Sweet dreams are made of this! Investigating consumers' intentions to recycle old mattresses for a greener tomorrow.

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Abstract
This study examines consumers' behavioral intentions towards the recycling of end-of-life mattresses. Specifically, we tested a theoretical model that integrates cognitive factors, social factors, and the valence of a specific behavior within the Theory of Planned Behavior (TPB). We employed an online survey to collect data. According to the findings of the Structural Equation Modeling (SEM) analysis, the primary predictor of the intention to recycle was self-identity, followed by subjective norms, perceived behavioral control, attitude towards recycling, and perceived benefit. Environmental knowledge positively influenced attitude towards recycling, perceived behavioral control, subjective norms, and self-identity. The relationship between perceived risk and intention to recycle was negative. Findings carry practical implications for both businesses and policymakers involved in end-of-life mattress management, offering insights to design interventions that can positively influence individuals.

Keywords
Sustainable consumption behavior, durable products, end-of-life management, mattresses

1. Introduction

Growing concerns about sustainability and its impact on the planet have been widely recognized, with numerous studies indicating that a substantial portion of the population is deeply worried about these issues. However, the environmental consequences of everyday decisions—such as choosing a mattress—are often overlooked. From production to disposal, mattresses leave a significant environmental footprint (Castellani et al., 2021; Ellingsen & Vildåsen, 2022). This makes the responsible management of end-of-life mattresses a critical challenge in today's world.

Despite extensive research on durable consumer goods, mattresses have received little attention in academic literature. As Castellani et al. (2021) note, while mattresses have one of the lowest consumption intensities (< 0.3 pieces/year per capita), they produce the highest environmental impact per unit. According to the European Bedding Industry Association, approximately 30 million mattresses reach the end of their life each year—equivalent to 678 times the height of Mount Everest (European Commission, n.d.). Common disposal methods include kerbside pickup, landfill drop-off, incineration, or illegal dumping (Barner et al., 2021). Given that nearly 85% of a mattress's components can be recycled through proper disassembly (European Commission, n.d.), recycling presents an environmentally favorable solution (Heiran et al., 2021). Unfortunately, limited awareness and accessibility to recycling facilities make this practice seem complicated or inconvenient for consumers (Fagerholm et al., 2023).

This study seeks to fill a critical gap in the literature by exploring consumer behavioral intentions toward recycling end-of-life mattresses. Existing research has primarily focused on the industry's role in creating more sustainable mattresses (e.g., Barner et al., 2021; L'Abbate et al., 2018; Lanoë et al., 2013; Mehta & Golkaram, 2022), but little is known about the factors that drive individual consumers to recycle these products. Understanding what influences consumer behavior in this context is essential for encouraging sustainable practices, particularly with respect to durable goods.

To guide our investigation, we employ the Theory of Planned Behavior (TPB; Ajzen, 1991), a well-established model for predicting sustainability-related behaviors. Although the TPB has demonstrated significant explanatory power (Rotimi et al., 2023), we enhance it by incorporating additional cognitive and social factors relevant to mattress recycling. For instance, environmental knowledge is a key determinant of sustainable behavior (Rosenthal & Leung, 2020), and self-identity has been shown to positively influence pro-environmental intentions (Rao et al., 2022). Moreover, drawing on Dhir et al.'s (2021) research on e-waste recycling, we include perceived benefits and risks, using the valence theory proposed by Peter and Tarpey (1975) to further extend the TPB framework.

This research is based on cross-sectional data collected from 650 Italian consumers. Our findings offer practical insights for businesses and policymakers involved in managing end-of-life mattresses, informing the development of strategies to promote mattress recycling.

2. Background to the Research Context

Existing literature primarily focuses on the environmental impact of mattress manufacturing. Lanoë et al. (2013) emphasize sustainable design strategies, such as repurposing excess foam and reducing polyurethane foam weight. Mehta and Golkaram (2022) highlight pyrolysis and mechanical recycling as more eco-friendly disposal alternatives to

incineration or landfills. Barner et al. (2021) report that most mattresses in Australia end up in landfills, stressing the need for circular economy practices like efficient disassembly and new supply chains. While research on recycling bulky items like appliances or batteries is extensive (Aboelmaged, 2021; Dhir et al., 2021), consumer-focused studies on mattress disposal remain limited. This study addresses that gap by exploring factors that influence consumers' recycling intentions, offering insights for policymakers and marketers to promote sustainable behaviors.

