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Plastic Waste Challenges and Recycling Innovation in Malaysia: From Waste to Wealth Jacquet Suit

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ABSTRACT
Plastic waste is a big problem for people's health and the environment around the world. Plastic makes up the third most waste in the world, and the amount of plastic waste is growing because the world's population and per capita usage are both rising. Malaysia has been the biggest importer of plastic waste in the world since 2017. It keeps an eye on global trends in total plastic waste production and single-use plastic usage. These things make the country's waste management system very difficult to use. This study describes the current state of making and dealing with plastic waste in Malaysia, including options like burning, recycling, and throwing it away. This research focuses on *how to recycle used plastic bottles into fashion materials that can be used for something else. This study chose two different types of subjects to find out how plastics are managed in Malaysia right now. Respondents were design students and fashion buyers. Each group looked at a different problem with the hope that the results would help fashion students come up with ideas for making things out of plastic waste.*

Keywords: *waste Plastic bottle1, Environment2, fashion design3.*

1 INTRODUCTION

According to Chen (2017) since 2000 the business that makes plastic has had one of the fastest growth rates of any. Malaysia has one of the biggest plastic industries in the world (2018), with over 1,300 makers. In 2016, resins worth 30 billion Malaysian Ringgits (MYR) were sent to plastic manufacturers all over the world. There are seven key sectors in Malaysia's plastic industry. These are agriculture, household, packaging, building, electronics, automotive, and other sub-sectors like medical devices and plastic furniture. Following a trend seen around the world, packing is the main use for plastic made in Malaysia, National Solid World Management (2015). Malaysia's waste management systems aren't up to the task of dealing with the huge amount of plastic waste that is made, just like those in most growing Southeast Asian countries. In this country, the main ways to get rid of plastic waste are to put it in dumps or burn it at home. Household waste production in Malaysia runs from 0.85 kg to 1.5 kg per person per day, depending on where they live and their income. In Malaysia, people make more household waste than in poor countries like Indonesia and the Philippines, where each person makes 0.22 kg and 0.4 kg of waste every day.

Malaysia is keeping an eye on world trends in both the amount of plastic waste made and the number of single-use plastics used. Since the 1970s, both have been going up. 19% of all the waste that was made in Malaysia in 2007 was plastic waste. 74 percent of this waste was single-use plastic films. Rigid

plastics and foam plastics made up 17 and 19 percent, respectively. As far as the amount of plastic in solid waste goes, Malaysia is second only to the Philippines in Asia. Malaysia will be making more than 0.94 million tonnes of improperly handled plastic waste every year by 2018. For Moh and Manaf (2017), one of the biggest environmental issues in Malaysia is dealing with solid waste. This is because the country's population is growing and more landfills are being built. Some of these problems are pollution of the air, water, and land, and climate change caused by the release of greenhouse gases into the atmosphere during production. A lot of the problems come from the fact that plastics are strong and last a long time in the world.

Table 1 Types of plastic bottles and products

Code & Type	Common Uses	Recycling Notes	Examples of Recycled Products
1 – PETE (Polyethylene Terephthalate)	Soda/water bottles, medicine containers, consumer packaging	Widely accepted; easy to recycle	Jacket filling, sleeping bag filling, rope, car bumpers, sails, furniture, new bottles, clothes
2 – HDPE (High-Density Polyethylene)	Detergent bottles, milk jugs, shampoo bottles, motor oil containers	Widely accepted; easy to recycle	Toys, piping, plastic lumber, rope
3 – PVC (Polyvinyl Chloride)	Pipes, shower curtains, medical tubing, vinyl dashboards, baby bottle nipples	Rarely accepted; low recyclability	Limited uses due to recycling challenges
4 – LDPE (Low-Density Polyethylene)	Wrapping films, grocery bags, sandwich bags	Rarely accepted; low recyclability	Limited uses due to recycling challenges
5 – PP (Polypropylene)	Tupperware, food containers	Rarely accepted; low recyclability	Limited uses due to recycling challenges
6 – PS (Polystyrene/Styrofoam)	Coffee cups, disposable cutlery, meat trays, packing peanuts, insulation	Accepted in some places; useful to recycle	Cassette tapes, rigid foam insulation
7 – Other/Mixed Plastics	Mixed or specialty plastics, unmarked plastics	Hardest to recycle; rarely collected	Best returned to manufacturers for proper disposal

