

# Circular Economy in Education: Evidence from UK Second-Hand School Uniform Market

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## Abstract

This study examines the behavioral and institutional factors, as well as cultural influences, impacting the adoption of second-hand school uniforms in the UK from a circular economy perspective. Using survey data from 207 respondents, including parents, students, school staff, and related stakeholders, I identify cost savings and environmental awareness as primary drivers, while concerns about fit, hygiene, and social stigma limit uptake. The butterfly diagram module on second-hand school uniforms highlights that community- and donation-based reuse systems can improve access and reduce stigma. The theoretical microeconomic model formalizing household purchasing decisions based on price, stigma, and environmental benefits, showing that both subsidies and stigma reduction policies increase adoption, with combined interventions yielding the most potent effects. The findings link 3R principles (reduce, reuse, recycle) to school-level practices, offering practical recommendations for policymakers and educators seeking to promote sustainable consumption and circular economy initiatives in the education sector.

## Keywords

Consumer Behavior, 3R, Circular Economy, Second-Hand School Uniforms Market

## 1. Introduction

The financial burden of school uniforms in the UK has increased significantly in recent years, particularly for families with multiple children. This issue has become more pronounced following the British Labour Party's decision to impose Value Added Tax (VAT) on independent schools (Macey-Dare, 2024). In particular, many lower- and middle-income families in state schools are struggling with rising living costs, while the average cost of secondary school uniforms remains high—

£266.14 for boys and £289.04 for girls, with private school uniforms such as those required at Eton College or Harrow School being even more expensive due to bespoke attire and strict dress codes (Page et al., 2021).<sup>1</sup> The average school uniform cost for state primary schools is around £326 annually, placing significant strains on low-income or homeless families.<sup>2</sup> As a result, second-hand uniforms or free uniform schemes are increasingly viewed as valuable alternatives for families.

Additionally, Economic, Social, and Environmental (ESC) became a hot topic since 2008 (Akella et al., 2009; Gudmanian et al., 2020). The Economic and Social Council of the United Nations (UN) also points out that the Sustainable Development Goals are long-term objectives of sustainable development worldwide (Trends, 2017; Kaya et al., 2023). I start to think: What social values can help people reduce expenses and achieve the ESC's goal during the current economic downturn in Britain? Based on the trade of second-hand goods, it has been a well-established practice in the UK for over a century. I think that promoting second-hand school uniforms is feasible. However, upon reviewing existing articles on the second-hand school uniform market, I observed a notable gap in scholarly attention. This lack of research prompted me to examine the issue through the lens of economic theory, leading to several critical questions: A: Social Value and Academic Neglect: Is the absence of research on second-hand school uniforms attributable to a perceived lack of social or economic significance? B: Educational Context: Given that academic research is predominantly conducted at the university level, does this explain why students from primary to secondary education have not explored this topic in depth? C: Circular Economy Connection: Alternatively, has the potential linkage between second-hand school uniforms and the principles of the circular economy been overlooked, resulting in limited scholarly engagement? Meanwhile, I also aim to apply economic theory to resolve real-life problems as an international high school student. I am keen to explore what happened in this market and how to stimulate the second-hand school uniform market in the UK. After that, my research results can suggest to schools and the government that adjustments be made to the police or rules, and that more parents and students be encouraged to donate and purchase second-hand school uniforms. These realistic observations motivate this study.

This paper examines the behavioral, cultural, and institutional factors that influence the adoption of second-hand school uniforms in the UK, utilizing a framework based on the circular economy. I aim to understand not only the motivations and barriers shaping parents' and students' choices, but also the market mecha-

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<sup>1</sup>For example, see: *The Guardian report on cost pressures* (2024), <https://www.retailconsulting-advisory.co.uk/circular-economy-in-the-fashion-industry-challenges-and-actions-needed>; *BMG Research: Cost of School Uniform Survey 2023*, [https://assets.publishing.service.gov.uk/media/677ea36522a085c5ff5c04db/Cost\\_of\\_school\\_uniform\\_survey\\_2023](https://assets.publishing.service.gov.uk/media/677ea36522a085c5ff5c04db/Cost_of_school_uniform_survey_2023); and *Billings & Edmonds: Starting at Eton College and Harrow School* (2025), <https://www.billingsandedmonds.co.uk/starting-at-eton-college>.

<sup>2</sup>*ITV News: The cost of school uniforms is higher than ever* (2019), *This Morning: How To Save Money On School Uniforms* (2024).

nisms underlying second-hand uniform transactions. By combining survey data, qualitative case studies, and a microeconomic model, I connect individual decision-making to market-level outcomes and policy interventions. More specifically, this study pursues three research objectives: 1) to quantify the main drivers and barriers affecting the demand for second-hand school uniforms, focusing on cost, environmental awareness, and social stigma, using survey data from UK households; 2) to analyze how institutional arrangements, such as school-level donation and resale programs, affect the supply of second-hand uniforms, drawing on evidence from two case studies in Leeds and Scotland; and 3) to develop and calibrate a microeconomic model that formalizes household purchase decisions and derives market equilibrium conditions, allowing me to simulate the effects of potential policies (e.g., price subsidies or stigma reduction campaigns) on adoption rates and welfare outcomes.

The main findings can be summarized as follows. Many parents support reuse for environmental reasons but lack awareness of the 3R principles, and adoption remains limited due to stigma and inconsistent school policies. The theoretical model highlights price, stigma, and environmental benefits as key determinants of purchasing decisions, showing that subsidies and stigma reduction policies can both increase adoption, with combined measures producing the strongest effects. Case studies<sup>3</sup>, as well as the Scot school case, demonstrate how community-driven donation systems, supported by Parent-Teacher Associations (PTAs), can enhance supply and reduce barriers. Additionally, redesigning and upcycling uniforms may appeal to adolescents, fostering creativity, sustainability, and self-expression. Successful implementation depends critically on school-level logistics, guidelines, and active promotion of second-hand uniform schemes.

The remainder of the paper is structured as follows. Section 2 reviews the related literature. Section 3 describes the research framework. Section 4 presents the survey findings. Section 5 develops a theoretical model of the second-hand school uniform market and discusses its implications. Section 6 concludes.

## 2. Literature Review

This paper makes three contributions to the literature. First, it provides novel evidence on the circular economy in education, highlighting the reuse of school uniforms as part of the 3R framework. Second, it offers practical recommendations for schools and policymakers to encourage sustainable consumption. Third, it raises public awareness of the second-hand uniform market, demonstrating potential cost savings and environmental benefits for families in the UK.

### 2.1. Circular Economy and the 3R Framework

The circular economy aims to maintain the value of products, materials, and re-

<sup>3</sup>*Leeds School Uniform Exchange—an innovative way of diverting good quality school clothes from the bin and back into the hands of local families* (2022); and *School uniform and clothing banks. Connect with the Scottish Parent Teacher Council* (2024).

sources for as long as possible while minimizing waste and environmental impacts (Gladek, 2017; Bakker & Mugge, 2017). Central to this concept is the 3R framework—Reduce, Reuse, and Recycle—which guides both industrial and consumer-level sustainability strategies. Policy initiatives, particularly within the European Union, emphasize extending product lifecycles and promoting material recirculation.<sup>4</sup>

Furthermore, the circular economy can play a significant role in achieving SDG 12, as outlined by the United Nations.<sup>5</sup> Despite this, significant circular economic action plans, such as those focusing on 3R reducing, reusing, and recycling remain in place for the second-hand school uniform market in the UK (Manickam & Duraisamy, 2019). Empirical studies show that second-hand markets play a key role in waste prevention. For instance, Wilts et al. (2021) demonstrate that second-hand product reuse in Germany significantly reduces overall waste volumes and resource extractions. It has evolved into a cultural movement, embracing second-hand fashion and environmental sustainability (McRobbie, 1989). With the rising cost of living and increased awareness of ecological issues, parents and schools are exploring the use of second-hand options as an alternative to purchasing new uniforms (Richmond & Regan, 2023). Similarly, Persson and Hinton (2023) highlight how different business forms and profit models affect fairness and accessibility in second-hand clothing markets, raising questions about how circular economies can be both sustainable and socially just. These studies establish that reuse and recycling are essential mechanisms for advancing sustainable consumption, yet little is known about their functioning in education-related markets such as school uniforms.

