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Frugal or Sustainable? The Interplay of Consumers' Personality Traits and Self-Regulated Minds in Recycling Behavior

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Abstract: Through the lens of self-regulation theory (SRT), this study investigates the following: (1) the ways in which consumers' personality traits of conscientiousness, openness, and agreeableness increase their self-regulated mindsets of frugality and green efficacy; (2) whether frugality facilitates green efficacy; and (3) whether frugality and green efficacy ultimately affect recycling behavior. This study proposes modeling the duality of the self-regulated mindsets of frugality and green efficacy as the reason why consumers engage in recycling behavior. This study conducted an online survey among U.S. consumers that garnered 400 responses for the empirical data analysis. The results reveal that frugality is positively influenced by conscientiousness and openness, whereas green efficacy is facilitated by agreeableness but not by openness. Notably, frugality contributes to green efficacy, which indicates the causal duality of the self-regulated mindset as a motive in recycling behavior. Both frugality and green efficacy predict greater recycling behavior. The findings provide theoretical and practical implications for consumers' recycling behavior and the development of effective public promotion strategies for the disposal of waste and recycling.

Keywords: frugality; efficacy; personality traits; recycling; self-regulation; sustainability



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1. Introduction

People consume products, food, and services through the process of purchasing, using, and disposing of them [1]. Past literature has indicated that modern consumers are becoming more environmentally aware and endeavor to recycle discarded products instead of simply throwing them away [2–4]. Researchers have generated a wealth of insights regarding the production of sustainable products that are less harmful to the environment [5–7], but it is also important to understand how products are discarded or recycled after consumption to allow us to rethink consumption and waste following the product lifecycle [8–10]. In fact, recycling is a highly essential theme in public campaigns that may increase consumers' awareness about their post-consumption behavior and, thus, might create a more positive societal change than focusing solely on supporting environmentally friendly products [4]. In this study, recycling behavior is defined as the conduct of disposing and collecting goods and materials in ways that make use of postconsumer waste, such as paper, cans, packaging cardboard, containers, newspapers, magazines, school supplies, clothing, furniture, and electronics, that can be reprocessed, remanufactured, and/or refurbished for reuse [11,12].

In most consumption behavior, the self-regulated mindset, or the self-directive ability to manage, redirect, and control one's desire toward a goal and outcomes, intervenes in people's consumption choices, predicting their accumulation of goods and wealth, personal

expenditures, food intake, and health decisions [13–15]. In the application of ecologically conscious behavior, two important metrics of self-regulated mindsets are frugality, the mindset of minimizing consumption and possessions [16,17], and green efficacy, self-assurance that one's sustainable actions can contribute to minimizing negative ecological consequences and enhancing our lives collectively [18,19]. In particular, green efficacy is known to play a central role in self-regulation and self-management processes [20,21]. For instance, Song and Kim [10] suggested that frugality and green efficacy inspire consumers to live minimally, choose quality over quantity, and restrain impulsive, self-oriented, and materialistic lifestyles. As in the case of self-regulated mindsets, many researchers have identified adoptive and positive personality traits such as conscientiousness, openness, and agreeableness as strong predictors of green consumers and fairly good proxies for recycling behavior [22–25].

Given the close proximity in the causal network, there is some evidence that a self-regulated mindset might bridge the relationship between personality traits and sustainable behavior. For example, Jones [14] suggested that consumers' actions eventually result from personality through self-regulation, filtering what they can control themselves in the anticipated consequences of their actions. Yet, little is known about whether and how individual traits facilitate self-regulated mindsets in carrying out recycling behavior [4]. The self-regulatory literature also suggests that the two psychological states of environmentalism and personal economic pursuit might simultaneously affect the motivation to behave sustainably [13,14,26]. Although scholars disagree about the existence of such dual motivations, empirical studies show some evidence of self–other overlap [26–28], raising the potential that recycling behavior is also jointly facilitated by the dual self-regulated mindset of being conscious about future saving and making better use of resources (i.e., frugality) and having ethical confidence in the consequences of one's own sustainable behavior (i.e., green efficacy) [10,26,29,30]. Thus, this study applies Baumeister and Vohs's [31] self-regulation theory (SRT) to recycling behavior as a theoretical lens, based on its assumption that self-regulated mindsets are influenced by positive traits and guide people's behavior toward engaging in desired recycling behavior. Further, the two states of mind of frugality and green efficacy might interact to strengthen one's willpower [13,20,21,31].

