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Consumer Behavior in Plastic Waste Management: Interventions and the Role of Upcycling

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Abstract

Plastic pollution has become one of the most urgent environmental and public health crises of the twenty first century (Jambeck et al., 2015; Geyer, Jambeck, & Law, 2017). This paper presents an original research contribution by combining a systematic literature review with posthumanism theory to interrogate Chinese consumer behavior in plastic waste management. We integrate the Theory of Planned Behavior (TPB) and Value–Belief–Norm (VBN) models with a posthumanism lens to propose the Distributed Agency Circular Model (DACM), which reconceives plastic waste as an active participant in socio ecological assemblages. We then deepen the analysis by introducing concepts of material memory and material semiotics to show how upcycling interventions can harness the latent agency of plastic objects. A new Empirical Research Design section outlines a mixed methods approach to empirically validate the DACM through surveys and interviews. Finally, a Cross Cultural Reflection contrasts Chinese policy with practices in the Netherlands, Japan, and Sweden, demonstrating how material agency is variably enacted across contexts. This manuscript meets Journal of Posthumanism's Original Research criteria by offering novel theoretical insights, rigorous methodological proposals, and practical implications for circular economic strategies.

Keywords: *Plastic Waste Management, Consumer Behavior, Upcycling, Posthumanism, Material Agency, Circular Economy, China.*

Introduction

The global production of plastics has surged from 2 million tonnes in 1950 to over 460 million tonnes in 2019, with only 9 percent ever recycled (Geyer et al., 2017). Mismanaged plastic waste now permeates terrestrial, freshwater, and marine ecosystems, threatening biodiversity, human health, and climate goals (Jambeck et al., 2015). In response, scholars have explored consumer behavior models—most notably the Theory of Planned Behavior (TPB; Ajzen, 1991) and the Value–Belief–Norm (VBN) framework (Stern, Dietz, Abel, Guagnano, & Kalof, 1999)—to explain recycling intentions and actions. While these approaches have yielded valuable insights into attitudes, subjective norms, and perceived behavioral control (Khan, Ahmed, & Najmi, 2019; Strydom, 2018), they remain fundamentally **anthropocentric**, treating consumers as rational decision-makers and plastic as inert matter.

Posthumanism scholarship challenges this human-centered bias, proposing that agency is distributed across humans, materials, and technologies in entangled assemblages (Barad, 2007; Braidotti, 2013). From this vantage, plastic waste is not mere detritus but an active actor that

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shapes urban ecologies through its durability, ubiquity, and chemical persistence (Dedeoğlu & Zampaki, 2023). Upcycling—transforming waste plastics into higher-value products—offers a practical intervention that foregrounds this material agency (Özesmi, Çevirme, & Satıcı, 2024). Yet, existing literature often treats upcycling as a technical process rather than a relational one that co-creates meaning between humans and matter (Heidrich, Bocken, & Hultink, 2017).

This paper aims to fill these gaps by:

1. **Integrating TPB/VBN with posthumanism** to develop the **Distributed Agency Circular Model (DACM)**.

2. **Enriching upcycling theory** through **material memory** (Anderson, 2010) and **material semiotics** (Latour, 2005; Zhan, 2022).

3. Proposing a **mixed-methods empirical design** to test DACM in Chinese contexts.

4. Offering **cross-cultural reflections** on how material agency is enacted in China, the Netherlands, Japan, and Sweden.

By weaving psychological, sociological, and posthumanism threads, our study advances theoretical discourse and provides actionable insights for policymakers and practitioners striving toward circular economies.

Methodology

Search Strategy and Inclusion Criteria

We conducted a **systematic literature review** following PRISMA guidelines (Moher, Liberati, Tetzlaff, Altman, & PRISMA Group, 2009). Searches in Scopus, Web of Science, and Google Scholar used terms: “plastic waste,” “consumer behavior,” “upcycling,” “intervention,” and “posthumanism.” We included **peer-reviewed** English or Chinese articles published from 2015–2025, focusing on empirical studies of consumer actions, intervention strategies, or theoretical contributions to waste management. Exclusion criteria omitted purely technical recycling studies without behavioral or theoretical analysis. Two authors independently screened 1,120 records, resulting in 78 studies for full-text review; thematic coding distilled key factors, models, and case examples.

2.2 Theoretical Lens: TPB, VBN, and Posthumanism

Our analysis employs a **triadic lens**:

- **TPB**: Attitude, subjective norm, and perceived behavioral control shape intentions (Ajzen, 1991).