Despite growing interests in sustainable apparel, school uniforms remain under-researched in the circular economy literature. Studies acknowledge that school-level initiatives, such as uniform exchanges or donation schemes, can provide cost savings and reduce textile waste, but systematic analyses are scarce. Most evidence comes from isolated case reports or local initiatives (e.g., Leeds School Uniform Exchange, Connect Scotland), lacking quantitative assessments of household decision-making or market dynamics. This gap is notable given the rising costs of school uniforms in the UK, and increasing policy attention to affordability sustainability in education. The reviewed literature provides three important insights: i) circular economy principles and second-hand markets can effectively reduce waste and resource use; ii) stigma, norms, price, and incentives strongly influence consumer behavior; and iii) institutional arrangements, such as exchange programs or market platforms, matter for access and fairness.

## 2.2. Consumer Behavior in Second-Hand Markets

While cost savings and environmental benefits are clear, behavioral economics

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<sup>4</sup>Supply Chain Sustainability School Limited (2020): *Circular Economy—What Government Leadership Looks Like*.

<sup>5</sup>See European Conference on Education (ECE) (2017): <https://ece.iafor.org/ece2017/https://ece.iafor.org/ece2017/>.

literature shows that psychological and social factors shape adoption of second-hand products. [Frahm et al. \(2025\)](#) synthesize evidence of six key motivations and barriers, including environmental concern, economic value, social stigma, and perceived quality risks. Social stigma, in particular, reduces willingness to purchase re-used goods, especially for children's clothing. Recent research explores how social norms and reassurance campaigns can mitigate this barrier: [Boyer et al. \(2024\)](#) finds that normative cues increase second-hand fashion recommendations among "Generation Z" ("Generation Z" refers to people who were born between 1997 and 2012) (GZ group) consumers, while [Freitas et al. \(2025\)](#) show that children's thrift stores can shift from stigmatized to fashionable spaces through changes in social practice and collective meaning-making.

Research in behavioral economics highlights factors such as the endowment effect, stigma, loss aversion, and social proof, providing valuable insights into understanding consumer behavior in these contexts ([Camerer, 2003](#); [Norris, 2012](#); [Hobbs, 2016](#); [Calvo-Porrall et al., 2024](#)). Consumers often face psychological barriers, which can limit participation ([Calvo-Porrall et al., 2024](#)). The current situation is that schools play a critical role in normalizing the use of second-hand uniforms. Community-based programs and government policies can further influence behavioral shifts ([Bakker & Mugge, 2017](#); [Vallacher & Wegner, 1987](#)).

However, little attention is paid to how these factors operate in school uniform settings. Some studies note the role of school programs or local charities, but typically in case reports<sup>67</sup>. In the discussion (part 4), the butterfly diagram module will fully explain these two cases in detail. Some studies indicate that second-hand uniform markets significantly reduce textile wastes and carbon footprints of adolescents and the GZ group. Especially, a low-carbon lifestyle can alleviate financial pressure on families, particularly for low-income households ([Schiaroli et al., 2024](#)).

In the UK, donations for uniforms have had a long history. A good example is a school in Leeds: 1000 school uniforms were donated by the school exchange system through volunteers, which saved parents hundreds of pounds. Families can bring old clothes and hand them to volunteers. Then, school staffs can wash, sort, size, and put the clothes out for people to take for free<sup>8</sup>. It has become a cultural movement, embracing second-hand fashion and environmental friendliness ([McRobbie, 1989](#)). With the rising cost of living and increased awareness of environmental issues, parents and schools are exploring second-hand uniform options as a viable alternative to purchasing new uniforms ([Richmond & Regan, 2023](#)).

Economic incentives and soft behavioral interventions can further shape adoption. Evidence from China shows that subsidies and non-monetary nudges (e.g.,

<sup>6</sup>See Leeds School Uniform Exchange "an innovative way of diverting good quality school clothes from the bin and back into the hands of local families".

<sup>7</sup>School uniform and clothing banks, Connect, 2024 Scottish Parent Teacher Council.

<sup>8</sup>See Leeds School Uniform Exchange "an innovative way of diverting good quality school clothes from the bin and back into the hands of local families".

environmental labels) significantly increase consumers' green purchasing behavior, including second-hand products (Wang & Li, 2022). These findings imply that second-hand consumption is not only driven by individual utility maximization but also by institutional framing, peer effects, and policy support.

### 2.3. Discussion: Research Gaps and Motivations

Existing research on second-hand school uniforms in the UK is limited, particularly regarding the role of school-level incentives, government tax relief, or social media campaigns in influencing consumer behavior<sup>9</sup>. There is a lack of systematic analysis linking school-level communication to household behavior. Meanwhile, there is a lack of primary research data and secondary survey data on the second-hand school uniform market in the UK.

Based on these gaps, my motivation is to create a primary survey to know the second-hand school uniform market in the UK, and focus on integrating behavioral theory and circular economy principles into a microeconomic model of school uniform reuse, calibrated with novel survey data from UK households and supported by qualitative evidence from case studies. This approach tries to understand how price, stigma, and institutional design jointly shape adoption, and insights into whether school power or confluence can affect parents' and students' behavior, providing a basis for policy recommendations to promote sustainable school uniform practices. Then, I can advise my classmates to purchase second-hand school uniforms to decrease the family's financial pressure. Additionally, I will suggest that schools promote the value that wearing old clothes is a new fashion that supports low-carbon and environmentally friendly. Finally, I hope to remind the UK government to re-enact tax benefits to school uniforms' donors.

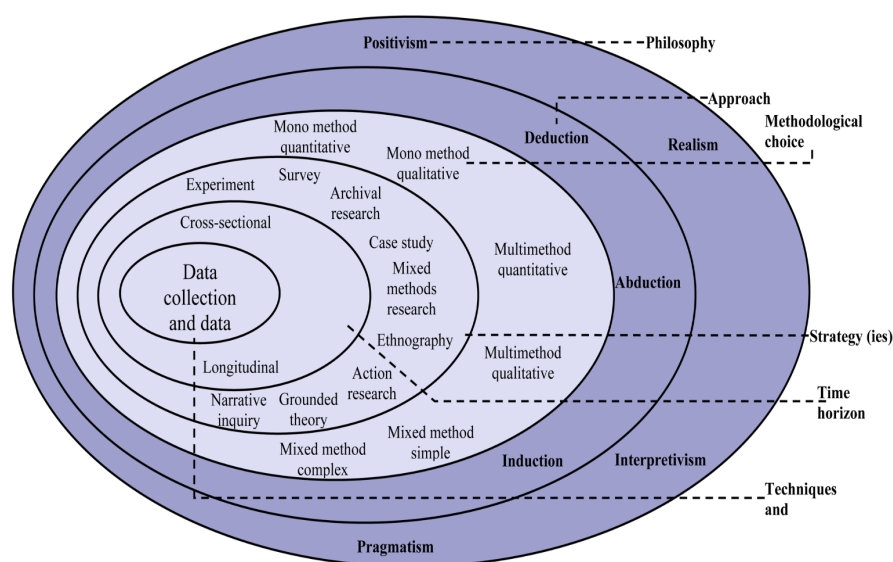
## 3. Research Framework

This section outlines the research framework adopted to investigate the second-hand school uniform market from a circular economy perspective. The study combines quantitative survey data with qualitative case studies to develop a simple theoretical model that formalizes household decision-making. I employ a mixed-methods research design combining survey data, case studies, and a theoretical microeconomic model. The quantitative component comprises a structured questionnaire targeting UK-based parents, students, and school staff, which provides data on attitudes, costs, and behaviors related to second-hand school uniforms. The qualitative component comprises two case studies of school-led uniform reuse programs in Leeds and Scotland, offering contextual insights into real-world circular economy practices. To complement the empirical evidence, I developed a simple theoretical model of household decision-making on second-hand school

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<sup>9</sup>Supply Chain Sustainability School Limited (2020): *Circular Economy—What Government Leadership Looks Like*.

uniform purchases. The module formalizes the feature households face, incorporates factor, such as stigma and environment benefits, and provides a welfare analysis and police simulations. Then, I use survey data to calibrate the theoretical model. This combined approach allows me to capture both observed behaviors and underlying mechanisms driving the adoption of second-hand school uniforms. **Figure 1** illustrates the “research onion” in this paper, with more details displayed as follows.



**Figure 1.** Research onion.

### 3.1. Survey Design

The questionnaire captures respondents’ demographics, motivations, awareness of the 3R (Reduce, Reuse, Recycle) concept, and the perceived costs and barriers to purchasing second-hand school uniforms. A non-probability snowball sampling method was used to reach UK residents through social media and community networks (YouTube, WhatsApp, WeChat). This approach allowed me to collect relevant responses efficiently from the target population. The full questionnaire and response statistics are provided in *Appendix. Survey Design and Data Collection*.<sup>10</sup>

In particular, I consider the *Online Survey Tips* as follows:

- 1) The respondents must live in the UK.
- 2) A plan for researching quantitative research using a single approach.
- 3) Conducting research surveys with a time frame, a cross-sectional analysis.
- 4) Techniques and methods of operation Data collecting that is structured.
- 5) The examination of Google chart.

