of alternative products** that utilize foam for insulation, packaging, sports mats, cushioning, pet houses, architectural models, clown nose, and decorative purposes.
- **Installation of a horizontal baler** to carry higher volume of bales in order to increase the customer demand.
- **Assessment of environmental and economic feasibility of mechanical and chemical recycling** to determine the best suitable recycling process in the long term.

Conclusion

This study is an on-going work to increase the operational efficiency of Park City Green. With this aim, several findings generated for discussion through in-depth analysis have been presented. A cost/benefit analysis for each recycling process will implement to evaluate the profitability for future research.

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