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Exploring Circular Economy Practices in School Uniforms: A Study on Parental Perspectives from Australia

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Abstract: The global school uniform industry, primarily driven by linear production models, significantly contributes to textile waste and environmental degradation. In Australia, over 2000 tons of school uniforms are discarded annually, highlighting the urgent need for sustainable alternatives. This study explores the integration of Circular Economy (CE) principles into school uniform systems through a case study of a private school in Victoria. Using a thematic approach, the research involved a parent survey with 106 participants and a focus group with 6 parents. The study identified financial, logistical, and socio-cultural factors influencing uniform consumption and disposal behaviors. Affordability emerged as the primary motivator for adopting second-hand uniforms (86%). However, barriers such as limited sizing, hygiene concerns, quality, and social stigma hinder wider adoption. Parents also expressed dissatisfaction with the current uniform design, material breathability, and durability, particularly in warmer climates. Despite increased awareness of sustainability (61% cited environmental concerns), actionable engagement remains low due to a lack of transparency and infrastructure. The study proposes a replicable circular uniform framework based on stakeholder co-design, reverse logistics, and curriculum-based sustainability education. These findings offer practical implications for policymakers, educators, and manufacturers aiming to reduce textile waste and promote CE adoption within the education sector.



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1. Introduction

The global school uniform market is a significant segment of the apparel industry, with a valuation of approximately USD 17.26 billion in 2023 and projections reaching USD 26.09 billion by 2031, growing at a compound annual growth rate (CAGR) of 7.1% [1]. This substantial market size reflects the extensive production and consumption of school uniforms worldwide. Predominantly operating under a linear “take-make-dispose” production model, this sector contributes substantially to textile waste and environmental degradation.

In Australia, approximately 2000 tons of school uniforms are discarded annually, with each school disposing of an estimated 100 to 200 kg of uniforms per year. This waste is exacerbated by the frequent replacement cycles of uniforms and the prevalent use of non-renewable materials, such as polyester [2]. The state of New South Wales alone, housing over 2000 schools, underscores the scale of this challenge and the pressing need for sustainable solutions [3]. In Australia’s context, approximately 3.9 million students collectively contribute to a substantial volume of textile waste through discarded school

uniforms. For instance, if each student discarded just one polo shirt during their schooling years, this would generate over 8619 tons of waste, the equivalent of 206 humpback whales [4]. The uniform consumption model is largely linear, characterized by rapid production, brief use, and disposal, aligning with the take-make-dispose framework that dominates the broader fashion industry [5].

Uniforms, often made from synthetic materials such as polyester, contribute to long-term environmental degradation due to their resource-intensive production processes and resistance to decomposition [6]. Virgin Polyester production demands significant water and energy resources while emitting high levels of greenhouse gases, exacerbating the textile industry's environmental footprint [7,8]. While polyester durability makes it a practical choice for school uniforms, its environmental impact underscores the need to ensure it does not end up in landfills. Instead, polyester should be kept within a circular loop, emphasizing reuse to extend its lifecycle and minimize waste. These environmental concerns are compounded by the financial burden on families, with the average annual cost of public-school uniforms in New South Wales ranging from AUD 250 to 300 [8]. Addressing this issue requires a paradigm shift from the linear model to a circular economy (CE) approach, which emphasizes resource conservation through durability, repair, reuse, and recycling [9]. The CE framework, by encouraging closed-loop systems, has the potential to redefine school uniform practices, transforming garments from disposable items into assets that maintain value throughout their lifecycle. Despite CE's increasing adoption across industries such as clothing, electronics, etc. [10,11], its application within the school uniform sector remains underexplored, with limited practical models for implementation and significant operational barriers.

Transitioning school uniforms to a circular model offers multiple advantages, including reduced financial burden on families, enhanced community participation, and significant environmental benefits. For example, research indicates that extending the average active use of a garment by just three months can lower its carbon footprint, water use, and waste generation by up to 5–10%. This estimate is grounded in lifecycle assessment (LCA) methodologies that assume typical consumer use patterns, energy inputs in laundering, and the environmental costs of production and disposal stages [12]. These models demonstrate how even modest extensions in product lifespan achieved through repairs, swaps, or second-hand use can yield meaningful sustainability outcomes. One aspect that may be of consideration is that the actual impact may depend on the garment archetype (synthetic, natural, or blended) and can have divergent footprints. This may also be dependent on the use phase of the garment, where laundering frequency may offset gains from extended use [13]. Accordingly, school-based initiatives such as uniform exchange programs, repair services, and second-hand supply chains can play a critical role in reducing textile waste while improving access and affordability. Additionally, initiatives such as uniform banks or swap events can foster community engagement by offering accessible, sustainable alternatives, encouraging families to adopt more conscious consumption patterns. Educational campaigns can complement these efforts by raising awareness of the environmental impacts of traditional uniforms and the benefits of sustainable choices. However, there is limited academic research into this area of school uniforms and the utilization of the CE principles in the context of Australia.

Therefore, the purpose of this research is to explore how CE principles can be effectively integrated into school uniform systems to enhance sustainability and reduce waste. This study is structured around these three research questions:

1. How can CE principles be effectively integrated into school uniform systems to enhance sustainability and reduce textile waste?

