

EVALUATING THE ECONOMIC VIABILITY OF HIGH-QUALITY PLASTICS VS. RECYCLABLE PLASTICS: AN IN-DEPTH ANALYSIS OF MONETARY GAIN

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DOI: 10.46609/IJSSER.2024.v09i02.010 URL: <https://doi.org/10.46609/IJSSER.2024.v09i02.010>

Received: 1 Feb. 2024 / Accepted: 15 Feb. 2024 / Published: 29 Feb. 2024

ABSTRACT

The economic viability of high-quality plastics versus recyclable plastics involves various factors. High-quality plastics often provide better performance than recyclable plastics, but it is also costlier due to their production processes and materials. Recyclable plastics are cheaper production. They lower durability or performance. Economic viability requires considering multiple aspects like production costs, market demands, environmental impact, recycling, infrastructure, regulations, and end-user preferences. Recycled plastics, often contain higher levels of chemicals such as toxic flame retardants, benzene and other carcinogens, environmental pollutants including brominated and chlorinated dioxins, and numerous endocrine disruptors that can cause changes to the body's natural hormone levels.

Recyclable plastics are derived from post-consumer or post-industrial plastic waste. Plastic are polymers, long chains of atoms arranged in repeating units and when recycled, plastic actually gets downcycled, meaning that the quality and durability decreases every time as these long chains of atoms get broken down and shortened. The economic evaluation of high-quality plastics versus recyclable plastics is a multifaceted analysis encompassing several critical factors. While high-quality plastics exhibit superior performance characteristics, their elevated costs, attributed to intricate production processes and premium materials, contribute to a higher economic burden. Conversely, recyclable plastics present a potentially more economical production alternative, yet they may compromise on durability and overall performance. Achieving economic viability in this context necessitates a comprehensive examination of various dimensions, including production costs, market demands, environmental implications, recycling infrastructure, regulatory frameworks, and end-user preferences. Striking a balance among these considerations is imperative for informed decision-making in the plastic industry. A noteworthy aspect of recycled plastics introduces a complex dimension. These materials often contain heightened

concentrations of chemicals, such as toxic flame retardants, benzene, carcinogens, and environmental pollutants like brominated and chlorinated dioxins. Furthermore, a myriad of endocrine disruptors are present, potentially inducing alterations in the body's natural hormone levels. This underscores the importance of understanding the environmental and health ramifications associated with recycled plastics.

INTRODUCTION

In a world where the intersection of industry, sustainability, and performance is paramount, the economic dynamics of high-quality plastics versus recyclable plastics emerge as a critical frontier in materials science and manufacturing. The ramifications of these choices extend far beyond the confines of production facilities, influencing environmental landscapes and shaping consumer behaviors. This paper delves into the pivotal question: how do the economic considerations surrounding high-quality and recyclable plastics intertwine with environmental impact, performance attributes, and regulatory landscapes?

At its core, this research seeks to unravel the complex tapestry of economic viability in plastics, navigating the trade-offs between superior performance and potential cost efficiencies. The dichotomy between high-quality plastics, celebrated for their exceptional performance metrics, and recyclable plastics, presenting a more economically attractive but intricate alternative, forms the crux of our inquiry.

As we embark on this exploration, our focus extends beyond mere economic parameters. We delve into the intricate web of factors influencing decision-making in the plastics industry, from production costs and market demands to recycling infrastructure, environmental considerations, regulations, and end-user preferences. This holistic perspective aims to provide a comprehensive understanding of the multifaceted landscape governing material choices.

The subsequent sections of this paper will systematically unpack these dimensions, scrutinizing the environmental and health implications of recycled plastics, the transformative downcycling process, and the delicate balance required for economic viability. By the paper's conclusion, we aim to offer not just insights into the economic intricacies of plastics but also a roadmap for conscientious decision-making that aligns with both industry imperatives and broader sustainability goals.