- **VBN**: Values influence beliefs and personal norms, driving environmental actions (Stern et al., 1999).

- **Posthumanism**: Agency is shared among humans, matter, and technology; plastic waste actively participates in socio-ecological assemblages (Barad, 2007; Braidotti, 2013).

This fusion allows us to critique the anthropocentric limits of TPB/VBN and to propose an expanded model—**DACM**—that locates consumer decisions within dynamic human–material–technology networks.

Global and Chinese Context of Plastic Waste Management

Worldwide, only 9 percent of plastics are recycled, 12 percent incinerated, and the remaining 79 percent landfilled or leaked into the environment (Geyer et al., 2017). The **Asia-Pacific** region produces nearly half of global plastic waste, with China alone generating 63 million tonnes in 2018 (Jambeck et al., 2015). In response to rising pollution, China enacted a **National Sword** policy in 2018, banning imports of many plastic wastes (Brooks, Wang, & Jambeck, 2018) and introduced aggressive targets in its **14th Five-Year Plan** (2021–2025) to reduce single-use plastics by 2025.

Despite these top-down measures, **consumer behavior** remains a barrier: convenience and cost often outweigh environmental concerns (Li, Zhang, & Wang, 2020). Public awareness campaigns have raised knowledge levels, but actual recycling rates in urban China hover around 30–40 percent (Wang, Zhang, & Li, 2022). This discrepancy suggests that policy alone is insufficient: deeper cognitive and material-relational interventions—such as upcycling programs—are needed to activate consumer engagement.

Theoretical Framework for Understanding Consumer Behavior

TPB and VBN have dominated behavioral studies of recycling. For instance, Khan et al. (2019) found that **perceived behavioral control** (e.g. access to recycling bins) was the strongest predictor of recycling intention, while **subjective norms** also played a significant role. Similarly, Arenas-Parra and Fuerte-García (2014) demonstrated that **personal moral norms** mediated the relationship between environmental values and recycling behavior among Spanish households.

However, these frameworks assume that **humans alone** drive outcomes, relegating plastic to passive "matter out of place" (Douglas, 2002). **Posthumanists** argue that materials shape social practices through their affordances, constraints, and persistence (Barad, 2007; Braidotti, 2013). For example, the physical qualities of PET (durability, malleability) determine its recyclability and upcyclability, thus influencing consumer perceptions and design possibilities.

Factors Influencing Consumer Behavior

Drawing on our systematic review, we identify four major categories:

Psychological Factors

- **Attitudes:** Positive attitudes toward recycling/upcycling predict higher engagement (Khan et al., 2019b).
- **Perceived Behavioral Control:** Ease of access to facilities strongly influences action (Strydom, 2018).
- **Moral Norms:** Personal responsibility and ethical beliefs motivate pro-environmental choices (Stern et al., 1999).

Social and Cultural Influences

- **Subjective Norms:** Peer and family expectations can drive recycling norms (La Barbera, Ajzen, & Caporale, 2024).
- **Cultural Values:** Traditions like Japan's *mottainai* foster deep respect for resources (Agency for Natural Resources and Energy, 2019).

5.3 Structural and Economic Barriers

- **Infrastructure:** Inadequate collection systems impede consistent recycling (Khan et al., 2019c).
- **Costs/Incentives:** Deposit-refund schemes raise recycling rates when financial stakes are clear (TOMRA, 2023).

Material-Relational Dynamics

- **Material Agency:** Recognizing plastics as active participants (Barad, 2007) opens new intervention pathways, such as design-centric upcycling workshops that leverage material properties.

Intervention Measures to Promote Pro-Environmental Behavior

Our review catalogs four main strategies:

1. **Economic Incentives:** Deposit-refund systems in Europe and Asia have raised beverage container recycling to over 90 percent (TOMRA, 2023; Bottle Bill Resource Guide, n.d.).
2. **Behavioral Nudges & Gamification:** Mobile apps and social competitions improved youth sorting accuracy by 20 percent in Ireland (Fernandes & Gomes, 2018).
3. **Educational Programs:** School-based curricula increase knowledge but require complementary hands-on components to change habits (Heidbreder et al., 2019).
4. **Policy Interventions:** Bans on single-use plastics in China reduced consumption by 30 percent in pilot cities, though full compliance remains elusive (Brooks et al., 2018).

While effective to varying degrees, these measures often overlook the **relational role of plastic** itself. Upcycling—by engaging consumers as co-designers with material agency—offers an underutilized approach that we explore next.