2. What are the perceptions and attitudes of parents toward sustainable and circular practices in school uniforms?
3. What are the key barriers and motivators influencing parental adoption of second-hand and sustainable school uniforms?

These questions serve as a framework for addressing the overarching research question and for providing actionable insights into sustainable consumption practices within the educational sector.

Utilizing a prestigious private school in Victoria as a case to explore the feasibility and implications of integrating circular economy principles into school uniform practices, this study adopts a mixed-methods approach, employing surveys and focus groups to assess current end-of-life pathways and stakeholder perceptions. The findings inform the development of a replicable framework for sustainable uniform management. By addressing these key areas, the research aims to enable stakeholders, including students, parents, and school administrators, to make informed decisions that support both environmental and economic sustainability.

The following sections provide a comprehensive literature review that examines the broader context of sustainable fashion, circular economy models, and their application to school systems. Following this, Section 4 outlines the research design and data collection process, while Section 5 provides an integrated discussion of the key themes identified. The paper concludes with actionable challenges and recommendations, reflecting on both the study's contributions and the broader implications for advancing sustainability within the education sector.

2. Theoretical Framework

This study explores a transformative approach to school uniform systems, shifting from the traditional linear “take-make-dispose” model to a more sustainable approach. This new model emphasizes key principles such as material selection, lifecycle extension, reuse, and repair, providing practical strategies tailored to the unique challenges faced by schools [8,14].

This paper integrates three theoretical frameworks, Systems Theory, Life Cycle Assessment (LCA), and Stakeholder Theory, to explore the transition toward a circular economy for school uniforms. Systems Theory provides a comprehensive understanding of the complex interactions within the school uniform supply chain, highlighting the interconnectedness of various components and the systemic changes required for sustainability [15]. This perspective is crucial for identifying leverage points where interventions can lead to significant improvements in sustainability. For instance, the integration of circular economy principles into the school uniform supply chain requires a systemic approach that considers production, distribution, use, and end-of-life management as interconnected processes [16]. By viewing the supply chain as a dynamic system, this study can better understand the feedback loops and dependencies that influence the overall sustainability of school uniforms.

LCA offers a detailed evaluation of the environmental impacts associated with school uniforms throughout their entire life cycle, from production to disposal, identifying key areas for improvement. LCA provides a detailed analysis of the resource use and emissions associated with each stage of the product’s life, enabling the identification of hot spots where improvements can be made [17]. When combined with circular economy principles, LCA helps in designing school uniforms that minimize waste and maximize resource efficiency. For example, using durable materials and designing for easy repair and recycling can significantly extend the lifespan of uniforms, thereby reducing their environmental footprint. Studies have shown that integrating LCA with circularity indicators enhances decision-making and improves environmental performance, making it a valuable framework for assessing the sustainability of school uniforms [18,19].

Stakeholder Theory is essential for understanding the roles and influences of various stakeholders in the transition toward a circular economy for school uniforms. This theory posits that the success of circular initiatives depends on the active engagement and collaboration of all relevant stakeholders, including students, parents, schools, and uniform manufacturers [20,21]. By considering the interests and influences of these groups, researchers can develop strategies that foster collective action toward sustainability. Engaging stakeholders in initiatives such as uniform recycling programs and repair services can create a shared sense of responsibility and drive the adoption of circular practices [22]. The integration of Stakeholder Theory with Systems Theory and LCA provides a holistic framework for addressing the multifaceted challenges of transitioning to a circular economy, ensuring that environmental, economic, and social dimensions are considered in a balanced manner.

By combining these theoretical frameworks, this study provides a cohesive framework for analyzing CE practices in school uniforms. This alignment not only bridges the gap between theory and application but also offers a robust model for transitioning educational institutions toward sustainability. As further explored in the literature review, CE principles, centered on resource efficiency, waste minimization, and regenerative practices, hold transformative potential for achieving the sustainability goals outlined in this study.

3. Literature Review

3.1. Circular Economy—A Holistic Approach

The CE is a transformative model that redefines traditional resource management practices, transitioning from the linear “take-make-dispose” approach to a regenerative system aimed at maintaining resource utility and minimizing environmental degradation. CE emphasizes resource efficiency, conservation, and equitable growth by focusing on strategies such as reduce, reuse, and recycle (3Rs), as well as take-back systems that decouple economic growth from resource depletion [23–25]. By addressing global challenges such as resource scarcity, waste accumulation, and climate change, CE aligns closely with sustainable development goals, presenting a comprehensive approach to harmonizing economic growth with environmental and social responsibility [26].

In contrast to the linear economy, which prioritizes rapid consumption and disposability, CE offers a substitute framework that retains the value of products and materials in continuous use, thereby reducing environmental footprints [15]. Liu [27] defines CE as an economic system that fosters sustainable growth by reducing reliance on natural resources and reintroducing waste materials into production processes. This closed-loop model prioritizes waste prevention at its source, aiming to minimize the exploitation of finite resources while extending material value and utility across the economy [26]. Industries like textiles, characterized by resource-intensive production-consumption-disposal cycles, stand to benefit significantly from CE adoption, especially in mitigating the environmental toll exacerbated by fast fashion’s disposability culture [28,29].