<sup>10</sup>Survey link available

[https://docs.google.com/forms/d/e/1FAIpQLScwCnGqpIsBAh-DMgeQc2Kod3sXwG9JZATYyzCrJ40hKy9tYw/viewform?usp=sf\\_linkhere](https://docs.google.com/forms/d/e/1FAIpQLScwCnGqpIsBAh-DMgeQc2Kod3sXwG9JZATYyzCrJ40hKy9tYw/viewform?usp=sf_linkhere).

### 3.2. Theoretical Model

Finally, I developed a microeconomic model of household choice over second-hand uniform purchases. Each household decides whether to buy a reused uniform  $q_i \in \{0,1\}$  based on utility derived from price, social stigma, and environmental benefits (McFadden, 1972). The model specifies demand and supply functions, solves for market equilibrium, and conducts comparative statics to evaluate how changes in stigma or environmental awareness affect adoption. Using survey data for calibration, I estimated equilibrium prices and simulate counterfactual policy interventions—such as stigma reduction campaigns or subsidies—to assess their potential welfare effects.

**Table 1.** Questionnaire structure.

Theme	Key Questions
Demographics	Gender, Age, Nationality, Occupation, Household income level.
School Background	Type of school (state, private, special education), school communication on second-hand uniforms.
Purchase Behavior	Experience of buying second-hand uniforms in the past 3 years, purchasing channels (school shop, online, charity shop, peer-to-peer).
Motivations and Barriers	Reasons for buying (cost-saving, sustainability), reasons for not buying (hygiene concerns, fit issues, limited availability).
Savings and Cost Factors	Estimated yearly savings from purchasing second-hand uniforms.
Donation and Recycling	Attitudes toward donating uniforms, knowledge of the 3R principles, perceived barriers and opportunities for second-hand uniforms.
Upcycling and Sustainability Initiatives	Opinions on upcycling uniforms as a fashion trend, support for school initiatives promoting low-carbon lifestyle through reuse and redesign.

## 4. Survey Results and Discussions

### 4.1. Core Survey Findings

This section summarizes the key findings of the survey, highlighting the demographics of respondents, purchasing behavior and motivations, barriers to adoption, and opportunities for improving the second-hand school uniform market. **Figures 2-23** present descriptive statistics for the main survey questions.

#### 4.1.1. Demographics of Respondents

**Figure 2** shows that 53.2% of respondents were male and 46.8% female, while the majority were over forty years old (**Figure 3**), reflecting a strong representation of parents and school employees in the sample. In terms of nationality, local UK citizens accounted for 49.5%, followed by respondents from Asia (23.5%) (**Figure 4**). Most participants came from private schools (68.6%) or state schools (28.4%) (**Figure 5**), and the main occupations were students (44.3%) and parents or guardians (39.9%) (**Figure 6**). Household income distribution (**Figure 7**) suggests that middle- and high-income families are well represented, consistent with their par-

ticipation in private schooling.

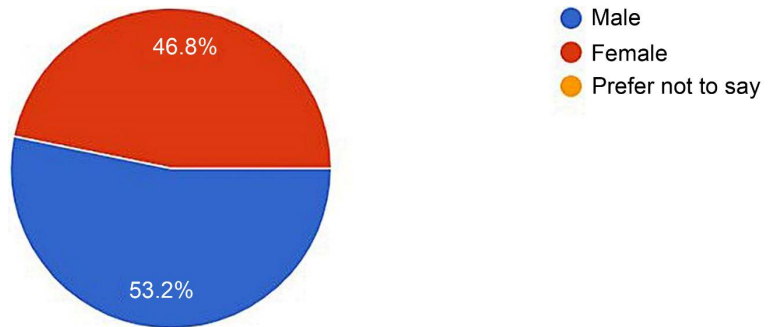


Figure 2. Gender.

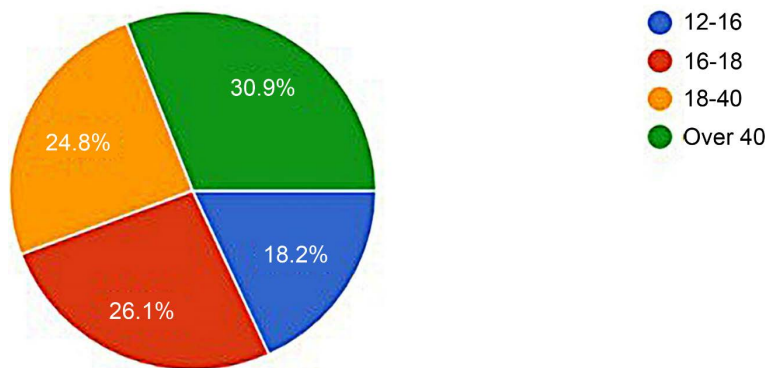


Figure 3. Age.

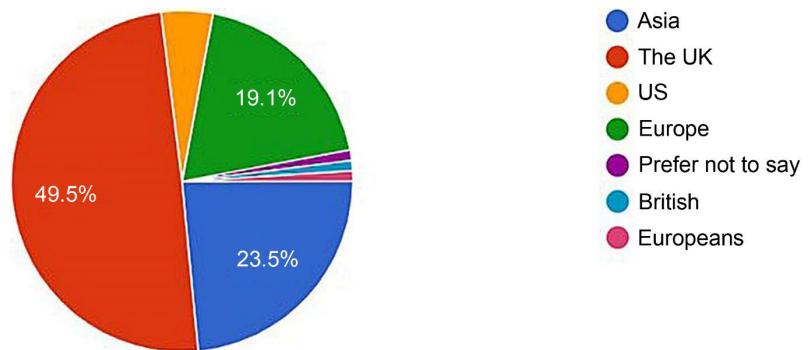


Figure 4. Where are you from?

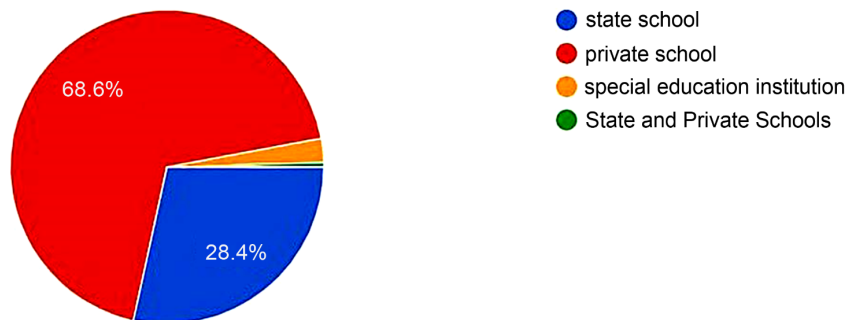


Figure 5. What type of school do you go to?

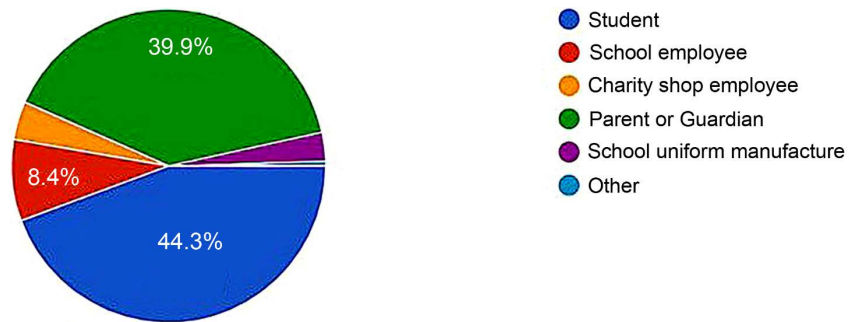


Figure 6. What is your occupation?

