

Consumer Clothing Carbon Footprint Accounting and Evaluation

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Abstract

Sustainability in the fashion and textile industry is becoming a significant research focus due to global warming and climate change. However, more research is needed on consumers' carbon emissions in the context of clothing consumers. This study focuses on consumers and develops a comprehensive accounting model of the carbon footprint of clothing consumption. A simulation experiment is conducted through surveys and empirical data to calculate the carbon emissions associated with consumers engaging in clothing purchase and clothing use. The sensitivity analysis examines the factors influencing carbon emissions at each stage. The finding reveals that in the overall carbon footprint of clothing consumers, clothing use has the highest impact than clothing purchase. The findings from this study offer valuable insights for consumers looking to reduce their carbon footprint during clothing purchase and use and also serve as a foundation for future research endeavours, which has great significance for the reduction of carbon emissions in society as a whole.

Keywords: Clothing Consumption; Consumer Behavior; Carbon Footprint; Sensitivity Analysis

1 Introduction

With the unprecedented development of the economy and society and a significant improvement in consumer income levels, there is a growing focus on enhancing quality of life. Despite being a key industry in China, the textile and garment sector still needs to overcome challenges such as high energy consumption and extensive water pollution. These issues contribute to environmental degradation, resource wastage, and increased emissions of greenhouse gases, particularly carbon dioxide. Changes in clothing consumption concepts and the diversification of demand have led to higher colour, style, fabric and fit requirements.

Current research on the carbon footprint of clothing primarily examines products, enterprises and supply chains. Life cycle assessment (LCA) [1-3] an input-output method (I-O) [4] are commonly utilised to calculate and evaluate the carbon emissions of a specific type of textiles and garment enterprises, supply chains and product life cycles, and strategies for reducing carbon

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emissions. More detailed research on the carbon footprint associated with consumers in the clothing industry needs to be conducted. Global warming is the result of both man-made and natural effects. The international community has agreed that reducing man-made greenhouse gas emissions is crucial in mitigating global warming [5]. Throughout the research hotspots in recent years, the focus on carbon emissions has gradually shifted from the production side to the consumption side [6]. Consumers play a crucial role in carbon emissions through their consumption activities. Approximately 80% of energy consumption and carbon dioxide emissions can be linked to consumer behaviour and economic activities [7]. Carbon emissions generated during clothing consumption directly result from consumers' choices in behaviour. The quantity of carbon emissions attributed to consumers is intricately linked to individual consumption and lifestyle [8].

Among the many ways to calculate carbon footprints, the Life Cycle Assessment (LCA) method has emerged as a crucial method for accounting for carbon footprint at a micro level. Still, it cannot specifically obtain the product's carbon emissions in the retail stage [9]. The input-output (I-O) method is commonly employed in calculating consumption carbon footprint; the data used typically pertain to the overall consumption of specific products or services by certain consumer groups (e.g., food or medical expenses) [10], limiting detailing. Consequently, it is difficult to study the carbon emissions of clothing consumers due to consumption behaviour [11]. The CLA framework is utilised to analyse the energy usage and carbon dioxide emissions from various factors influencing consumer activities [11, 12]. Utilising the consumer-oriented comprehensive evaluation framework known as the lifestyle approach (CLA), the study of the carbon footprint resulting from the consumption behaviour of clothing consumers holds great importance in efforts to reduce carbon emissions among consumers and society as a whole [13].

This study introduces a model for calculating the carbon footprint of clothing consumption, encompassing the purchase and use of clothing consumers. A comprehensive data accounting list is established by utilising official and measured data. The study also conducts a sensitivity analysis of the accounting results to determine the impact of various factors on carbon emissions in clothing consumption. The findings from this study offer valuable insights for consumers looking to reduce their carbon footprint and serve as a foundation for future research endeavours.

2 Method

2.1 Boundary

Li Jiahui et al. defined the time boundary for studying the carbon footprint of textiles and clothing from the first to the last washing of clothing products by consumers [14]. Jianfang Liang categorised sustainable consumption behaviour into three stages: purchase, use and abandonment [15]. In the waste stage, Chinese consumers typically rely on waste manufacturers, incineration, and landfill institutions to dispose of clothing, which does not produce a carbon footprint [16].

Based on the above research, this paper's spatial boundary of the carbon footprint accounting model for clothing consumers encompasses the water, electricity, fossil fuel, and other carbon emissions associated with both consumers' consumption activity. The time boundary is divided into two stages. Firstly, the purchasing stage considers transportation modes and travel distance. The consumer use stage examines washing, drying, ironing frequency, time, equipment energy