Circular economy, which is based on the Gaia Hypothesis [30], highlights the elimination of waste, circulation of products at their highest value, and regeneration of nature from the impact of uniform production and disposal. By promoting practices such as recycling and reuse, this perspective underscores how individual and institutional actions contribute to ecological balance and environmental stewardship [31].

The textile industry, one of the most resource-intensive and polluting sectors, demonstrates the urgency of CE adoption. Traditional practices generate approximately 92 million tons of waste annually, with the fashion industry accounting for nearly 10% of global carbon emissions [32]. Fast fashion’s reliance on synthetic materials like polyester exacerbates these challenges, contributing to persistent environmental degradation due to their long

decomposition timelines and reliance on fossil fuels [29]. CE principles offer solutions such as closed-loop recycling, biodegradable materials, and extended product lifecycles to mitigate these impacts, promoting sustainable consumption and production [1,33].

Operationalizing CE involves interconnected phases: Take, Make, Distribute, Use, and Recover, which collectively address resource inefficiency and waste [34]. Sustainable sourcing defines the Take phase, prioritizing renewable and recycled materials to reduce dependency on finite resources [35]. The Make phase embeds circularity into production by incorporating modular designs and repairability, extending product lifespans. Eco-efficient logistics in the Distribute phase minimize packaging waste and emissions, while the Use phase involves active consumer engagement to prolong product utility through repair and reuse. The Recover phase ensures materials re-enter the economy at their highest value, supported by advanced recovery processes [26].

Strategic pillars further operationalize CE by addressing systemic challenges and fostering sustainability. Design for Longevity encourages durable product design to minimize waste, fostering both emotional and physical attachment to goods [27]. Material CircularitY emphasizes closed-loop systems where materials are continually reused or recycled, reducing reliance on virgin resources [36]. Cradle-to-Cradle (C2C) principles advocate a design approach that ensures all materials used in a product can either be safely returned to nature or reused in new products, so nothing becomes waste [37]. Extended Producer Responsibility (EPR) expands manufacturers' accountability across product lifecycles, incentivizing sustainable design and efficient recycling systems [37]. Reverse logistics and take-back programs close the loop by facilitating the return and recovery of materials, bridging the gap between production and consumption cycles [38,39].

CE's principles, phases, and pillars collectively provide a robust framework to transition industries toward sustainability. Nikolaou et al. [35] emphasize that CE's value lies not only in waste reduction but also in transforming linear production-consumption systems into regenerative models. These insights are particularly relevant to sectors like textiles, where CE principles enable innovations like fiber-to-fiber recycling and modular design, extending product lifecycles and reducing resource dependency [9,33]. For this study, these frameworks offer a lens to explore the transformative potential of CE in school uniform systems, aligning sustainable practices with broader environmental and social goals.

3.2. CE in School Uniforms

Building upon the foundational principles and pillars of CE, the school uniform sector emerges as a compelling arena for the practical application of these concepts. As a microcosm of the larger textile industry, school uniforms present unique opportunities to implement CE strategies across their lifecycle. The sector's engagement with CE principles is manifesting globally through diverse initiatives. In the UK, schools are establishing uniform recycling schemes, extending garment lifespans through resale and donation [5], while Japanese municipalities are pioneering the collection and recycling of polyester uniforms into new textiles [29].

In Australia, innovative efforts by companies such as Worn Up are transforming old school uniforms into furniture [40], effectively diverting significant textile waste from landfills and creating a closed-loop system within the education sector. Additionally, second-hand uniform shops and op shops have gained popularity, providing accessible platforms for families to donate outgrown uniforms and purchase pre-loved items at reduced costs. These practices align with CE principles by promoting reuse and resource efficiency. Simultaneously, the industry is embracing sustainable production methods, with Zhao et al. [41] demonstrating that incorporating recycled polyester in uniforms significantly reduces carbon footprints, embodying the principle of waste elimination.

The concept of design for longevity, a key CE pillar, is becoming increasingly important as designers focus on durability to minimize replacement frequency. Furthermore, take-back programs and digital platforms for second-hand uniforms are emerging, facilitating the return flow of materials and extending product lifespans [4]. These initiatives not only operationalize CE principles into practice but also serve an educational purpose, instilling sustainability values in students. However, the sector faces challenges in changing perceptions about sustainable alternatives and ensuring the quality of recycled products [32].

Despite these hurdles, the integration of CE principles in school uniforms represents a significant step toward sustainability in the textile industry. As this sector continues to evolve, it offers valuable insights into the practical implementation of CE strategies (as summarized in Table 1), potentially serving as a model for broader adoption across other industries.

Table 1. Summary of CE Strategies and Resource Implications.

CE Strategy	Description	Indicative Cost	Time/Resource Investment
Take-back Programs	Collection of used uniforms for redistribution or recycling [9,40].	Low (bins, awareness)	Low (end-of-term collection)
Second-hand Uniform Shops	School- or community-run outlets for donating and buying used uniforms [42].	Very Low (volunteer-based)	Moderate (sorting, maintenance)
Use of Recycled Polyester	Replacing virgin polyester with recycled PET in manufacturing [42].	Moderate	None after sourcing is established
Design for Longevity	Enhancing garment durability to extend usable lifespan [1].	Slight increase	None (post-implementation)

These findings underscore the pivotal role of collaborative frameworks and multi-stakeholder engagement in operationalizing CE principles within complex systems such as school uniforms. The integration of CE strategies not only requires systemic shifts in material flows and product lifecycle management but also demands active participation from diverse actors, including educational institutions, social enterprises, and policymakers.