3. Research framework

From a theoretical perspective, numerous studies (e.g., Tonglet et al., 2004; Wang et al., 2016; Echegaray & Hansstein, 2017) have applied the Theory of Planned Behavior (TPB) to examine recycling behavior. According to Ajzen's (1991) model, behavioral intention is driven by attitude, subjective norm, and perceived behavioral control. Attitude reflects beliefs about behavior outcomes, subjective norm assesses social pressures, and perceived control measures one's ability to perform the behavior. While TPB's components often explain recycling behavior (Ma et al., 2023), some studies report inconsistencies (Khan et al., 2019; White & Hyde, 2012; Davis et al., 2006), possibly due to factors like demographics, cultural differences, or service variations (Li et al., 2019; Ertz et al., 2017). Behavior is complex, and TPB alone may not suffice (Liu et al., 2022). Knowledge is also key, as individuals are more likely to recycle when they understand the issue (Rosenthal & Leung, 2020), aligning with the information-motivation-behavioral skills model (Fisher et al., 2003). Thus, this study expands the TPB to include knowledge as a factor.

Additionally, social influences like self-identity play a role in behavior. Identity theory suggests that people act in ways consistent with their self-concept (Stryker & Burke, 2000); those who see themselves as environmentally conscious are more likely to recycle (Rao et al., 2022). We, therefore, incorporate self-identity into the TPB. Perceived risk and benefit also shape recycling behavior (Dhir et al., 2021). Valence theory (Peter & Tarpey, 1975) explains that individuals weigh the pros and cons of an action. Perceived risk involves potential downsides like cost or effort (Ozturk et al., 2017), while perceived benefit includes positive outcomes like environmental or health benefits (Adjei et al., 2022). Figure 1 presents our research model, which integrates cognitive factors (knowledge), social factors (self-identity), and the valence of behavior (perceived risk and benefit) into the TPB framework.

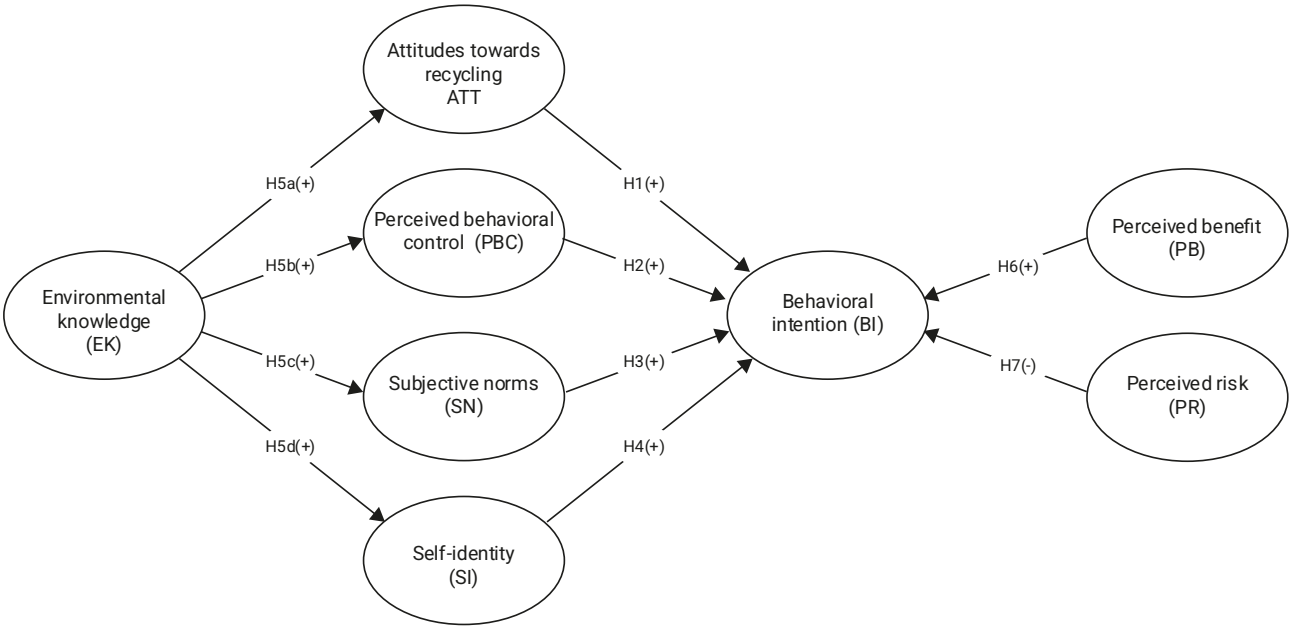

Figure 1. Conceptual framework.

4. Development of Research Hypotheses

4.1. Attitude towards Recycling

According to the Theory of Planned Behavior (TPB), attitude influences behavioral intention (Ajzen, 1991). Attitudes reflect an individual's tendency to favor or oppose certain behaviors (Almasi et al., 2019), and several studies have shown a positive relationship between attitude and recycling intention (Tonglet et al., 2004; Kumar, 2019; Hameed et al., 2021). Thus, we propose:

H1: Attitude towards recycling positively impacts the intention to recycle an old mattress.