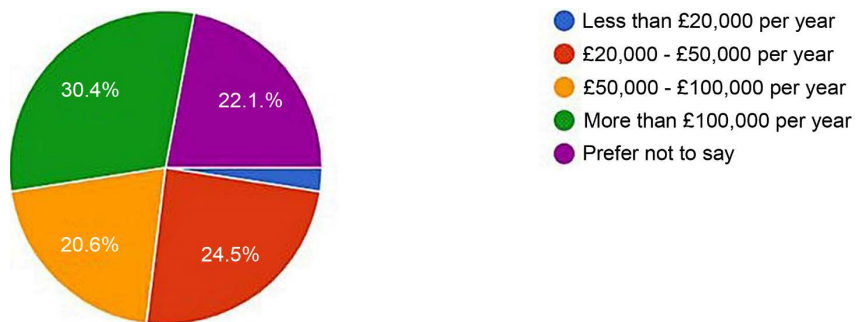


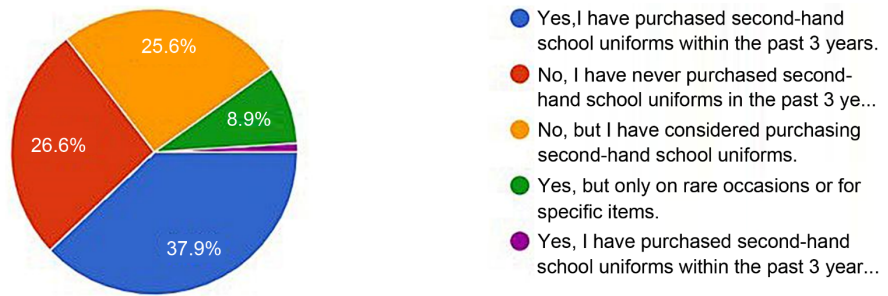
Figure 7. What is your family's household income level or yearly salary after taxes?

#### 4.1.2. Purchasing Behavior and Motivations

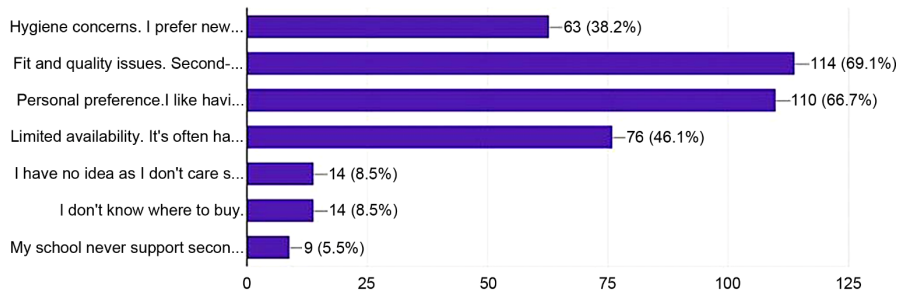
Nearly 40% of respondents reported purchasing second-hand uniforms in the past three years (Figure 8), while 26.6% had considered doing so. Figure 11 highlights that saving money (55%), environmental sustainability (55%), and the fast growth of children (49.7%) are the main drivers for buying second-hand uniforms, with school recommendations playing a smaller role (30.7%). As shown in Figure 12, most families reported savings between £100 and £600 annually from buying second-hand uniforms. Respondents typically purchased these items from school-organized shops or sale events (Figure 10), with a smaller share using online platforms or direct parent-to-parent exchanges. However, knowledge gaps persist: only 34.3% were both aware of and experienced in purchasing second-hand uniforms, while 24.5% were unfamiliar but willing to learn (Figure 13).

#### 4.1.3. Barriers to Adoption

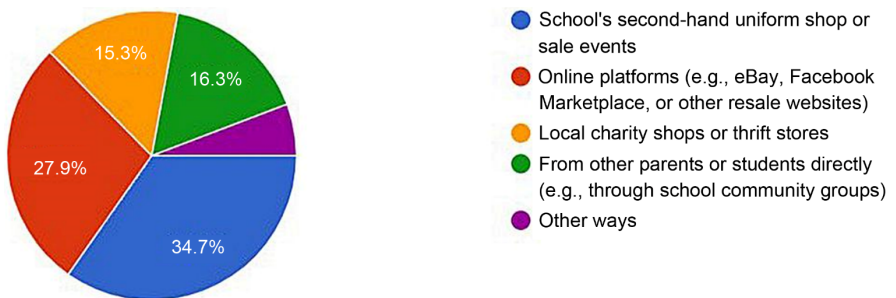
Among non-buyers, fit and quality issues (69.1%), personal preference for new clothing (66.7%), and hygiene concerns (38.2%) are the primary barriers (Figure 9). Social stigma and school policies requiring new uniforms are also significant constraints, with 64.9% and 48% of respondents citing these barriers, respectively (Figure 18). Communication gaps were evident: 34.3% of respondents reported never receiving school communications about second-hand options (Figure 14). Buyers most valued correct sizing, good condition, and affordability when considering purchases (Figure 15).



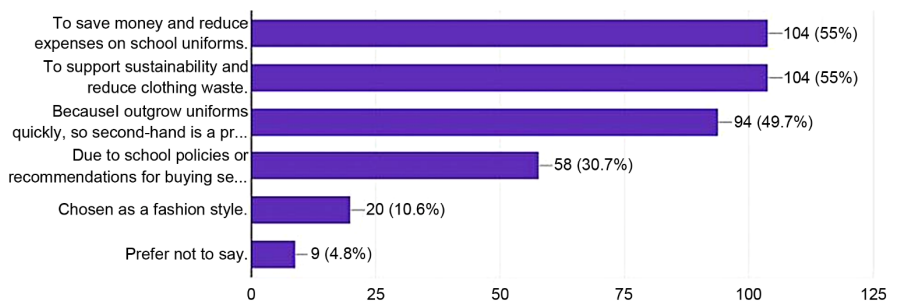
**Figure 8.** Have you ever purchased a second-hand school uniform in the past 3 years?



**Figure 9.** For whoever chooses no, please answer: Why do you not purchase second-hand school uniforms? You can choose from more options.



**Figure 10.** Where do you usually buy second-hand school uniforms?



**Figure 11.** Why do you buy second-hand school uniforms? You can choose from more options.

#### 4.1.4. Donations, Opportunities, and School Influence

Donation behavior appears underdeveloped: almost half of respondents were willing but had not donated (Figure 16), indicating untapped potential to expand second-hand supply. Most participants agreed that promoting sustainability (76.8%), cost

savings (61.5%), and stronger community ties (61.6%) are key opportunities for the market (Figure 19). However, only 27.4% considered schools as the main influence on uniform purchasing decisions, while many perceived individual or family factors as more important (Figure 17). Awareness of the 3R rules is limited, with only 13.4% fully understanding them (Figure 20), suggesting a need for education campaigns.

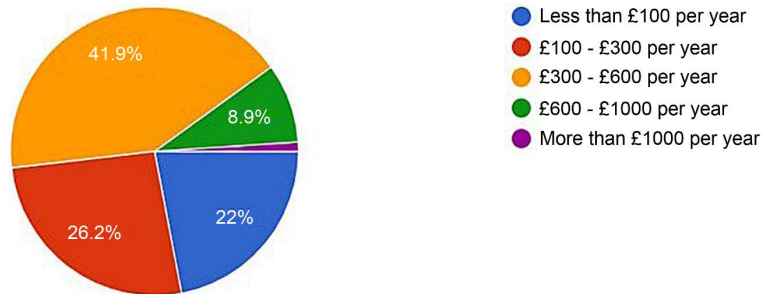


Figure 12. How much do you save to buy second-hand school uniforms yearly?



Figure 13. Do you know how to buy second-hand school uniforms?



Figure 14. Does your school send emails or letters to you to buy second-hand school uniforms?

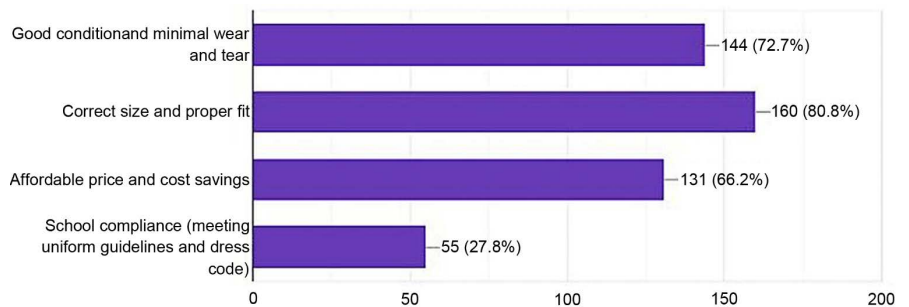


Figure 15. Which feature do you consider when buying second-hand school uniforms?



Figure 16. What is your attitude towards donating your school uniform?



Figure 17. Do you think schools are the leading influence on parents and students regarding second-hand school uniforms?