The next section outlines the methodology employed in this study, detailing the research design, data collection methods, and analytical approaches used to investigate the implementation of CE principles in school uniform systems.

4. Methodology

The study incorporated a mixed methods approach with surveys and focus groups. This study's data collection involved a blend of primary and secondary research methods, aimed at gaining an in-depth understanding of material usage and stakeholder perspectives on circular economy practices for school uniforms. Primary data were gathered through consultations with the school's administrative staff responsible for uniform procurement and management. This approach allowed for a detailed mapping of the materials involved, their sources, and how they can be evaluated to keep these materials at the highest possible level of the waste hierarchy. It also helped us identify how to sort the uniforms and distribute them further to the various partners.

4.1. Participants

The school was selected based on its established uniform policy, active involvement in sustainability initiatives, and expressed interest in collaborating on research exploring circular economy practices.

Parents connected to the students currently enrolled in grades 7–10 were asked to voluntarily participate in both surveys and focus groups. A total of 102 parents responded to the survey. The focus group had 6 parent participants in an hour-long focus group meeting.

4.2. Measures

This study employed a survey and focus group methodology, utilizing self-developed questions tailored to the research objectives. The measures included closed-ended and open-ended survey questions, designed to capture both quantitative data (e.g., purchasing behaviors, willingness to adopt sustainable uniform practices) and qualitative insights (e.g., concerns about second-hand uniforms, attitudes toward recycling initiatives). The parents' survey consisted of seven multiple-choice questions assessing uniform purchasing frequency, decision-making factors, and sustainability perceptions, along with three open-ended questions exploring disposal practices and barriers to second-hand adoption. Focus groups further enriched the findings by allowing participants to expand on survey responses, discuss challenges, and propose solutions for implementing circular economy practices in school uniforms. This structured approach ensured a comprehensive understanding of sustainability perceptions, combining statistical representation with deeper qualitative exploration.

4.3. Procedures

Participants were selected based on the school's internal criteria, and parents of students in grades 7–10 were invited through newsletters and email communication. Many were already involved in uniform design activities, sustainability clubs, or related initiatives, ensuring informed perspectives on the topic. As primary decision-makers in uniform purchases, parents who have both a financial and personal stake in uniform policies provided valuable insights into cost considerations, practicality, and their willingness to adopt end-of-life circular practices such as reuse and recycling. Due to privacy concerns, no details about the participants were shared with the researchers. Participation was voluntary.

4.4. Data Analysis

The analysis of survey and focus group data was conducted using a combination of quantitative and qualitative methods to interpret responses accurately and comprehensively. Survey data were processed using Qualtrics software, which facilitated both statistical analysis of quantitative responses and thematic identification for qualitative feedback gathered through open-ended questions. This approach enabled a nuanced understanding of stakeholder attitudes, combining measurable trends with detailed insights into individual perspectives on sustainability and circularity in school uniforms.

For the qualitative data, responses to open-ended survey questions and focus group transcripts were analyzed using thematic analysis. The focus group discussions were recorded, transcribed verbatim, and analyzed following Braun and Clarke's [43] six-phase framework: (1) familiarization with the data, (2) generation of initial codes, (3) identification of themes, (4) review of themes, (5) definition and naming of themes, and (6) report production. Coding was conducted manually using an inductive approach, allowing themes to emerge from the data rather than from a pre-existing framework. Two researchers independently reviewed the transcripts to ensure reliability, and discrepancies in coding were discussed and resolved collaboratively. Key quotes were selected to illustrate central themes related to fabric quality, design functionality, transparency, and stigma around reused uniforms.

This integrated approach enabled the systematic interpretation of quantitative survey data alongside the generation of in-depth qualitative insights from focus group participants. Thematic analysis of the qualitative data revealed key patterns and concerns, offering a nuanced understanding of both logistical and perceptual factors that shape stakeholder attitudes toward circular uniform practices. This dual-method strategy enhanced the rigor and comprehensiveness of the study's findings.

The combined analysis approach, which used Qualtrics for structured survey data and manual transcription for focus groups, ensured a thorough exploration of the research questions. This allowed the study to present both statistical findings and rich qualitative descriptions, strengthening the overall validity and comprehensiveness of the results.

5. Findings and Discussion

The findings are presented in a sequential structure by method, highlighting insights from each phase of the research, including the survey and focus groups. Each method contributed distinct data: the survey captured stakeholder attitudes and concerns, and the focus groups provided in-depth qualitative insights. This approach allows for a clear understanding of the challenges and opportunities associated with implementing circular economy principles in school uniforms.