2 LITERATURE REVIEW

Malaysia generates substantial quantities of plastic waste, with estimates ranging from hundreds of thousands to millions of tonnes annually (World Bank, 2021). A global assessment by Jambeck et al. (2015) ranked Malaysia as the eighth largest contributor to mismanaged plastic waste, with approximately 0.94 million tonnes generated in the last decade. National waste management reports highlight persistent challenges in addressing single-use plastics, particularly polyethylene terephthalate (PET) bottles, which constitute a significant share of packaging waste (Kementerian Alam Sekitar dan Air (KASA, 2021). PET bottles, commonly used for beverages, are among the most recyclable plastic types due to their chemical properties and established processing technologies (MPMA, 2020). However, while PET collection rates in Malaysia are higher than other plastic resins, they remain relatively low—averaging between 30% and 36% in pre-2020 reports (World Bank, 2021). Industry studies indicate that recycling capacity exists domestically, but logistical limitations, inconsistent collection systems, and feedstock contamination hinder full utilisation (MPMA, 2020).

The increasing accumulation of plastic waste has become a major environmental concern worldwide, prompting designers and researchers to explore innovative approaches that transform waste materials into valuable products. The concept of waste-to-wealth emphasises the conversion of discarded materials into resources with economic, social, and environmental value. Within the fashion industry, this approach is increasingly associated with sustainable design practices that reduce waste generation while promoting resource efficiency. Kamarulbaharin (2022) demonstrated that discarded textile materials can be reconstructed and reused as new materials for product development, highlighting the potential of waste materials as alternative resources rather than disposable items. Similarly, Hui, Aris, and Rusli (2024) that sustainable fashion practices contribute significantly to environmental preservation and support the development of a responsible fashion ecosystem.

The integration of recycled materials into fashion products also aligns with the broader principles of circular economy and sustainable consumption. Sustainable fashion encourages designers to extend material life cycles through recycling, upcycling, and creative material innovation. According to Mazani, et. al (2026), sustainable design practices can generate economic opportunities while simultaneously addressing environmental concerns through creative value creation. In addition, Haron, et al. (2026) highlighted the importance of integrating functionality, sustainability, and user-centred design in product development, suggesting that innovative material applications can enhance both product value and consumer acceptance. These perspectives support the notion that plastic waste can be transformed into aesthetically appealing and functional fashion products without compromising sustainability objectives.

Furthermore, environmental awareness plays a crucial role in encouraging sustainable consumption and waste reduction practices. Azlani, Ghazali, and Che Din (2026) the importance of visual communication and environmental awareness in influencing public understanding of pollution issues, including microplastic contamination. Such awareness encourages consumers and designers to support environmentally responsible alternatives, including products developed from recycled plastic waste. Therefore, transforming plastic waste into fashion products represents a practical waste-to-wealth strategy that not only minimises environmental pollution but also creates economic value through sustainable fashion innovation, creative entrepreneurship, and responsible resource utilisation.

There are over 100 kinds of plastics, but six are the most common. Each type is marked with a number (1–7) inside a triangle of arrows, a system created by the Society of the Plastics Industry (SPI) in 1988. These codes make it easier for consumers, recyclers, and manufacturers to identify and sort plastics for recycling. Overall, plastics fall into four main categories based on how easily they can be recycled. The reuse of waste plastic bottles, particularly those made from polyethylene terephthalate (PET), presents an innovative and sustainable approach to garment manufacturing. PET possesses excellent recyclability and can be converted into polyester fibres through a process involving collection, cleaning, shredding, melting, and extrusion. These fibres are then spun into yarn and woven or knitted into fabrics that can be used in the production of jacket suits.