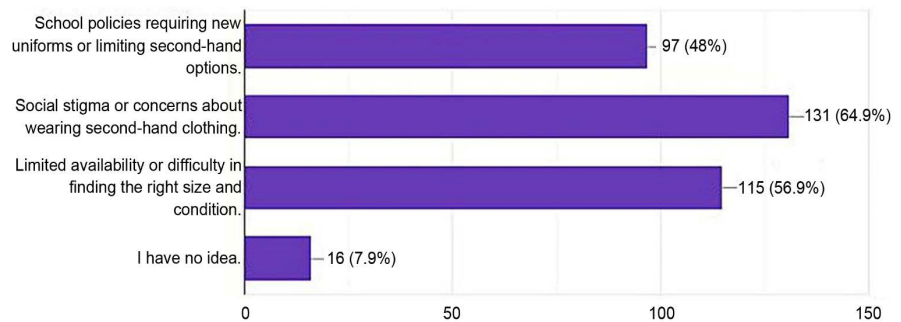


Figure 18. What do you think is a barrier to second-hand school uniforms?

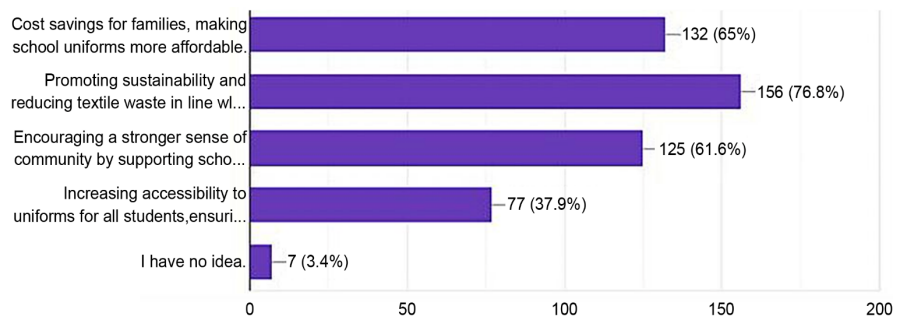


Figure 19. What do you think is an opportunity to second-hand school uniforms?

#### 4.1.5. Upcycling and Future Trends

Respondents expressed mixed views on upcycling and redesigning second-hand uniforms: 45.1% considered it possible but conditional on appealing designs and marketing support (Figure 22). Similarly, 47.7% would support school initiatives

promoting environmental protection through upcycling if proper resources and organization were provided (Figure 23). These findings suggest opportunities for schools to combine sustainability education with creative fashion approaches to increase acceptance of reused uniforms. I next provide further discussions for the results.

Overall, the survey highlights a strong latent demand for second-hand school uniforms driven by cost and environmental factors, yet hindered by stigma, perceived quality issues, and limited school involvement. Strengthening communication channels, ensuring quality and fit, expanding donation programs, and introducing online resale platforms (Figure 21) could significantly boost adoption. Coupled with policy incentives and educational campaigns on 3R principles, these measures would help integrate circular economy practices into UK school culture.

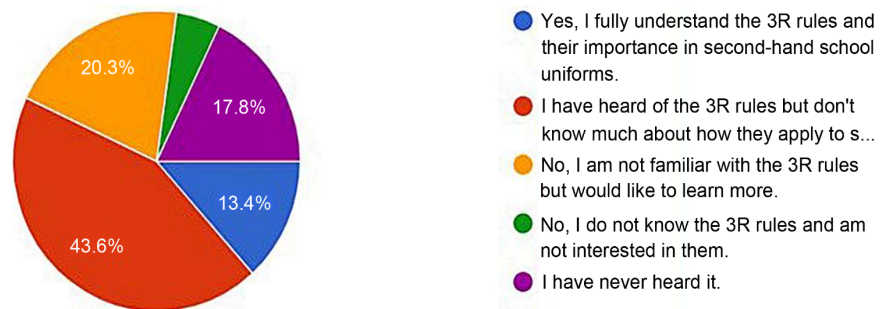


Figure 20. Do you know the rules of the 3R process for second-hand school uniforms in the UK?

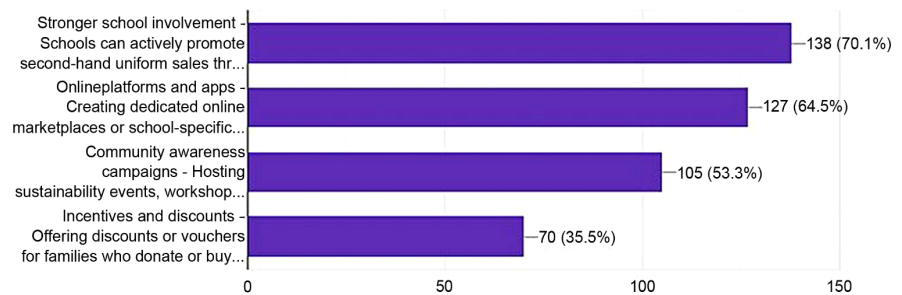


Figure 21. Do you think there is a way to improve second-hand school uniform marketing in the UK? You can choose from more options.

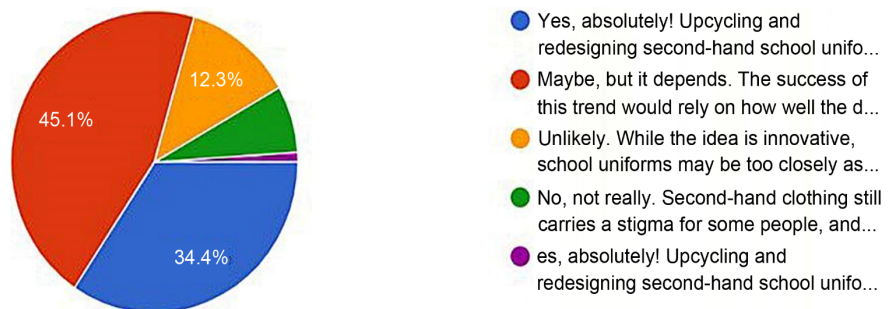


Figure 22. Do you think redesigning or upcycling second-hand school uniforms could create a new fashion trend among adolescents & the GZ group in the UK?



**Figure 23.** Would you support a school initiative promoting environmental protection and a low-carbon lifestyle by upcycling second-hand school uniforms, including rules and resource support?

## 4.2. Comparative Insights

This section explores how socio-demographic characteristics, household factors, and institutional roles affect engagement with the circular economy for school uniforms. I examined four dimensions: gender, school type, household income, and occupation, providing comparative insights into donation, purchasing, and communication behaviors related to second-hand school uniforms.

### 4.2.1. Gender Differences in Donation Behavior

**Figure 24** illustrates gender-based differences in donation attitudes. The data show that 43.42% of women and 53.92% of men are willing to donate their school uniforms, while 22.37% of women and 30.33% of men have already donated. This suggests that men display a slightly more positive attitude towards donation. Leveraging male community engagement could enhance overall donation rates, expanding the available supply of second-hand uniforms.

Gender	What's your attitude to donating your school uniform?				
	Actively donate	Willing to donate	Prefer to sell	Do not donate	Don't
Female	22.37%	43.42%	25.00%	6.58%	2.63%
Male	30.34%	53.93%	10.11%	1.12%	4.49%

**Figure 24.** Gender-related donation of second-hand school uniforms.

### 4.2.2. School Type and Consumer Preferences

Consumer preferences vary by school type, as shown in **Figure 25**. Across public, private, and special schools, over 70% of respondents value “good condition and minimal wear and tear” when considering second-hand uniforms, with special schools reporting 100%. Only 5.31% of private school respondents emphasized strict compliance with dress codes, possibly due to their familiarity with uniform guidelines. These results highlight that improving garment quality and comfort is essential to boosting adoption, addressing Research Objective 1 on consumer motivation.

### 4.2.3. Income Level, 3R Knowledge, and Savings

**Figure 26** presents the relationship between household income, understanding of the 3R principles, and annual savings from buying second-hand uniforms. Middle-

income families (£20,000 - £50,000) exhibit higher 3R awareness (35.29%) and report the greatest savings, often over £300 per year. Lower-income families (<£20,000) have less knowledge of 3R principles and achieve smaller savings (<£100). This suggests that circular economy awareness is unevenly distributed, potentially limiting adoption among lower-income households despite evident cost benefits.