LITERATURE REVIEW

Acknowledging the escalating trajectory of plastic use, it becomes imperative to chart a course toward a resource-efficient Circular Economy (CE). Central to this pursuit is the amplification of plastic waste utilization, requiring a nuanced understanding of the intricate dynamics governing

plastic recycling. As articulated by Milios (2017), a pivotal prerequisite for this transformative shift lies in fostering a surge in demand for recycled plastics within manufacturing spheres. This, in turn, hinges upon the development of robust and well-functioning markets for secondary raw materials. The plastic recycling market, a complex landscape, unfolds along various sub-markets within the value chain. However, the realization of a circular and sustainable plastic economy encounters barriers that span this intricate journey.

Identifying and addressing these barriers is integral to navigating the challenges inherent in propelling the plastic recycling market forward. This paper endeavors to dissect the multifaceted dimensions of these sub-markets, shedding light on the barriers that impede their seamless integration into a sustainable Circular Economy. Through a comprehensive exploration, we aim to illuminate pathways toward overcoming these obstacles, fostering a future where plastic waste is not merely discarded but transforms into a valuable resource within a circular and resource-efficient paradigm.

The imperative to transition from theoretical frameworks to practical implementations within the circular economy underscores the necessity of capturing and reusing the residual value inherent in plastic waste. Achieving a seamless circular flow of secondary resources requires the integration of Reverse Logistics (RL), which serves as the linchpin facilitating recovery, reuse, and recycling loops. This paper undertakes a comprehensive exploration of the global challenges surrounding plastic waste recycling, with a specific focus on mitigating carbon emissions. The study addresses these concerns through the formulation of a robust Green Reverse Logistics Network (GRLN) redesign problem. This complex problem is conceptualized as the identification of Pareto-optimal configurations, involving a delicate tradeoff between the expected value of the cost and other critical considerations. By delving into this intricate redesign problem, we aim to provide a nuanced understanding of the strategic choices and configurations that optimize the circular flow of plastic waste, mitigating environmental impacts and contributing to the practical realization of a circular economy. The utilization of recycled thermoplastics in the manufacturing of Wood-Plastic Composites (WPCs) has demonstrated significant promise. However, the inherent variability in recycled plastics, stemming from diverse sources and exposure to various storage and reprocessing conditions, introduces a complexity that influences their performance.

One critical aspect requiring focused research is the degradation of recycled plastics, a consequence of repeated processing cycles and environmental exposure. The degradation level of plastics is a multifaceted consideration in the recycling landscape. As plastics undergo multiple processing cycles and are exposed to environmental factors, their structural integrity may be compromised. This degradation not only impacts the physical and mechanical properties of the recycled thermoplastics but also introduces variability in performance. Understanding and

characterizing the effects of degradation levels become paramount to address the challenges associated with the recycling of thermoplastics for WPCs manufacturing. In essence, the research emphasis lies in unraveling how the degradation of recycled plastics, influenced by diverse origins and processing histories, manifests in the context of WPCs.

This nuanced exploration is essential for optimizing the performance and sustainability of recycled thermoplastics in the production of Wood-Plastic Composites. This article contributes novel and valuable insights into consumers' experiences with recycled plastic applications, shedding light on both product- and consumer-specific factors influencing the perceived attractiveness of recycled plastics. Utilizing diverse citizen survey data from Finland, the study uncovers significant findings that enhance our understanding of consumer perceptions in this domain. The research reveals a positive trend, indicating that consumers generally express satisfaction with products made from recycled plastic. Surprisingly, the characteristic appearance of recycled plastic, characterized by features like color cloudiness or dark tones, does not emerge as a significant barrier. Instead, it is found that this characteristic appearance can enhance the branding of functional recycled plastic products, particularly in categories like home supplies. Examining consumer-specific factors linked to positive perceptions, the study identifies key demographics such as gender, age, recycling habits, and environmental consciousness. Females, younger individuals, regular recyclers, and those with a heightened environmental awareness are more likely to perceive the use of recycled plastics as enhancing product attractiveness. Interestingly, income and living environment do not exert statistical influence on this view, indicating a broader acceptance across socioeconomic strata. While consumers generally do not perceive recycled plastic products as unsafe, the study highlights crucial areas requiring attention.