To this end, our study develops a research model of self-regulated recycling behavior to explore the influences of the personality traits of conscientiousness, openness, and agreeableness on the self-regulated mindsets of frugality and green efficacy. We then test the existence of the duality of self-regulated mindsets and how these mindsets influence subsequent recycling behavior. This study extends SRT to explain the mechanism of recycling behavior and provides a deeper understanding of consumer recycling culture that helps tailor effective public promotion strategies for behavioral interventions and participation, pursuing frugal and sustainable lifestyles.

2. Literature Review

2.1. Self-Regulation Theory (SRT)

Self-regulation is one's capacity to influence, alter, and control their own behavior [31]. The terms self-control and self-regulation are often used interchangeably. Self-control refers to "the capacity for altering one's own responses, especially to bring them into line with standards such as ideals, values, morals, and social expectations, and to support the pursuit of long-term goals" [31] (p. 351). Put simply, self-regulation is adjusting one's behavior to match ideals or social standards; hence, it is an important basis for socially desirable behavior [31]. "Good self-regulation" generates desirable outcomes for both individuals and society [31].

Self-regulation is important for understanding environmental behaviors [32]. As mentioned earlier, two important metrics of self-regulation related to sustainable behavior are frugality and green efficacy. Frugality, which is the first self-regulated mindset investigated in this study, is demonstrated when an individual tries to possess fewer materials. Frugal people tend to regulate their spending behavior with environmental consciousness [17] and

strive to adhere to their environmental goals/standards through their frugal behavior [32]. For example, frugal individuals try to minimize the consumption of materials and products in order to save and conserve natural resources [33]. As self-regulation is the process by which people attempt to constrain unwanted urges (i.e., self-restraint), frugality is a form of self-regulation.

According to [34], the self-regulation process has three main aspects: standards, monitoring, and willpower. First, self-regulation requires a clear, well-defined “standard” or “goal” to pursue for behavior change (e.g., a goal to protect the environment). Second, self-regulation requires monitoring, which means that the individual keeps track of their behavior in order to align it with the standard (e.g., continuously reviewing and evaluating one’s recycling habits). The third aspect is willpower (i.e., self-regulatory strength). Regulating the self is challenging and therefore requires power, energy, and strength (e.g., a willingness to take used plastic water bottles to the recycling center). Green efficacy, the second self-regulated mindset investigated in this study, is related to this aspect of willpower, as it reflects one’s confidence in their ability to make a difference to the environment through green actions. Willpower is a personal attribute of “ability,” and a person’s perception of their willpower at a given moment is a type of self-efficacy appraisal [35]. When people believe or feel that they are capable (i.e., have self-efficacy), they perform better in self-control tasks [35]. Thus, green efficacy plays an important role in performing recycling behavior as a form of self-regulation.

There has been a consensus that self-regulation is attributable to personality traits. According to [36], in their study investigating the association among childhood traits, self-regulatory processes, and changes in health across middle age, children with high levels of conscientiousness (i.e., goal-directedness) are more likely to develop lifelong health-enhancing behaviors that require the exertion of self-control, such as healthy eating and exercising. Personality traits are the main drivers of self-regulation processes, making it important to investigate the role of trait-driven self-regulation in recycling behaviors.

Prior studies about consumer recycling behavior have found a “green gap”, which refers to an attitude–behavior discrepancy in recycling behavior [37]. Despite one’s beliefs, attitudes, and intentions to recycle, they do not always translate into actual recycling actions. The crucial variable required to carry out actual behaviors is one’s control beliefs (e.g., perceived behavioral control and self-efficacy). Therefore, the concept of self-control or self-regulation explains sustainable behaviors that intentions or attitudes alone cannot explain [13]. Additionally, no influencing variables act alone, and the interactions among multiple motivating variables should be considered to understand people’s recycling behavior [38]. By applying the self-regulation theory (SRT) to investigate recycling behavior, it is possible to simultaneously assess influential constructs related to behavior, providing an integrated explanation of the issue. In particular, self-regulation may bridge the gap between one’s traits and actual behavior in the environmental domain. Our study seeks to respond to this call by assessing the relevance of trait-driven self-regulation (i.e., the self-regulated mindsets of frugality and green efficacy influenced by personality traits) to consumer recycling behavior.