5.1. Financial Considerations and Accessibility

Cost and accessibility emerged as primary concerns among parents at the school regarding uniform purchases. The survey results (Table 2) indicated that 86% of parents who opted for second-hand uniforms cited affordability as their main motivator, with many families viewing second-hand purchases as a practical solution to the high costs associated with new uniforms. The average annual expenditure for public-school uniforms in New South Wales ranges from AUD 250 to 300 [4]. Environmental awareness also played a role, with 61% of parents choosing second-hand uniforms to reduce their environmental impact, highlighting a growing trend toward sustainable choices.

Table 2. Key motivations among parents for choosing second-hand school uniforms among surveyed Parents (n = 106).

Reason	Percentage (%)
Lower cost	86%
Better for the environment	61%
Hand-me-down	49%
Easy access	31%
Others	10%

Table 3 reveals that 31% of parents reported purchasing new uniforms every year, whereas 24% preferred second-hand options for cost savings.

Table 3. Frequency of uniform replacement among surveyed parents (n = 106).

Replacement Frequency	Percentage (%)
Every year	31%
Use second-hand	24%
Every 2 years	22%
Every semester	12%
Others	10%

As Environmental awareness also played a role, with 61% of parents choosing second-hand uniforms to reduce their environmental impact, highlighting a growing trend toward sustainable choices. Despite this willingness to embrace second-hand options, parents expressed frustration over limited availability in sizes and styles, with 44% identifying this as a barrier to fully utilizing second-hand uniform resources, as shown in Table 4.

Table 4. Reported barriers to accessing second-hand uniforms (n = 106).

Barrier	Percentage (%)
Limited options	44%
Not up to the standards	18%
Preference for new	16%
No access	12%
Others	10%

Parents expressed a desire for durable uniforms that justify the cost, as echoed by one parent's comment in the focus group: "*I would like to know if the \$250 AUD on a sports jacket is of really good quality to sustain for a long period of time with my kids.*" This sentiment reflects a common expectation that high-cost items should provide lasting value given their significant financial investment. Quality concerns influenced purchasing decisions, as 18% of parents felt that second-hand items did not meet their standards (Table 4).

5.2. Parental Concerns About Uniform Quality, Durability, and Functional Suitability

Parents' expectations around uniform quality, durability, and functional suitability were prominent in the focus groups, reflecting a desire for uniforms that justify their cost through long-term use. Survey data revealed that quality concerns significantly influenced purchasing decisions, with 18% of parents indicating that second-hand items did not meet their standards, often due to wear and tear from prior use (Table 4). During focus group discussions, parents frequently voiced concerns about fabric quality, with one participant stating, "*Fabrics are not breathable*", and another commenting on the need for "*washability and durability*". These remarks reflect an expectation for uniforms to offer both comfort and resilience, especially given their frequent wear, as shown in Figure 1.



Figure 1. Key concerns raised by parents during the focus group discussion, highlighting issues related to fabric quality. Quotes represent direct participant expressions and illustrate recurring themes identified in the qualitative analysis.

Technically, polyester, commonly used in school uniforms due to its durability and low cost, is a hydrophobic synthetic fiber, which means it retains heat and repels moisture [41]. While polyester offers strength and quick-drying properties, it can cause discomfort in warmer climates or during physical activity. Breathability, which is one of the factors of garment comfort, is not solely determined by its fiber type but is also significantly influenced by the fabric's construction. Factors such as the weave or knit, yarn type, and

density of the fabric play a crucial role in how easily air and moisture vapor can pass through it. The overall thermo-physiological comfort of textiles, encompassing aspects like breathability and moisture management, involves a complex interplay of multiple fabric properties [44].

In contrast, organic cotton provides superior breathability and skin comfort due to its natural fiber structure and moisture-wicking capability. However, cotton production generally requires more water and land resources. Recycled polyester, on the other hand, retains the durability of virgin polyester while reducing environmental impact through lower energy use and reduced reliance on fossil fuels. Lifecycle assessments (LCAs) show that recycled polyester can reduce carbon emissions by up to 30–50% compared to virgin polyester, although it still presents breathability limitations [45]. These trade-offs highlight the need for schools and suppliers to consider both user comfort and environmental performance when selecting uniform materials.

This expectation for high-cost items to offer durability is consistent with research suggesting that consumers increasingly value longevity in apparel, particularly when the initial investment is substantial [46,47].

Comfort and fabric choice also emerged as critical factors for parents during focus group discussion, who noted that some materials felt uncomfortable, especially in warmer climates. Phrases like “*fabrics are not that great*” pointed to dissatisfaction with the quality of synthetic materials commonly used in uniforms. Research on school uniforms supports these insights, suggesting that fabric comfort and ease of maintenance significantly impact satisfaction [48]. Durable and comfortable materials not only meet parental expectations but also contribute to sustainability goals by reducing the need for frequent replacements, reinforcing the principles of a circular economy [2].

Functionality was another key concern, particularly regarding gender specific designs. Certain styles, especially for girls, were seen as impractical for active school environments. Comments such as “*Designs for girls not functional*” highlighted parents’ dissatisfaction with these design choices. Literature on functional clothing underscores the importance of accommodating the active lifestyles of young wearers, promoting freedom of movement without compromising comfort or aesthetics [49]. Addressing these design and material concerns could enhance both satisfaction and sustainability, ensuring uniforms are practical, durable, and aligned with the everyday needs of students.