Malaysia generates a large volume of solid plastic waste—various studies report production ranging from hundreds of thousands to millions of tonnes annually. A global study ranked Malaysia among the top countries for *mismanaged plastic waste* (placed 8th in the analysis by Jambeck et al. (2015), with an estimated ~0.94 million tonnes of mismanaged plastic in the past decade. National statistics and current assessments highlight challenges in waste management, including single-use PET bottles that make up a significant portion of packaging waste. The literature highlights several major pathways through which plastic bottles end up as pollution: illegal dumping, inefficient domestic waste management, uncovered landfills, and leakage from broken collection systems. Lightweight bottles are easily carried by wind or water into drainage systems, eventually reaching rivers and the sea, contributing to marine pollution and microplastic accumulation. Coastal and marine studies in Malaysia report high levels of plastic waste at many shoreline sites.

Malaysian government has introduced several policy documents and initiatives—such as the *Malaysia Roadmap Towards Zero Single-Use Plastics (2018–2030)* and the *Malaysia Plastics Sustainability / Circularity Roadmap*—aiming to reduce single-use plastics and improve recycling rates. Following the ban on contaminated plastic imports (post-China ban in 2018), Malaysia enforced the return of prohibited plastic containers and shut down illegal recycling facilities. National recycling rate targets have been set higher (e.g., 40%+ by 2025/2030 in some plans). However, implementation faces challenges due to incomplete coordination of separation-at-source systems at the local level

From an environmental perspective, transforming waste bottles into wearable garments offers multiple benefits. This process diverts significant amounts of plastic waste from landfills and waterways, contributing to the reduction of environmental pollution. Furthermore, manufacturing recycled polyester consumes less energy and water compared to producing virgin polyester, thereby lowering greenhouse gas emissions and resource depletion. From a design and production standpoint, recycled polyester derived from PET bottles offers several desirable qualities for jacket suits. It is durable, lightweight, wrinkle-resistant, and retains colour well, making it suitable for both formal and casual jacket designs. Advances in textile finishing have also enabled the creation of recycled polyester fabrics with softer textures and enhanced comfort, comparable to high-quality virgin fabrics.

According to Malaysia's Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC), plastic has overtaken other materials in versatility and functionality (Mestecc, 2019). With about 1,300 active manufacturers, Malaysia is a major global producer but ranks 8th among countries with the highest levels of mismanaged plastic waste. Of the 0.94 million tons generated, 0.14–0.37 million tons flow into the oceans. Single-use plastics—such as packaging, bags, and straws—are widely discarded after one use. Since polyethylene's invention in the 1950s, humans have produced 8.3 billion tons of plastic, and projections indicate that by 2050, this could rise to 34 billion tons—equivalent to four Argentine provinces (New Straits times, 2018). The crisis extends beyond land, continuing to suffocate marine ecosystems worldwide.