School type	Percentage of know how to buy second hand	Which feature do you consider when buying second-hand school uniforms?			
		Affordable price and cost saving	Correct size, Good condition	Good condition and minimal wear and tear	School compliance(meeting uniform guidelines and dress code
State	73.81%	7.14%	11.90%	80.95%	0.00%
Private	73.45%	6.19%	15.04%	73.45%	5.31%
Special education	75%	0%	0%	100%	0%

**Figure 25.** Type of school and features considered when purchasing second-hand uniforms.

Family household income level £	Percentage of know 3R	Movey saved £			
		<100	300-600	600-1000	>1000
<20K	0.00%	100.00%	0.00%	0.00%	0.00%
20-50K	35.29%	8.82%	58.82%	5.88%	0.00%
50-100K	25.00%	6.90%	48.28%	20.69%	0%
>100K	9.43%	50.00%	0%	6.82%	4.55%
Prefer not to say	2.22%	20.45%	56.82%	2.27%	0%

**Figure 26.** Household income, 3R knowledge, and savings from second-hand uniforms.

#### 4.2.4. Occupation and Communication Channels

Occupation also shapes purchasing and communication patterns (Figure 27). While 53.25% of students and parents reported buying second-hand uniforms, 83.33% of charity shop employees did so, likely due to better access to supply channels. Moreover, 100% of school employees and manufacturers reported receiving email communication from schools about second-hand options, compared to only 12% of students. This suggests that information gaps exist for younger consumers, underscoring the need for better-targeted school communication strategies.

Occupation	Percentage of second-hand school uniform buyers	Second-hand school uniform buyers who received email form school
Student	53.25%	12.00%
Parent/guardian	35.82%	83.33%
Charity shop employee	83.33%	80.00%
School employee	60.00%	100.00%
School uniform manufacturer	50.00%	100.00%

**Figure 27.** Occupation, purchase behavior, and school communications on second-hand uniforms.

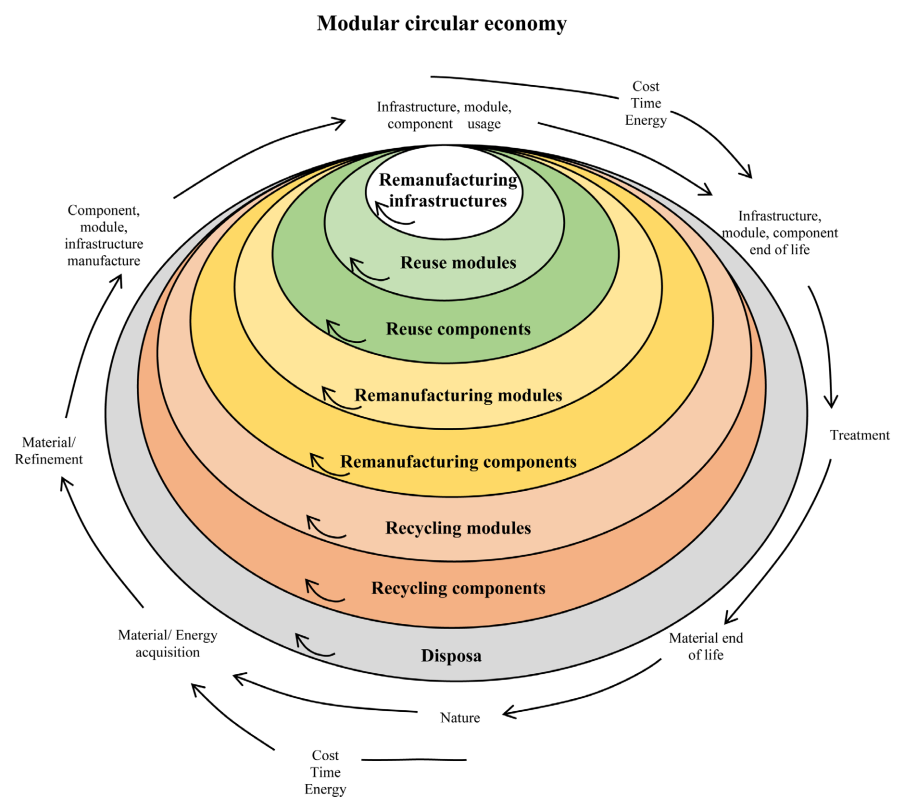
### 4.3. Results Interpretation, Case Studies, and Butterfly Module Analysis

Overall, the survey reveals that motivations to purchase second-hand uniforms are primarily driven by cost savings and environmental concerns, while barriers include personal preferences for new clothing, fit and quality issues, and social stigma. Communication gaps persist: 37.3% of respondents report never receiving school messages about second-hand options, suggesting room for improvement in policy implementation. Donation willingness is high but underutilized, offering potential to strengthen community-based supply channels (Akerlof & Kranton, 2002).

Fashion trends also play a role. Around 33.1% of respondents believe that upcycling and redesigning second-hand school uniforms could make them more attractive to adolescents and Gen Z consumers. Creative design initiatives and stronger school-led campaigns could reshape social norms, improve participation, and align uniform reuse with circular economy principles and low-carbon lifestyles.

Improving product features (correct size, good condition, affordability) and addressing school policy restrictions would likely increase adoption rates. These findings provide practical guidance for schools and charities in designing effective second-hand uniform programs, connecting individual motivations to institutional and community-level actions.

Building on broader literature, **Figure 28** illustrates a traditional circular economy approach applied in other industries (Mignacca & Locatelli, 2021), where



**Figure 28.** Traditional vs. modular circular economy approaches (Mignacca & Locatelli, 2021).

modular design reduces resource waste in energy infrastructure projects. In the fashion industry, shown in **Figure 29**, environmental impacts are driven by water use, carbon emissions, and waste generation.<sup>11</sup> Efforts to apply circular principles face challenges from complex supply chains and consumer behavior, yet young generations are increasingly receptive to sustainable fashion choices.

Inspired by these frameworks, a tailored butterfly diagram for school uniforms is proposed (**Figure 30**). It illustrates how reusable items are cleaned and redistributed, while damaged garments undergo repair or remanufacture before being redistributed to students, parents, or charities. Parent-Teacher Associations coordinate the process, supported by schools, councils, and volunteers, promoting environmental sustainability, cost savings, and community responsibility.



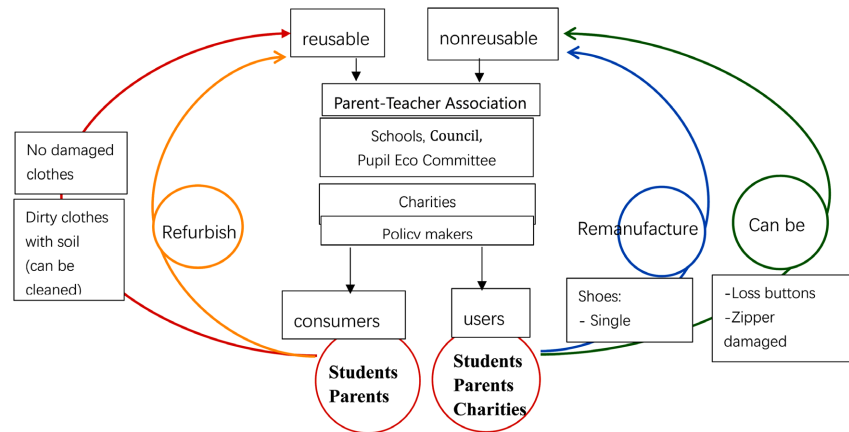
**Figure 29.** Circular economy in the fashion industry.

Two successful initiatives exemplify this approach. In Leeds, schools normalize reuse by offering year-round access to second-hand uniforms, respecting family comfort and privacy, and encouraging donations even of damaged items for repair or recycling<sup>12</sup>. In Scotland, schools collaborate with local uniform banks and com-

<sup>11</sup> <https://www.retailconsulting-advisory.co.uk/circular-economy-in-the-fashion-industry-challenges-and-actions-needed>.

<sup>12</sup>See Leeds School Uniform Exchange "an innovative way of diverting good quality school clothes from the bin and back into the hands of local families", available at: <https://www.youtube.com/shorts/BUZRjcxuUmQhttps://www.youtube.com/shorts/BUZRjcxuUmQ>.

munity groups to expand supply, distribute free or low-cost items, and involve pupils in CO<sub>2</sub> savings projects. Together, these efforts demonstrate how structured community engagement can overcome stigma, reduce textile waste, and build a sustainable school culture<sup>13</sup>.



**Figure 30.** Butterfly diagram module for second-hand school uniforms.

## 5. Theoretical Model of the Second-Hand School Uniform Market

### 5.1. Model Setup

In this section, I developed a simple microeconomic model to formalize how households decide whether to purchase second-hand school uniforms. Each representative household  $i$  faces a binary choice  $q_i \in \{0,1\}$ , where  $q_i = 1$  indicates purchase. I define the indirect utility from purchasing a second-hand uniform as:<sup>14</sup>

$$U_i = V_i - P_i - \lambda S_i + \theta E_i + \varepsilon_i, \quad (1)$$

where:

- $P_i \in \mathbb{R}^+$  denotes the effective price of the second-hand uniform relative to a new item;
- $S_i \in [0,1]$  measures perceived social stigma attached to second-hand clothing;
- $E_i \in [0,1]$  captures environmental awareness or intrinsic satisfaction from sustainable consumption;
- $\lambda > 0$  and  $\theta > 0$  are the marginal utility coefficients associated with stigma (negative) and environmental motives (positive);
- $V_i$  reflects baseline utility from owning a uniform (fit, quality);
- $\varepsilon_i$  represents an idiosyncratic preference shock.