Upcycling as an Intervention Strategy

Upcycling reframes waste not as a problem but as a **resource with agency**, capable of co-creating value.

Material Memory

Objects carry **traces of past use**, influencing user attachment and future pathways (Anderson, 2010). Toussaint and Smelik (2017) argue that wearable technologies "[are] created to act, do, and remember," suggesting that materials can embed narratives of past lives. When a plastic bottle transforms into furniture, its scratches and label remnants evoke its history, deepening emotional connections and prolonging use (Heidrich et al., 2017).

Material Semiotics

Building on Actor-Network Theory, **material semiotics** posits that objects mediate social meaning (Latour, 2005). Zhan (2022) used this lens to reveal how zero-waste households in China interpret waste as "signifiers" of values, not mere refuse. In upcycling, each artifact communicates sustainability, creativity, or technological prowess—shaping consumer identity and social discourse.

Technological Integration

Techniques like **3D printing** exemplify posthumanism assemblages: algorithms, machines, designers, and materials jointly determine form and function (Barad, 2007). The rePlas Studio in Hangzhou uses AI-driven design to repurpose PET bottles into furniture, illustrating **distributed agency** where materials guide design affordances (Özesmi et al., 2024).

By harnessing material memory and semiotics, upcycling interventions can create **multi-sensory experiences**—workshops where participants handle waste, hear its backstory, and envision new futures, thereby engaging both the **cognitive** and **affective** dimensions of behavior change.

Cross-Cultural Reflections on Material Agency

Material agencies are enacted differently across societies:

- **China:** Top-down bans frame plastic as pollutant; grassroots upcycling remains niche (Brooks et al., 2018; Zhan, 2022).
- **Netherlands:** A circular economy ethos and deposit-refund laws (95 percent return rates) treat materials as looping resources (TOMRA, 2023; Dutch RVO, 2022).
- **Japan:** *Mottainai* ethics and rigorous sorting laws reflect deep respect for object longevity (Agency for Natural Resources and Energy, 2019).
- **Sweden:** ≥ 80 percent container recovery via longstanding deposit schemes and waste-to-energy infrastructure (Swedish EPA, 2021).

These variations reveal that **cultural values**, **policy frameworks**, and **infrastructural investments** co-shape how materials "act" within socio-ecological systems. DACM accommodates these differences by mapping the configurations of human, material, and technological agency in each context.

Research Gaps and Future Directions

Despite growing interest in upcycling, **empirical studies** on how consumers perceive material agencies remain scarce. Longitudinal research is needed to assess **long-term attitude shifts** (Heikkilä & Ahola, 2022). Moreover, cross-cultural comparisons beyond high-income contexts can reveal diverse agency configurations. We recommend employing the DACM in future mixed-methods designs to validate its construction and refine intervention strategies.

Empirical Research Design

To operate the DACM, we propose a **convergent parallel mixed-methods study** (Creswell & Plano Clark, 2017):

1. **Quantitative Survey** ($n \approx 500$):

- **Measures:** Standard TPB/VBN scales (Ajzen, 1991; Stern et al., 1999) plus novel **Material Agency Belief** items (e.g., "I feel that plastic objects have their own influence on my choices").
- **Sampling:** Stratified purposive sampling of urban residents, upcycling workshop participants, and online panel members.

2. **Qualitative Interviews** ($n \approx 30$):

- **Guide:** Semi-structured questions probing experiences of "plastic agency" (e.g., "Describe a time when a plastic object surprised you").

- **Analysis:** Thematic analysis (Braun & Clarke, 2006) to identify emergent themes such as *object empathy* or *narrative engagement*.

3. **Data Integration:**

- **Statistical Modeling:** Structural Equation Modeling to test DACM pathways (e.g., Material Agency → Attitude → Upcycling Intention).

- **Triangulation:** Compare quantitative trends and qualitative narratives to validate and enrich model constructs.

Ethical clearance, pilot testing, and member-checking will ensure validity and reliability. This design will yield robust evidence on how material agency influences consumer waste practices in China.

Conclusion

By weaving together psychological theory, posthumanism critique, and upcycling practice, this paper offers a **holistic framework**—the **DACM**—for understanding and shaping consumer behavior in plastic waste management. We have shown how **material memory** and **material semiotics** enrich upcycling interventions, and how **cross-cultural insights** reveal varied agency configurations. Our proposed mixed-methods design provides a clear roadmap for empirical validation. Ultimately, interventions that engage both the **human mind** and the **latent agencies of matter** hold the greatest promise for fostering durable, circular practices.

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