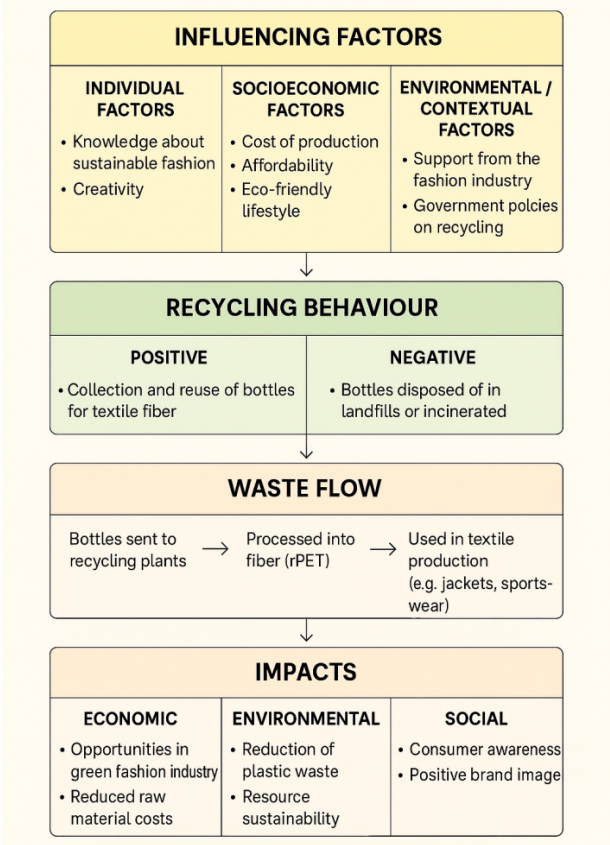

Figure 1 Theoretical framework of Factors Influencing Clothing Production from Discarded Plastic Bottles

The transformation of waste plastic bottles into clothing products is influenced by several interconnected factors that determine recycling behaviour, waste flow, and the resulting impacts. These factors can be categorised into individual, socioeconomic, and environmental/contextual domains.

Firstly, individual factors such as knowledge about sustainable fashion and creativity are essential in shaping innovative solutions for waste reduction. People who are aware of eco-friendly practices and possess creative skills are more likely to explore alternative uses of plastic waste, such as converting it into textile fibre for clothing.

Secondly, socioeconomic factors like the cost of production, affordability, and eco-friendly lifestyle play a significant role. The feasibility of producing clothing from recycled bottles depends on whether the production costs are competitive compared to conventional textiles. Furthermore, consumers' willingness to purchase eco-friendly products is influenced by their lifestyle choices and financial capability.

Thirdly, environmental and contextual factors include support from the fashion industry and government policies on recycling. Industry adoption and government incentives encourage large-scale recycling initiatives, making it possible for waste bottles to be repurposed into useful textile products. Without these structural supports, the recycling process may remain limited in scope.

These influencing factors shape recycling behaviour, which can be either positive or negative. Positive behaviour involves the collection and reuse of bottles for textile fibre, while negative behaviour refers to the disposal of bottles in landfills or incineration, which prevents resource recovery. The outcome of recycling behaviour determines the waste flow. Properly collected bottles are sent to recycling plants, processed into recycled polyethylene terephthalate (rPET) fibres, and eventually used in textile production for items such as jackets and sportswear. On the contrary, bottles that are not recycled end up as waste, contributing to environmental pollution.

Finally, the impacts of producing clothing from waste bottles can be observed in three dimensions: economic, environmental, and social. Economically, it creates opportunities in the green fashion industry while reducing dependency on raw materials. Environmentally, it contributes to the reduction of plastic waste and promotes resource sustainability. Socially, it raises consumer awareness of sustainable practices and enhances the positive brand image of companies adopting green innovation.

In summary, this theoretical framework highlights how the integration of individual creativity, socioeconomic support, and environmental policies can drive the sustainable transformation of waste plastic bottles into valuable clothing products.

3 METHODOLOGY

An interview survey involving 30 fashion students was conducted to examine their awareness, practices, and perceptions regarding the recycling of mineral water bottles. The results indicate that the level of awareness among respondents is relatively high, with 86% acknowledging that mineral water bottles are recyclable. Nevertheless, only 58% demonstrated comprehensive knowledge of the recycling process, suggesting that while general awareness is widespread, in-depth understanding remains insufficient.

Several factors were identified as influencing recycling behaviour. Environmental consciousness emerged as the predominant motivator, as reported by 71% of respondents, followed by the availability of recycling bins (65%). Conversely, the most significant barriers included inadequate recycling infrastructure within campus premises (49%) and a lack of accessible information concerning recycling procedures (31%).

Respondents also proposed various measures to enhance recycling rates. The majority (74%) recommended the installation of additional dedicated recycling bins for plastic bottles at strategic, high-traffic locations within the university. Furthermore, 56% suggested the implementation of regular awareness campaigns, including recycling competitions or incentive-based collection programmes, to foster greater student participation.