5.3. Sustainability Awareness and Educational Opportunities

Sustainability awareness within the school community was apparent, with parents and teachers alike showing a commitment to environmentally conscious practices. Survey data revealed that 61% of parents opted for second-hand uniforms partly to reduce environmental impact (Table 2), signaling a growing inclination toward sustainable choices. Focus group discussions echoed this sentiment, with parents advocating for greater transparency in uniform production, particularly regarding “*fabric composition, traceability, and sourcing*”. This aligns with research suggesting that transparent supply chains enhance consumer trust and promote engagement in sustainable practices [50].

In addition to their own purchasing decisions, parents emphasized the importance of integrating sustainability education into the curriculum. They suggested initiatives to inform students about the lifecycle of textiles and the environmental benefits of reusing and recycling uniforms. This recommendation is in line with studies on sustainability education, which highlight the positive impact of eco-conscious learning on student behavior and awareness. One parent commented, “*People are unaware and unclear*” about sustainable options, indicating that a lack of information could be a barrier to broader adoption of sustainable practices (Figure 1). Practical activities such as upcycling projects, along with

educational sessions on textile reuse, were proposed to bridge these knowledge gaps and make sustainability more tangible for students.

5.4. Logistical Barriers and Implementation Challenges

Logistical challenges emerged as a significant barrier to implementing sustainable practices in school uniforms, particularly concerning the accessibility and quality of second-hand options. Survey results indicated that 44% of parents identified limited availability (Table 4) in sizes and styles as a key obstacle, which made it difficult for families to find suitable options in second-hand uniforms. Focus group discussions reinforced this concern, with parents noting that existing second-hand selections often lacked variety, compromising their ability to meet specific needs. One parent shared a perception issue, remarking, “*Sometimes second-hand uniforms feel dirty*”, which reflects not only logistical limitations but also a potential barrier in terms of social acceptance and quality perception.

Survey findings indicated that 46% of parents passed down outgrown uniforms to family or friends, while 37% opted to sell them. However, 17% of respondents expressed uncertainty about what to do with uniforms once they were outgrown, suggesting a potential gap in established pathways for uniform recycling or reuse. These findings reveal that while some families are proactive in reusing or redistributing uniforms, others lack clear options, further complicating the logistics of maintaining a sustainable uniform lifecycle within the school environment.

Bianchi and Birtwistle [50] suggested that limited variety in second-hand clothing can discourage consumers, who often prioritize convenience and availability in their purchasing decisions. The findings reveal that the challenges in implementing a sustainable uniform system stem from a blend of logistical limitations, such as restricted second-hand availability and inconsistent end-of-life practices, alongside curriculum constraints that hinder teachers from fully engaging students in sustainability education.

While informal redistribution is already practiced, formal systems such as uniform banks or school-managed take-back programs could provide more reliable and equitable alternatives. For instance, uniform banks allow for centralized sorting, laundering, and redistribution of pre-owned items, ensuring quality control and greater sizing accessibility. Although they may require initial investment in infrastructure and staffing, they can reduce long-term purchasing costs for families and divert significant textile waste from landfills. In contrast, take-back programs where schools collect outgrown uniforms at end-of-term can serve as a more scalable and lower-cost alternative, especially when integrated into existing school operations. The Australian initiative Worn Up demonstrates how such programs can extend circularity further: by collecting worn-out uniforms and transforming them into composite furniture panels for schools and offices, they not only divert waste but also create educational touchpoints on sustainability [42]. Including cost-benefit considerations in future planning will be critical to selecting appropriate models that align with each school’s resources and values.

A more structured approach to managing second-hand uniforms, coupled with age-appropriate sustainability initiatives, could help overcome these barriers and cultivate a stronger culture of environmental responsibility within the school community.

5.5. Social Perceptions and Acceptance of Reused Uniforms

Social perceptions play a pivotal role in shaping the acceptance of reused uniforms within the school community, particularly among older students who are more attuned to peer opinions and social trends. While some parents appreciate the cost-effectiveness and environmental benefits of second-hand uniforms, concerns over cleanliness and perceived quality create a barrier to broader adoption. One parent expressed this concern directly,

stating, “*Sometimes second-hand uniforms feel dirty*”, reflecting the stigma often associated with pre-owned items. This aligns with studies that highlight hygiene and quality concerns as major factors deterring the acceptance of second-hand clothing, especially in contexts where newness is associated with higher value [51].

Among adolescents, social awareness intensifies this reluctance, as self-consciousness about appearance and a desire to conform to social norms make second-hand options less appealing. A parent commented, “*Kids are more self-aware and understand how expensive clothes are!*” Capturing the balance between financial awareness and social image that many students navigate. This observation is consistent with research showing that social stigma and the desire for social acceptance can discourage young people from choosing second-hand items, which may be perceived as inferior or less fashionable [52].

Stakeholder Theory provides a valuable lens for interpreting these dynamics. Schools occupy a position of both high influence and high interest in the “influence–interest” matrix, as they govern uniform policies, set behavioral expectations, and shape the social norms within the school environment [13]. Their endorsement or lack thereof can either mitigate or reinforce the stigma associated with reused clothing.