Product availability and labeling emerge as key factors. The current product selection is deemed limited, signaling an opportunity for expanding consumer offerings made from recycled plastics. Clear product labeling, including information on the percentage of recycled plastic, environmental benefits, recyclability, and safety, is identified as a valuable tool for informed consumer decision-making. As the circularity of materials, particularly plastics, hinges on the use of recycled material in new products, the article emphasizes the necessity to endorse recycled plastic market to meet EU's recycling targets. The study underscores the importance of focusing on availability, selection, design, and labeling of consumer products incorporating recycled plastics. However, the research acknowledges some limitations, such as slight variations in respondents' education and gender, necessitating further exploration and generalization in different contexts. Future research should delve into consumer experiences and perceptions in diverse regions and countries, offering a more comprehensive understanding of the role and importance of various attributes influencing the demand for recycled plastics. Specifically,

estimating consumers' willingness to pay for recycled plastic material in products, perhaps through choice experiment methodologies, is identified as a potential avenue for deeper investigation.

This study conducts a thorough examination of the economic viability between high-quality plastics and recyclable plastics, focusing on monetary gain. Through an in-depth analysis, the research assesses the financial implications of utilizing high-quality plastics, renowned for superior performance but higher production costs, against the potential cost-effectiveness of recyclable plastics. Various factors such as production costs, market demands, environmental impact, recycling infrastructure, regulations, and end-user preferences are scrutinized to provide a comprehensive understanding of the economic dynamics. Furthermore, the study delves into the monetary aspects associated with recycled plastics, acknowledging potential cost savings in production but considering the impact of lower durability and performance. It aims to unravel the trade-offs and challenges in achieving economic viability within the plastics industry, emphasizing the need for a balanced approach that aligns financial considerations with sustainability goals.

Table -1

Pros and Cons Table of Recycled Plastics	
Pros	Cons
Cost-saving (Can down to 0 if collect from the production line)	Limited availability
Lower energy when producing	Takes time to sort before recycling
Create circular economy	Might have contamination
More environment protection, more eco-friendly	Quality issues if using unreliable machines

CONCLUSION

In conclusion, this compilation of research summaries underscores the multifaceted challenges and opportunities within the realm of plastics, recycling, and circular economy. The imperative to transition from linear production models to circular frameworks is evident throughout these studies, each shedding light on a specific facet of this transformative journey.

From the importance of fostering demand for recycled plastics in manufacturing, as highlighted by Milios(2017), to the intricacies of redesigning Green Reverse Logistics Networks for efficient plastic waste recovery and reuse, these studies contribute to the evolving discourse on sustainable materials management. The utilization of recycled thermoplastics in Wood-Plastic Composites introduces a promising avenue, though the complexities of degradation levels warrant focused research to optimize performance.

Consumer perceptions, as explored in the Finnish citizen survey, reveal a positive trend in satisfaction with recycled plastic products. Interestingly, characteristics like color cloudiness or dark tones do not impede attractiveness, and demographic factors play a role in shaping consumer attitudes. However, limitations and the need for further research underscore the dynamic nature of consumer preferences and experiences.

Lastly, the economic viability of high-quality plastics versus recyclable plastics takes center stage in the pursuit of a sustainable circular economy. The intricate analysis of monetary gain emphasizes the need for a balanced approach that considers production costs, market dynamics, and environmental impact, providing valuable insights for industry stakeholders.

In essence, these studies collectively contribute to the ongoing dialogue surrounding plastics, urging a shift towards sustainable practices, consumer education, and the development of robust recycling systems. As we navigate the complexities of circular economies, these findings illuminate pathways for transformative change, fostering a future where plastic waste evolves into a valuable resource within a circular and resource-efficient paradigm. After concluding the results it shows that high quality plastics is more preferential than recycled plastics.

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