Figure 2 Collecting and Sorting Plastics

The process begins with the collection of post-consumer plastic bottles, primarily polyethylene terephthalate (PET). These bottles are gathered from recycling centres, households, and waste collection points. Once collected, they are sorted based on type, colour, and quality to ensure that only suitable PET materials are used for textile production. Proper sorting is essential to maintain the purity and strength of the recycled fibres.

Figure 3 Creating Clothing Pattern

After the recycled PET is transformed into fibres and woven into fabric, fashion designers or garment technologists create clothing patterns. These patterns serve as templates that guide the cutting of fabric pieces according to specific measurements and garment designs. A precise pattern ensures the efficiency of fabric usage, reduces waste during the cutting process, and guarantees the correct fit of the final product.

Figure 4 Sewing Process Begins

Once the fabric pieces are cut, the sewing process begins. Using either industrial sewing machines or manual stitching, the cut pieces are assembled to form the structure of the garment. This stage involves attaching different parts such as sleeves, collars, or linings. High-quality stitching is important to ensure the durability and functionality of the clothing.

Figure 5 Making Clothing Prototype

Before entering mass production, a prototype garment is created. This prototype is essential for testing the design, evaluating the garment's comfort, fit, and overall appearance. Adjustments are made during this stage to refine the design and correct any flaws. The prototyping phase ensures that the final clothing line meets design specifications and consumer expectations.

Figure 6 Final Product: Finished Clothing

After successful prototyping and quality assurance, the garments move into the final production stage. The finished clothing is then subjected to quality checks to ensure consistency in size, design, and durability. The end result is sustainable apparel produced from recycled plastic bottles, representing an innovative approach to waste management and sustainable fashion.

4 ANALYSIS

Table 2 Findings from interview with fashion students on producing jackets from discarded mineral water bottles

No.	Interview Question	Summary of Responses	Key Points Identified
1	Awareness of using recycled PET bottles in fashion	Majority of students (80%) were aware that PET bottles can be converted into polyester fabric for clothing production.	Awareness is high; some students lack technical knowledge on the process.
2	Interest in designing jackets from recycled materials	92% expressed interest in experimenting with sustainable fashion projects involving recycled PET.	High interest in sustainable design initiatives.
3	Perceived benefits of using recycled bottles for jackets	Students cited environmental protection, waste reduction, and the uniqueness of eco-friendly branding as main benefits.	Positive environmental and marketing value identified.
4	Perceived challenges in the production process	Limited access to recycled polyester fabric, higher production costs, and lack of specialised equipment were common concerns.	Need for better resources and supply chain support.
5	Willingness to participate in a collaborative project	88% showed willingness to join cross-department collaborations (fashion, engineering, and environmental studies) for such projects.	Strong potential for interdisciplinary projects.
6	Suggestions for promoting recycled PET jackets	Recommendations included fashion shows, online campaigns, and limited-edition product launches to attract public interest.	Promotion strategy focuses on awareness and exclusivity.

Wolcott (1985) advocates using 'conversations or discussions' rather than interviews in ethnographic research. He recommends what he call 'semi-structured' interviews, that is, interviews with some questions but not following a particular order and permitting digression as serendipity tells a 'personal story'. He notes that the anthropologist Geertz (1973) believes the interview to be the power of the scientific imagination bringing the researcher in touch with the lives of strangers. The researcher had previously used this approach to good effect in life history research and felt that once again coming close to the lives of the interviewees could best be achieved with a non-hierarchical, conversational approach.

There are, in fact, three types of interviews: structured, semi-structured and unstructured (Carruthers, 1990). The problem for the ethnographer with the structured interview is that is inevitably hierarchical; the interviewer retains control throughout and there is no opportunity for the interviewee to digress and take control. A pure structured interview emphasises objectivity to the point insisting that questions are worded and the voice pitched in the same way for each interview. The unstructured interview, on the other hand, although pure ethnography has attendant problems such as needing additional time to interview in order to fill gaps at a later date; such substantial periods of time were not available in this case. The collection of data in this study will be undertaken by using three methods namely, interviews, documentation analysis / archives and audio / visual.