4.2. Perceived Behavioral Control and Recycling Intention

Perceived behavioral control refers to an individual's belief in their ability to perform a behavior despite external constraints (Ajzen, 1991). It has consistently been linked to pro-environmental behaviors, including recycling (Hameed et al., 2021; Tang et al., 2023). Based on this, we hypothesize:
H2: Perceived behavioral control positively impacts the intention to recycle an old mattress.

4.3. Subjective Norm and Recycling Intention
Subjective norms involve social pressures or influences that shape behavior (Ajzen, 1991). Studies show that positive social norms encourage recycling intentions (Khan et al., 2019; Dong & Ge, 2022; Hameed et al., 2021). We propose:
H3: Subjective norms positively impact the intention to recycle an old mattress.

4.4. Self-Identity and Recycling Intention
Self-identity relates to how individuals view themselves in relation to certain behaviors (Conner & Armitage, 1998). Research shows that self-identity can predict recycling behavior (Reid et al., 2018; Yeow & Loo, 2018). We suggest:
H4: Self-identity positively impacts the intention to recycle an old mattress.

4.5. Environmental Knowledge
Environmental knowledge is crucial for pro-environmental behavior (Fryxell & Lo, 2003). Studies link it to attitude, perceived behavioral control, subjective norms, and self-identity (Liu et al., 2020; Wu et al., 2022; Tang et al., 2022). We propose:
H5a: Environmental knowledge positively impacts attitude.
H5b: Environmental knowledge positively impacts perceived behavioral control.
H5c: Environmental knowledge positively impacts subjective norm.
H5d: Environmental knowledge positively impacts self-identity.

4.6. Perceived Benefit and Recycling Intention
Perceived benefit refers to the positive outcomes individuals associate with recycling (Kumar, 2019; Dhir et al., 2021). Research shows a strong link between perceived benefit and recycling intentions (Cao & Liu, 2019). Thus, we hypothesize:
H6: Perceived benefit positively impacts the intention to recycle an old mattress.

4.7. Perceived Risk and Recycling Intention
Perceived risk involves potential negative consequences of a behavior, such as time and effort (Bradley et al., 2020; Chai et al., 2015). Time-related risks often hinder recycling efforts (Pedersen & Manhice, 2020). Therefore, we propose:
H7: Perceived risk negatively impacts the intention to recycle an old mattress.

5 Methods
An online survey was conducted to meet the research objectives. Participants were recruited from a nationally representative panel maintained by Dynata, with data collected between February and March 2022. The sample was stratified by Italian region and age group, resulting in 120 strata from which units were randomly selected. A total of 650 valid responses were gathered, with 69.1% female and 30.9% male participants. Most respondents were aged 46–55 (24.5%) and 56–65 (21.1%), with 44% holding a college degree and 56.8% employed.
The questionnaire included seven scales measuring recycling intention and key variables: attitude, perceived behavioral control, subjective norm, self-identity, environmental knowledge, perceived benefit, and perceived risk. A demographic section was also included. Established scales from prior research were used to ensure validity. Attitude, recycling intention, and environmental knowledge were adapted from Kahn et al. (2019) and Yeow and Loo (2018). Other variables, such as perceived benefit, risk, and self-identity, were measured using items from Yu et al. (2011) and Dhir et al. (2021). All items were rated on a 7-point Likert scale from "strongly disagree" (1) to "strongly agree" (7).
We used structural equation modeling (SEM) to evaluate the research framework and test the hypotheses. Following Anderson and Gerbing's (1988) two-step approach, SEM includes confirmatory factor analysis (CFA) for latent variable measurement and path analysis for estimating causal relationships (Fan et al., 2016). Both were conducted using IBM AMOS 23. A bootstrapping procedure (5000 subsamples) with a 95% bias-corrected interval was used to assess the statistical significance of path coefficients (Hair et al., 2014).

6. Results
Prior to testing the hypotheses, we assessed the goodness-of-fit for the path model. The results indicate that the model aligns very well with the data. Specifically, the CMIN/df ratio was 2.768, with a significance level of $p < 0.001$. Additionally, the Bentler's Comparative Fit Index (CFI) was 0.954, the Tucker-Lewis Index (TLI) was 0.946, the Normed Fit Index (NFI) was 0.930, and the Root Mean Square Error of Approximation (RMSEA) equaled 0.052 (with a Pclose value of 0.191). These statistics collectively demonstrate a strong fit between the model and the data. The

results of hypotheses testing are depicted in Table 4. The main predictor of intention to recycle was found to be self-identity (β = 0.235, p < 0.001), followed by subjective norms (β = 0.209, p < 0.001), perceived behavioral control (β = 0.198, p = 0.001), attitude towards recycling (β = 0.147, p = 0.009), and perceived benefit (β = 0.140, p = 0.001). It was observed that environmental knowledge had a positive effect on attitude towards recycling (β = 0.140, p = 0.003), perceived behavioral control (β = 0.202, p < 0.001), subjective norm (β = 0.138, p = 0.001), and self-identity (β = 0.164, p < 0.001). The relationship between perceived risk and intention to recycle is negative (β = - 0.177, p < 0.001).