<sup>13</sup>School uniform and clothing banks, Connect, 2024 Scottish Parent Teacher Council. available at: <https://www.connect.scot/resources/school-uniform-and-clothing-banks>.

<sup>14</sup>This additive separable utility specification follows standard discrete choice theory (McFadden, 1972), where price reduces utility due to budget constraints, stigma reduces perceived quality or social payoff, and environmental benefits increase non-monetary utility. The assumption of linear separability simplifies estimation and aligns with consumer theory under quasi-linear preferences.

A household chooses  $q_i = 1$  if and only if:

$$U_i \geq 0 \Leftrightarrow V_i - P_i - \lambda S_i + \theta E_i + \varepsilon_i \geq 0. \quad (2)$$

Assuming  $\varepsilon_i$  follows a standard logistic distribution, the choice probability is given by:

$$\Pr(q_i = 1 | P_i, S_i, E_i) = \frac{1}{1 + \exp(-(\alpha - \beta P_i - \lambda S_i + \theta E_i))}, \quad (3)$$

where  $\alpha$  captures the population average of  $V_i$  and  $\beta > 0$  denotes price sensitivity.

*Aggregate Demand:* Given a population of  $N$  heterogeneous households  $i$ , aggregate demand  $Q_d(P, S, E)$  is defined as:

$$Q_d(P, S, E) = \frac{1}{N} \sum_{i=1}^N \Pr(q_i = 1 | P, S, E). \quad (4)$$

Under the representative agent assumption with homogeneous parameters  $(\alpha, \beta, \lambda, \theta)$ , the aggregate demand simplifies to:

$$Q_d(P, S, E) = \frac{1}{1 + \exp(-(\alpha - \beta P - \lambda S + \theta E))}. \quad (5)$$

This captures the expected adoption rate as a function of price, stigma, and environmental awareness.

*Market Supply:* Supply of second-hand uniforms depends on donations and school-managed resale systems. Higher compensation or resale prices incentivize greater participation by suppliers (parents, charities). I assume a linear supply:

$$Q_s(P) = a + bP, \quad b > 0. \quad (6)$$

This is a standard competitive market approximation.<sup>15</sup>

## 5.2. Market Equilibrium

Equilibrium price  $P^*$  and adoption  $Q^*$  are defined by:

$$Q_d(P^*, S, E) = Q_s(P^*). \quad (7)$$

Substituting equations (5) and (6):

$$\frac{1}{1 + \exp(-(\alpha - \beta P^* - \lambda S + \theta E))} = a + bP^*. \quad (8)$$

Rearranging:

$$\exp(-(\alpha - \beta P^* - \lambda S + \theta E)) = \frac{1 - a - bP^*}{a + bP^*}. \quad (9)$$

Taking natural logarithms gives an implicit equation for  $P^*$ :

<sup>15</sup>This specification follows classical partial equilibrium theory where supply is upward sloping in price (Varian, 2003). While donations are not perfectly price-elastic, small monetary incentives (e.g., vouchers or resale credits) positively correlate with supply volume.

$$-\alpha + \beta P^* + \lambda S - \theta E = \ln \left( \frac{1-a-bP^*}{a+bP^*} \right). \quad (10)$$

The solution  $P^*(S, E)$  can be obtained numerically. Equilibrium adoption is  $Q^* = Q_d(P^*, S, E)$ .

### 5.3. Comparative Statics

To analyze welfare effects of changes in stigma  $S$  or awareness  $E$ , consider the total derivative of the equilibrium condition:

$$\frac{\partial Q_d}{\partial P} dP^* + \frac{\partial Q_d}{\partial S} dS + \frac{\partial Q_d}{\partial E} dE = b dP^*. \quad (11)$$

Solving for  $\partial P^*/\partial S$ :

$$\frac{\partial P^*}{\partial S} = \frac{-\partial Q_d/\partial S}{\partial Q_d/\partial P - b}. \quad (12)$$

From (5),

$$\frac{\partial Q_d}{\partial S} = -\lambda Q_d(1-Q_d), \quad \frac{\partial Q_d}{\partial P} = -\beta Q_d(1-Q_d).$$

Therefore:

$$\frac{\partial P^*}{\partial S} = \frac{\lambda Q_d(1-Q_d)}{\beta Q_d(1-Q_d) + b} > 0, \quad (13)$$

implying that higher stigma raises equilibrium prices (supply needs higher price to meet lower demand) but reduces  $Q^*$  since:

$$\frac{\partial Q^*}{\partial S} = \frac{\partial Q_d}{\partial P} \frac{\partial P^*}{\partial S} + \frac{\partial Q_d}{\partial S} < 0.$$

Analogously,  $\partial Q^*/\partial E > 0$ : higher environmental awareness increases adoption.

### 5.4. Parameter Calibration with Survey Data

#### 5.4.1. Parameter Calibration

I use the 207 survey responses to estimate the parameters of the demand function.

In specific,

- Price  $P$ : annual cost savings suggest a range £50 - £400.
- Stigma  $S$ : 57.9% of respondents report stigma, mapped to mean  $\approx 0.58$ .
- Environmental awareness  $E$ : 35.4% fully aware of 3R rules, mean  $\approx 0.4 - 0.5$ .
- Purchase  $q_i$ : 40% purchase, 23.6% consider, 27.9% refuse.

Fitting the logit model (3) yields:

$$\hat{Q}_d = \frac{1}{1 + \exp(-(8.15 - 0.0205P - 4.067S + 2.521E))}. \quad (14)$$

with linear supply  $Q_s = -0.1 + 0.003P$ , the numerical solution gives:

$$P^* \approx \text{£}305, \quad Q^* \approx 0.82.$$

Thus, under current conditions, about 82% of households would adopt second-

hand uniforms if market prices equilibrate near £305.

#### 5.4.2. Policy Interventions Analysis

##### Baseline Scenario

With stigma  $S = 0.58$  and environmental awareness  $E = 0.45$ , the equilibrium results are:

$$P_0^* = £294.97, \quad Q_0^* = 78.5\%.$$

This serves as the reference point for policy comparison.

##### Scenario 1: Stigma Reduction

Reducing social stigma by 20% ( $S = 0.464$ ) shifts the demand curve upward, yielding:

$$P_1^* = £304.09, \quad Q_1^* = 81.2\%.$$

Demand expansion increases both equilibrium price and adoption by approximately 2.7 percentage points relative to baseline.

##### Scenario 2: Price Subsidy

A 10% price subsidy reduces effective prices for households to  $P(1-0.1)$ , resulting in:

$$P_2^* = £308.36, \quad Q_2^* = 82.5\%.$$

This policy raises adoption by around 4.0 percentage points compared to baseline.

To sum up, both policy interventions significantly promote the adoption of second-hand school uniforms. While price subsidies generate a slightly stronger short-term effect, reducing social stigma also enhances market outcomes by improving acceptance among parents and students. Implementing both measures in tandem could further accelerate adoption and strengthen the circular economy framework within UK schools.

Finally, the broader implications of this model merit attention. The calibrated framework offers a theoretically grounded basis for examining how price, social stigma, and environmental awareness jointly shape market outcomes. Comparative statics suggest that policy interventions targeting stigma reduction ( $\Delta S < 0$ ) or subsidies ( $\Delta P < 0$ ) will shift the demand curve upward, increase equilibrium adoption, and enhance circular economy performance in UK schools.

## 6. Conclusion

The findings reveal four main barriers: i) personal preferences for new clothing, concerns about fit, quality, and hygiene; ii) persistent social stigma attached to second-hand uniforms; iii) limited school communication and lack of formal policies to promote reuse; and iv) low awareness of the 3R principles among families. Despite these challenges, opportunities exist: most respondents value cost savings, environmental benefits, and community support from reuse programs. Theoretical modeling shows that price subsidies increase adoption in the short term, while stigma reduction improves long-term social acceptance. A combined policy approach is the most effective in fostering a sustainable second-hand uniform market.