Adopting this method, a list of topics was prepared, and these were to be covered by the end of the interview. In this way, respondents retain control of the interview and in the course of making their expansive responses often answer other questions. Rather than interrupt them to keep them focused on one point, the researcher can tick off the topics as they emerge and then cover any remaining topics later in the interview. As a result, interesting data can emerge that might not come out of a formally structured interview. Data that might appear gratuitous may prove invaluable as the patterns begin to surface and serendipity, therefore, become significant. In these circumstances the relationship

developed is not one of researcher down to interviewee but of researcher as colleague, as friend or as co-investigator.

The interviews with fashion students revealed several important insights regarding the use of recycled PET bottles in clothing production, specifically in designing jackets. Firstly, the majority of students (80%) demonstrated awareness that PET bottles can be converted into polyester fabric suitable for garment production. However, while the overall awareness level was high, some students indicated that they lacked detailed technical knowledge of the recycling and transformation process.

Secondly, the students expressed a very strong interest in sustainable design projects, with 92% showing enthusiasm for experimenting with recycled PET in fashion, particularly jacket design. This indicates a growing motivation among young designers to explore sustainable alternatives in their creative work. When asked about the benefits of using recycled bottles in fashion, respondents highlighted several key points: environmental protection, reduction of waste, and the unique branding potential of eco-friendly products. These responses illustrate both positive environmental impacts and the marketing value of sustainable fashion.

On the other hand, the interviews also identified challenges in implementing such projects. Students mentioned limited access to recycled polyester fabric, higher production costs compared to conventional textiles, and the lack of specialised equipment for processing. These issues point to a need for better resources, infrastructure, and supply chain support in order to make recycled PET fashion more feasible.

Despite these challenges, 88% of the respondents expressed willingness to participate in collaborative projects that involve multiple disciplines, such as fashion, engineering, and environmental studies. This demonstrates a strong potential for interdisciplinary cooperation in developing sustainable clothing innovations.

Finally, the students suggested several strategies for promoting recycled PET jackets. Their recommendations included organising fashion shows, running online campaigns, and producing limited-edition collections to generate public interest. These ideas reflect the importance of awareness campaigns and exclusivity in encouraging consumer acceptance of sustainable fashion.

In summary, the findings highlight a high level of awareness, interest, and willingness to participate, alongside clear recognition of both the benefits and challenges of using recycled PET bottles in fashion. This provides a strong foundation for further exploration of sustainable fashion projects, particularly those that integrate cross-disciplinary collaboration and creative promotional strategies.

5 CONCLUSION

In conclusion, the findings demonstrate that although students possess a commendable level of awareness regarding the recyclability of mineral water bottles, consistent recycling behaviour is contingent upon the provision of adequate infrastructure and targeted promotional initiatives. Addressing these factors is likely to yield substantial improvements in recycling participation rates within the institution setting.

6 SUGGESTION FOR FURTHER RESEARCH

To implement such an initiative effectively within a university or community setting, collaboration between recycling facilities, textile manufacturers, and design students could be established. Students in fashion and textile programs could design clothing collections using fabrics derived from recycled bottles, while engineering and environmental science students could contribute to optimising the recycling process. Furthermore, public awareness campaigns could highlight the link between plastic recycling and sustainable fashion, encouraging greater participation in bottle collection drives.

This approach not only addresses the pressing issue of plastic waste but also aligns with global movements towards circular economy practices, where resources are continually reused rather than discarded. By integrating recycled PET into the clothing supply chain, institutions can demonstrate a tangible and innovative method of turning waste into value, fostering both environmental responsibility and creative industry development.

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CONFLICT OF INTEREST

There is no conflict of interest in this research study.

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