By contrast, manufacturers and uniform suppliers often possess high influence due to their control over design and distribution but typically exhibit lower interest in behavioral or cultural outcomes unless incentivized by institutional partnerships or sustainability policies. Mapping parental concerns and student perceptions to these stakeholder roles helps clarify where responsibility and opportunity lie. For example, schools can reduce stigma by actively promoting uniform exchange initiatives as socially acceptable and school-endorsed. Suppliers, in turn, can improve the appeal of reused garments through professional laundering, rebranding, or quality assurance, helping shift public perception from “used” to “circular”.

Together, these insights reveal a complex interplay between cleanliness concerns, peer influence, and personal identity in the acceptance of reused uniforms. Addressing these social barriers may require not only educational efforts that emphasize the benefits of second-hand choices, but also a cultural shift within the school community to normalize reuse. By fostering a positive narrative around second-hand uniforms, schools can encourage students to view reused items as a sustainable, socially accepted choice.

5.6. Community Engagement and Promotion of Sustainable Practices

Fostering a community-wide commitment to sustainability has been identified as essential for the successful implementation of eco-friendly uniform practices. Survey and focus group data reveal that both parents and teachers are interested in engaging with sustainable practices, though there are gaps in awareness and actionable guidance that need addressing. Many parents expressed a desire for more knowledge about sustainable options, with one remarking, “*People are unaware and unclear; it's not that they do not want to practice*”, underscoring a need for clearer communication and accessible information on sustainability efforts. This sentiment reflects findings in educational research, which show that community-led education and transparency can significantly enhance participation in sustainability initiatives [12].

Parents also emphasized the value of community-driven events to normalize and promote sustainable practices around school uniforms. During focus group discussions, many suggested organizing uniform swap events, competitions, and interactive campaigns to create excitement and awareness. Ideas such as “*educating about the lifecycle of products*” and promoting campaigns around sustainability were proposed as strategies to address knowledge gaps and build a culture that values reuse and environmental responsibility. Research indicates that structured, community-based events can effectively foster positive perceptions of eco-friendly choices and reduce social stigmas associated with second-hand use [28,53].

These insights from parents highlight the potential for a collaborative, multi-faceted approach to sustainability within the school community. By integrating sustainability education into the curriculum, hosting community events, and empowering student-led initiatives, schools can create an environment where sustainable practices are embraced and normalized. Such efforts are not only likely to reduce the environmental impact associated with school uniforms but also to cultivate a lasting sense of responsibility and environmental consciousness among students and their families.

5.7. Parental Concerns About Uniform Quality and Sustainability

Beyond cost and accessibility, fabric quality and uniform design emerged as significant concerns among parents in the focus group discussions. Many parents highlighted that school uniforms are made from non-breathable fabrics, leading to discomfort for students, particularly in warmer weather. Washability and durability were also major concerns, with parents noting that frequent washing led to fabric deterioration, forcing replacements sooner than expected. These issues contribute to uniform waste and increase costs for families, making sustainability a key consideration.

Additionally, parents expressed a need for greater transparency regarding fabric composition, sourcing, and traceability. Many were uncertain about the environmental and ethical impact of the materials used in their children's uniforms, indicating a gap in awareness and communication between manufacturers and schools. Design functionality, particularly for girls' uniforms, was another major issue, with parents pointing out that certain designs were restrictive and impractical for active school life.

These insights highlight the need for schools and uniform suppliers to prioritize high-quality, breathable, and durable materials, along with clear communication about sustainability efforts. Improving design inclusivity and offering longer-lasting, ethically sourced fabrics would not only reduce uniform waste but also align with circular economy principles, ensuring that uniforms remain functional and sustainable for extended use.

5.8. Framework Development

The proposed framework consists of three core components: stakeholder co-design, reverse logistics infrastructure, and curriculum-integrated sustainability education as shown in Table 5.

Table 5. Components of the Replicable Circular Uniform Framework.

Framework Component	Key Actions	Intended Outcomes	Primary Stakeholders
Stakeholder Co-Design	<ul style="list-style-type: none"> - Establish school-led working groups - Engage parents, students, suppliers - Co-develop inclusive uniform policies 	<ul style="list-style-type: none"> - Reduce stigma around second-hand use - Increase buy-in and transparency 	Schools, Parents, Students, Uniform Suppliers
Reverse Logistics Systems	<ul style="list-style-type: none"> - Implement take-back programs - Set up sorting and redistribution stations - Partner with textile recycling initiatives (e.g., Worn Up) 	<ul style="list-style-type: none"> - Divert uniforms from landfills - Extend garment life - Enable reuse and upcycling 	Schools, Operations Teams, Local Councils, NGOs
Sustainability Education	<ul style="list-style-type: none"> - Integrate circularity topics into curriculum - Run awareness campaigns and student projects - Connect uniform use with sustainability learning 	<ul style="list-style-type: none"> - Build long-term cultural change - Promote student-led behavioral shifts 	Teachers, School Administrators, Education Departments

Replicability refers to the framework's adaptability across diverse school contexts, guided by shared principles rather than prescriptive solutions. Stakeholder co-design involves structured collaboration between schools, families, and suppliers to develop inclusive policies and reduce the stigma around second-hand uniforms. Reverse logistics includes systems for uniform collection, sorting, redistribution, and end-of-life processing,

supported by partnerships with textile recovery initiatives such as Worn Up. The integration of circular economy concepts into curriculum delivery further reinforces cultural change by embedding sustainability awareness into everyday learning. Together, these components provide a scalable model that schools can progressively adopt to promote circularity and reduce textile waste.