From a policy perspective, the study highlights the need for stronger institutional involvement. Schools and Parent-Teacher Associations (PTAs) should establish standardized quality controls, reliable donation and exchange systems, and consistent communication channels (emails, online platforms, school shops) to improve accessibility and trust. Broader educational campaigns can increase 3R awareness, normalize reuse behavior, and embed sustainability values into school culture. Government support in the form of incentives or funding for school-based programs could further accelerate circular economy adoptions in education. This study has two limitations. The survey design lacked skip logic in certain questions, which could have potentially affected the precision of responses regarding non-purchasing behavior. Moreover, the limited policy of tax documentation on second-hand school uniforms constrained the analysis of broader regulatory effects.

Future research could use longitudinal data to evaluate long-term impacts of tax policy interventions, incorporate government stakeholders to study institutional incentives, and quantify the environmental benefits of large-scale second-hand uniform programs.

## Acknowledgements

*About Research Motivation:* With the introduction of Value Added Tax (VAT) on private schools in 2024 by the British government, my classmates and I faced additional financial pressures. My friend, who attends a state school, also believes that living costs have risen significantly since the COVID-19 pandemic. Across the UK, many families have gradually shifted their focus from spending on quantity to prioritizing quality, dedicating more time to managing household finances—for example, moving to smaller houses and purchasing second-hand items. In recent years, parents and students have increasingly considered using pre-owned clothes and books to reduce expenses related to school fees. While the second-hand school uniform supply chain has met some of these needs, nearly half of parents and students remain unaware of how to purchase second-hand school uniforms effectively. Through my research, I discovered that school communication systems are often inadequate. I believe that parent-teacher associations (PTAs) could play a critical role in building donation platforms, bridging the gap between schools and families, and solving key issues for both buyers and sellers. My goal is to develop a “butterfly diagram” framework to improve the security of second-hand school uniform transactions and enhance school service chain efficiency, thereby encouraging more students to use pre-owned uniforms. In addition, I participated in a United Nations initiative called Voices for Values, which aims to promote Sustainable Development Goal (SDG) 12 from the United Nations in ECE 2017. This project seeks to drive the transition toward a circular economy by encouraging sustainable consumption patterns through innovative technologies and the principles of reducing, reusing, and recycling (3R). These advancements are reshaping the life cycle of school uniforms—from production and use to disposal and recycling—helping reduce waste and extend their lifespan. *About My Supervisor:*

I am sincerely grateful to Mr. David Morgan for his invaluable guidance throughout this research project. He provided detailed advice on designing survey questionnaires, collecting data, and constructing economic models. He also carefully proofread and reviewed my drafts during the Extended Project Qualification (EPQ), ensuring academic rigor and clarity. His encouragement inspired me to broaden the scope of this research and emphasize the global importance of examining sustainability in education and everyday life. I would also like to express my heartfelt thanks to Harrow School in the UK and the Summer School at Harvard University in the US for their support during this project. Furthermore, I would like to thank my parents and family members for their moral support and for continuing to encourage and guide me during the low points of scientific research. Finally, I would also like to thank the students and teachers at Harrow School and the parents from Global who finished my survey form. For 207, their mutual help and cooperation enabled the originally seemingly impossible task to be gradually completed step by step. It is precisely because of the individuals mentioned above that I can complete scientific research projects and papers. I want to express my heartfelt thanks here!

### Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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## Appendix. Survey Design and Data Collection

To investigate the UK second-hand school uniform market from a circular economy perspective, I conducted an online survey via *Google Forms*.<sup>16</sup> The questionnaire targeted students, parents or guardians, school staff, and related stakeholders. A total of 207 valid responses were collected. All questions and response options are listed below. The questionnaire was structured into several thematic blocks, as summarized in **Table 1**. Most questions were multiple-choice with optional open-text responses.

### 1. Gender

- (a) Male
- (b) Female
- (c) Prefer not to say

### 2. Age

- (a) 12 - 16
- (b) 16 - 18
- (c) 18 - 40
- (d) Over 40

### 3. Nationality

- (a) Europeans
- (b) Asia
- (c) British
- (d) American
- (e) Prefer not to say

### 4. Occupation (continue if you are student, parent, or guardian)

- (a) Student
- (b) Parent or Guardian
- (c) Charity shop employee
- (d) School uniform manufacturer
- (e) School employee

### 5. School type (your or your children's education background)

- (a) State school
- (b) Private school
- (c) Special education institution
- (d) Other

### 6. Household income (annual, after taxes)

- (a) Less than £20,000 per year
- (b) £20,000 - £50,000 per year
- (c) £50,000 - £100,000 per year
- (d) More than £100,000 per year

<sup>16</sup>See google Survey

[https://docs.google.com/forms/d/e/1FAIpQLScwCnGqpIsBAh-DMgeQc2Kod3sXwGi9JZATYyzCrJ40hKy9tYw/viewform?usp=sf\\_link](https://docs.google.com/forms/d/e/1FAIpQLScwCnGqpIsBAh-DMgeQc2Kod3sXwGi9JZATYyzCrJ40hKy9tYw/viewform?usp=sf_link) entitled "Examining the UK Second-Hand School Uniform Market Through Circular Economy Perspective".

(e) Prefer not to say

**7. Have you purchased a second-hand school uniform in the past 3 years?**

(a) Yes, I have purchased second-hand school uniforms within the past 3 years.

(b) No, I have never purchased second-hand school uniforms.

(c) No, but I have considered purchasing second-hand school uniforms.

(d) Yes, but only on rare occasions or for specific items.

**8. [If answered “No”] Why do you not purchase second-hand school uniforms?**

**(multiple choice)**

(a) Hygiene concerns (worry about cleanliness even if washed)

(b) Fit and quality issues (may not fit well or be in good condition)

(c) Personal preference (prefer brand-new uniforms)

(d) Limited availability (hard to find right size/items)

(e) I don't care about school uniforms

**9. Where do you usually buy second-hand school uniforms?**

(a) School's second-hand uniform shop or sale events

(b) Online platforms (e.g., eBay, Facebook Marketplace)

(c) Local charity shops or thrift stores

(d) From other parents or students directly (e.g., school community groups)

**10. Why do you buy second-hand school uniforms? (multiple choice)**

(a) To save money and reduce expenses

(b) To support sustainability and reduce clothing waste

(c) Because children outgrow uniforms quickly

(d) Due to school policies or recommendations

**11. Yearly savings from buying second-hand school uniforms**

(a) Less than £100

(b) £100 - £300

(c) £300 - £600

(d) £600 - £1000

(e) More than £1000

**12. Do you know how to buy second-hand school uniforms?**

(a) Yes, I know and have done so before

(b) Yes, I know but have never purchased

(c) No, but interested to learn

(d) No, and not interested

**13. Does your school send emails or letters about second-hand uniforms?**

(a) Yes, regularly

(b) Yes, occasionally or during events

(c) No

(d) Not sure

**14. Features you consider when buying second-hand uniforms**

(a) Good condition and minimal wear

(b) Correct size and proper fit

(c) Affordable price and cost savings

(d) School compliance (dress code)

**15. Attitude to donating school uniforms**

- (a) Actively donate
- (b) Willing to donate but haven't yet
- (c) Prefer to sell rather than donate
- (d) Do not donate and have no plans
- (e) Don't know who accepts old clothes

**16. Do you think schools are the leading influence on parents/students?**

- (a) Yes, schools play the biggest role
- (b) Schools have some influence but other factors matter more
- (c) No, decisions are independent
- (d) Not sure

**17. Barriers to second-hand school uniforms**

- (a) School policies requiring new uniforms
- (b) Social stigma or concerns
- (c) Limited availability or sizing issues
- (d) Lack of awareness or promotion by schools

**18. Opportunities for second-hand school uniforms**

- (a) Cost savings for families
- (b) Promoting sustainability and reducing textile waste
- (c) Encouraging a stronger sense of community
- (d) Increasing accessibility to uniforms for all students

**19. Do you know the 3R rules for second-hand school uniforms?**

- (a) Yes, fully understand
- (b) Have heard of them but not much detail
- (c) No, but would like to learn
- (d) No, and not interested

**20. Ways to improve second-hand uniform marketing (multiple choice)**

- (a) Stronger school involvement (newsletters, PTA)
- (b) Online platforms or apps for easier exchange
- (c) Community awareness campaigns
- (d) Incentives or discounts for donations/purchases

**21. Do you think redesigning/upcycling could create a new fashion trend?**

- (a) Yes, absolutely
- (b) Maybe, depends on appeal and marketing
- (c) Unlikely
- (d) No, second-hand stigma remains

**22. Would you support a school initiative for upcycling uniforms?**

- (a) Yes, absolutely
- (b) Maybe, with proper organization and funding
- (c) Not sure, depends on quality and acceptance
- (d) No, second-hand not widely accepted