Table 1. Results of hypotheses testing.

Paths			β	95% CI		SE	P-value	Hypothesis
				Lower	Upper			
ATT	→	BI	0.147	0.031	0.257	0.056	0.009	H1 supported
PBC	→	BI	0.198	0.09	0.303	0.053	p < 0.001	H2 supported
SN	→	BI	0.209	0.111	0.312	0.052	p < 0.001	H3 supported
SI	→	BI	0.235	0.148	0.319	0.044	p < 0.001	H4 supported
EK	→	ATT	0.140	0.045	0.240	0.05	0.003	H5a supported
EK	→	PBC	0.202	0.106	0.296	0.048	p < 0.001	H5b supported
EK	→	SN	0.138	0.053	0.227	0.044	0.001	H5c supported
EK	→	SI	0.164	0.073	0.259	0.047	p < 0.001	H5d supported
PB	→	BI	0.140	0.055	0.222	0.042	0.001	H6 supported
PR	→	BI	-0.177	-0.248	-0.114	0.034	p < 0.001	H7 supported

Note: β = Standardized β Weights, CI = Confidence interval, SE = Bootstrap Standard error.

7. Discussion

This study examined factors influencing the intention to recycle old bed mattresses, focusing on environmental knowledge, attitude towards recycling, perceived behavioral control, subjective norms, self-identity, perceived benefit, perceived risk, and behavioral intention. The findings supported Hypothesis H1, showing a positive relationship between attitudes towards recycling and behavioral intention, consistent with existing literature (e.g., Hameed et al., 2021; Kumar, 2019).

Hypothesis H2, linking perceived behavioral control to behavioral intention, was also supported, suggesting that individuals who feel they have the resources and knowledge to recycle are more likely to intend to do so. Factors like the proximity of recycling centers and available information can enhance this perception.

Hypothesis H3 showed that subjective norms positively impact behavioral intention, indicating that social acceptance of recycling can influence individual behavior. Similarly, H4 demonstrated a positive link between self-identity and behavioral intention, suggesting that aligning recycling with personal values reinforces the intention to recycle.

Hypotheses H5a-d confirmed that environmental knowledge enhances attitudes towards recycling, perceived behavioral control, subjective norms, and self-identity, supporting findings from previous studies (e.g., Liu et al., 2020). Additionally, H6 indicated that perceived benefits are positively associated with the intention to recycle, while H7 revealed a negative relationship between perceived risk and intention to recycle, highlighting that fears of negative outcomes can deter recycling behavior (e.g., Chai et al., 2015).

7.1 Theoretical Implications

This study offers three key theoretical contributions. First, it extends the Theory of Planned Behavior (TPB) by incorporating cognitive and social factors, including perceived risk and benefit, enriching our understanding of recycling intentions for end-of-life mattresses. Second, it provides a holistic model by examining both perceived risk and benefit, allowing for more accurate predictions of recycling intentions. Third, contrary to previous research, it establishes a significant correlation between perceived risk and pro-environmental behavior, suggesting that valence theory can enhance the TPB framework.

7.2 Practical Implications

The research holds important implications for marketers, governments, and policymakers. First, practitioners should emphasize the environmental and health impacts of improper mattress disposal, utilizing various platforms to inform consumers about the benefits of proper recycling. Second, messages highlighting collective responsibility can strengthen self-identity as environmentally conscious citizens. Collaborating with influencers and community leaders can enhance perceptions of socially acceptable recycling behavior. Finally, marketers should develop educational campaigns to alleviate fears surrounding mattress recycling by providing clear information about safety measures. Governments could

offer financial incentives to encourage recycling, and the mattress industry might implement trade-in programs to promote recycling while enhancing brand loyalty.

8. Limitations and Future Work

This study has limitations that present opportunities for future research. First, conducting the survey solely in Italy limits generalizability. Future studies should explore mattress recycling practices in diverse countries. Second, the cross-sectional design may introduce response bias, impacting findings' robustness. Future research could apply different theoretical frameworks or examine moderating variables that influence perceived risks, such as specific messaging strategies and the presence of recycling facilities.

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