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The Challenges in Achieving a Circular Economy within Leather Recycling

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Abstract

Over the past two decades there has been a rapid growth in tanning and leather manufacturing in developing countries, an undesirable by-product of this is an increase in waste associated with leather products. End-of-life management options for leather products are often limited to incineration or landfill; these carry a range of environmentally damaging impacts. This indicates a need for an urgent diversion towards material recycling in order to prevent further environmental degradation. This paper investigates a number of interdependent and complex challenges in implementation of a circular economy approach within leather industry. These challenges range from achieving economy of scale required for commercial viability and finding secondary markets for the recycled materials to developing 'resource efficient recycling processes' that are especially tailored to the specific needs of leather products.

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Keywords: Reconfigurable Recycling; Circular Economy; Leather Recycling

1. Introduction

Leather is one of the most widely traded commodities in the world. Leather products industry plays a prominent role in the world's economy, with an estimated global trade value of approximately US$100 billion per year. [1]

Global population grew substantially in the 20th century and this combined with a general rise in wealth has led to a significant increase in the demand for meat, which in turn has kept the supply of skins for the leather industry fairly constant. Current predictions indicate that the supply of leather raw material will continue to follow the growth in population [1]. In developed countries a declining 'per capita' consumption of red meat has reduced the supply of skins and leather hides, while in the developing world, leather raw materials have become increasingly more available with over half of the world's supply originating in developing countries (Figure 1) [2].

An unwanted by-product of the global leather market is the waste generated during every stage in the lifecycle of leather and leather goods production. Recovery options exist for a small percentage of the waste generated, this includes: extraction of organic material for fertilisation and incineration of waste for energy recovery. However, a large proportion of the total leather waste is still sent to landfill with no material or energy recovery.

This paper explores the complex interdependent challenges faced when trying to implement a circular economy

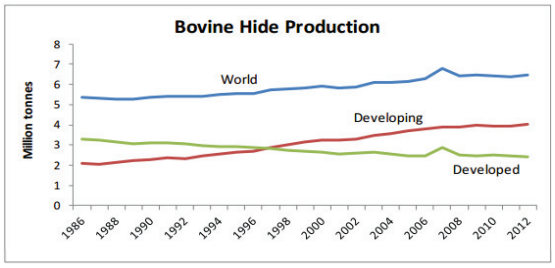

Figure 1: Increase in production of bovine hide [2]

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approach within the leather industry. These challenges range from achieving economy of scale required for commercial viability and finding secondary markets for the recycled materials to developing 'resource efficient' recycling processes that are tailored to the specific needs of leather products.

The work presented is an extension of research reported by Lee & Rahimifard (2010) on footwear recycling and aims to further develop and re-apply previous knowledge to a wider range of leather products.

One main outcome from previous work was that it is no longer economically feasible to think in silos when it comes to recycling individual product types. Recycling systems need to advance and adapt in order to allow the processing of multiple products with similar material content on the same line, which will provide enough scale to enable commercial viability.

The paper begins by presenting the lifecycle of leather along with an illustration of the waste generated at each stage. A review of the latest literature on the disposal of leather waste is performed along with an investigation into the key drivers for a material recycling system for leather. The key challenges in creating a leather material recycling system are investigated and the final section of this paper presents an analysis of all the considerations for creating a leather recycling system.

2. Lifecycle of leather

The lifecycle of leather is illustrated in Figure 2, along with examples of the waste generated at each stage in the lifecycle.

During the production of leather, animal skins undergo a series of operations in which a substantial quantity of solid waste is generated [3]. In a report by The World Bank, it was claimed that up to 70 % of the wet weight of the original hides can be wasted [4].

Wastes from tanneries include uniform waste streams such as wet blue trimmings and shavings (Figure 2 (a) and 2 (c)) and mixed waste streams, such as finished and dyed cuttings (Figure 2b). These wastes pose a serious threat to the environment and are an unavoidable by product of current tanning methods.

During the manufacturing stages finished leather hides are cut and formed into leather products such as footwear, apparel and furniture. The waste streams associated with this stage of the lifecycle include trimmings from the cutting of shaped leather pieces and prototype samples (Figure 2(d), 2(e) and 2(f)).

The next stage of the lifecycle includes the distribution and retailing of leather goods. Wastes associated with this stage include unsold stock, returned items from consumers including damaged items and seized counterfeit goods (Figure 2(g), 2(h) and 2(i)). Typically the number of different types of materials within this waste stream is high but the condition of the materials is often very good (excluding damaged items).

The final stage of the lifecycle is the post-consumer stage, where the consumer no longer needs or wants the leather products. This category of leather waste also includes a high-level of mixed material, however the quality and condition of materials are often very poor (Figure 2(j), 2(k) and 2(l)).

As you move through the lifecycle the waste stream becomes more diverse and complex, moving from mono-material 'pure' leather wastes in the tanneries to multi-

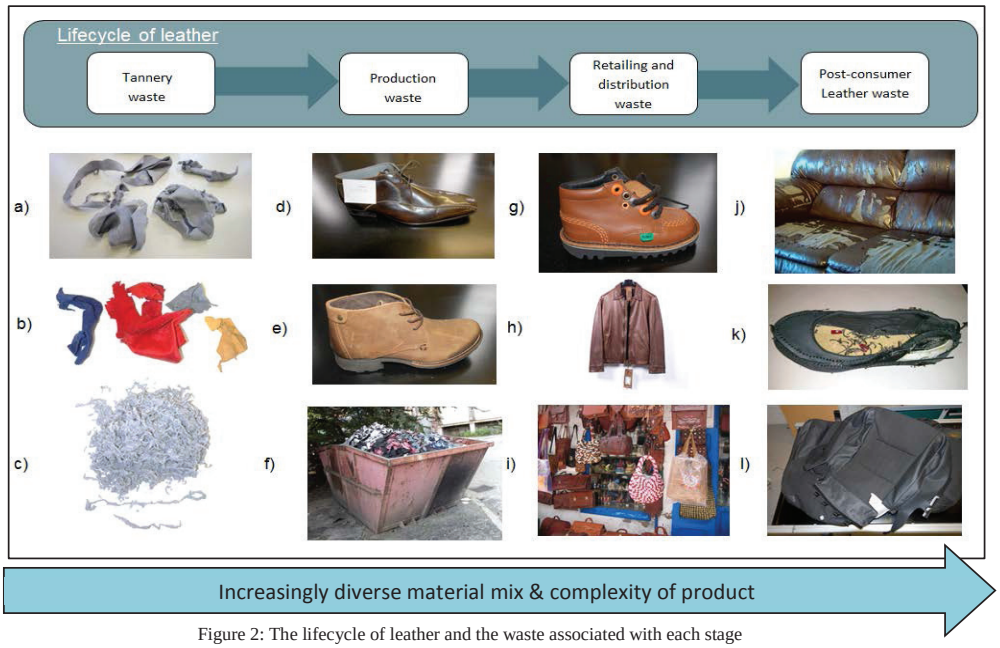

Figure 2: The lifecycle of leather and the waste associated with each stage