5.9. Key Barriers and Strategic Recommendations for Circular Uniform Adoption

This study identified three key barriers in adopting CE principles for school uniforms, highlighting areas for targeted future research and actionable recommendations. Addressing these challenges can help create a more parent-inclusive, community-driven framework for sustainable uniform management.

One major barrier is the lack of awareness and standardized guidance for parents regarding sustainable uniform options. Many parents support sustainability in principle but lack clear, accessible information on how to participate effectively in uniform recycling, repair, or second-hand initiatives. A strategic opportunity lies in enhancing parental engagement through clearer communication strategies. This can include school-led sustainability campaigns, interactive online resources, and the provision of visual guides on uniform longevity and care.

Another significant barrier is parental hesitation toward second-hand uniforms, driven by concerns about hygiene, durability, and social stigma. While some parents actively reuse or resell uniforms, others remain uncertain or unwilling due to perceptions of second-hand clothing as inferior. To address this, behavioral interventions aimed at shifting parental attitudes are recommended. These can include peer-led testimonials, organizing school-wide uniform swap events, and implementing trust-building initiatives such as verified quality checks for second-hand garments. Furthermore, introducing financial incentives such as discounted new uniforms for those who participate in resale programs could encourage greater parental participation.

The study also highlights gaps in parent-student collaboration in uniform sustainability decisions. While parents make uniform purchases, students ultimately wear and experience the product daily. Therefore, co-designing uniform solutions with both parents and students, present a valuable strategy, ensuring that sustainability goals align with comfort, practicality, and fashion preferences. Additionally, employing gamification techniques, such as repair challenges or sustainability pledges within the school community can make circular economy practices more engaging and widely adopted among families.

By linking these barriers with practical solutions centered on parental engagement, this study underscores the need for a community-driven approach to sustainable uniform adoption. Bridging the gap between awareness, accessibility, and active participation will be key to ensuring that circular economy principles are not only understood by parents but also integrated seamlessly into their purchasing and decision-making habits. Implementing these strategies can help families transition toward long-term, sustainable uniform practices, while reinforcing the financial, social, and environmental benefits of circular solutions.

5.10. Limitations and Future Recommendations for This Study

While this study contributes to a growing body of research on circular economy applications in the school uniform sector, several limitations should be acknowledged. These limitations also highlight opportunities for future research to extend its findings and practical relevance.

Firstly, while the focus group discussions provided valuable insights into stakeholder perspectives on the circularity of school uniforms, the limited number of participants is acknowledged as a constraint. Smaller groups enabled deeper engagement and open dia-

logue; however, a broader participant pool could have enhanced the representativeness of the findings. Future research should aim to expand the number of focus group participants and include a more diverse range of stakeholders, particularly from different types of educational institutions, such as public schools, and varied geographical contexts. This would help capture a wider spectrum of experiences, values, and systemic challenges, enriching the depth of qualitative data and improving the generalizability of recommendations.

Secondly, a further limitation lies in the study's exclusive reliance on parental perspectives for qualitative insights. While parents offered meaningful reflections on uniform affordability, fabric durability, and sustainability awareness, the absence of other key stakeholder voices, particularly those of students and teachers, limits the breadth of the findings. Students, as primary users of school uniforms, can provide experiential insights into comfort, practicality, and daily wearability. Teachers can offer critical reflections on policy implementation, compliance, and the embedding of sustainability culture. Including these perspectives would have deepened the understanding of behavioral patterns, institutional dynamics, and barriers to adoption. Future research should therefore prioritize the inclusion of both students and teachers, perhaps through structured focus groups, surveys, or co-designed workshops to capture a more comprehensive view of stakeholder engagement and to explore how best to foster parent-student collaboration in sustainability decisions.

Thirdly, this study presents a snapshot of behaviors and attitudes at a single point in time. Longitudinal research is recommended to examine how stakeholder behaviors evolve following specific interventions, such as communication strategies, behavioral interventions (e.g., uniform swap programs, quality checks, take-back schemes, financial incentives, co-design initiative, or gamification techniques suggested in Section 5.9). Such studies would provide valuable insights into the long-term effectiveness of circular strategies and their role in shifting both institutional practices and community norms. Finally, building on strategic recommendations, future research should also explore the development and scalability of effective models for sustainable uniform management. This includes investing the impact of different communication strategies on parental engagement, the efficacy of various behavioral interventions in shifting attitudes towards second-hand uniforms, and the outcomes of co-design processes involving parents and students. Further exploration of how gamification can be effectively implemented and sustained within school communities is also warranted.

As schools continue to emerge as key sites for embedding sustainability practices, the integration of circular uniform systems offers not only environmental and economic value but also a unique platform for shaping socially conscious future generations. Rigorous future research will be crucial in optimizing these systems.

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