2.2. Recycling Behavior

Recycling is defined as the process of collecting and processing materials that would otherwise be discarded as waste, transforming them into new [11] (para.1). According to a recent report by the EPA [11], the total solid waste recycled in the U.S. in 2018 exceeded 69 million tons, with paper and paperboard (e.g., newspapers, magazines, and cardboard containers) accounting for 68 percent of the total [11]. Metals (e.g., steel cans) constituted approximately 13 percent, while plastic (e.g., plastic containers), glass (e.g., glass jars), wood (e.g., furniture), and rubber/leather/textiles (e.g., old clothes and shoes) comprised between 4 and 6 percent. Recycling contributes to the preservation of natural resources or raw materials, saves energy, and benefits the environment. The recycling process largely depends on the labor, time, energy, and skill invested by end users to sort and collect

items [38]. For instance, individuals who engage in recycling set up designated recycling bins at home and allocate time to tasks such as cleaning and drying used plastic containers or flattening cardboard before disposal. Recent market research indicates that 76 percent of consumers across six countries express a desire to recycle more than they currently do [39]. In view of results showing that a large percentage of the public is eager to engage in recycling initiatives, the importance of raising awareness has grown. Understanding the factors that influence recycling behavior is crucial to encourage people to contribute to environmental sustainability by engaging in recycling activities.

Previous studies have explored the motivators of consumer recycling activity. For example, Soutter et al. [40] found that consumer personality traits, including openness, agreeableness, conscientiousness, and extraversion, have also been identified as significant predictors of recycling. As discussed earlier, recycling behavior should be explained by a multitude of motivating factors [38], and the role of self-regulation is crucial in establishing a connection between personality traits and recycling behavior. This study aims to contribute to the existing knowledge on consumer attributes that motivate recycling behavior by examining the causal mechanism among personality traits, self-regulated mindsets (i.e., frugality and sustainable efficacy), and recycling behavior.

2.3. Personality Traits

In the psychological literature, the “Big Five” is a widely used framework describing personality as consisting of five broad trait domains: conscientiousness, agreeableness, openness, extraversion, and neuroticism [41]. These traits are expected to affect people’s behavior across a range of contexts. In this study, we assessed the roles of conscientiousness, agreeableness, and openness as possible predictors of the self-regulated mindsets of frugality and green efficacy, which would subsequently influence recycling behavior. These three particular personality traits were chosen for investigation in this study based on the previous literature (e.g., Soutter et al. [40]), which has proved them as dominant predictors of pro-environmental behaviors. In the study by Ribeiro et al. [42], the researchers found the significant role of these three personality traits in influencing recycling, resource saving, or ecological purchase behaviors associated with frugality and self-efficacy. Each of these personality traits and its relation to frugality and green efficacy are reviewed in this section.

2.3.1. Conscientiousness

Conscientiousness refers to an individual’s ability to regulate their own behavior patterns [43]. It is positively associated with control tasks that enhance behavior, such as thinking before acting, self-control, and being organized, goal-directed, and hard-working [44]. Individuals who score high in conscientiousness tend to display characteristics of being careful, responsible, and trustworthy. Conversely, those who score low in conscientiousness are often perceived as indolent, careless, negligent, and more self-indulgent [45].

Researchers have highlighted conscientiousness as one of the primary traits associated with frugality [46]. High levels of conscientiousness are linked to high self-control and a tendency toward frugality, as individuals with frugal tendencies are not only cautious about their spending and consumption, but are also concerned about how they select, use, preserve, and protect products in the pursuit of long-term goals [17]. Prioritizing long-term goals is also a characteristic commonly observed in both conscientious individuals and frugal individuals [44]. Based on the aforementioned discussion, we posit that conscientiousness influences one’s tendency to be frugal.

H1a. *Conscientiousness positively influences frugality.*

2.3.2. Openness

As a personality dimension, openness is characterized by a propensity toward varied experiences sought purely for their intrinsic enjoyment and encompassed sub-traits, such as intellectual curiosity, aesthetic appreciation, and liberal attitudes [47]. Individuals high in

openness exhibit qualities such as creativity, intelligence, broad mindedness, productivity, and a curiosity for new experiences [48]. However, individuals low in openness tend to be more traditional in their values and beliefs, have conservative tastes, and rigidly adhere to their opinions. They are emotionally reserved and exhibit behavioral inflexibility [49]. People with high levels of openness demonstrate curiosity and perceptiveness toward the environment [50]. Furthermore, individuals with a high level of aesthetic sensibility, which is a sub-trait of openness, tend to value the environment and hold pro-environmental attitudes [23].

The features of openness also include cognitive flexibility, engagement in intellectual and creative domains, and a propensity for problem solving [51]. According to Bauman [52], frugality is considered more of an “exception” than the norm in today’s society. Therefore, adopting a frugal lifestyle requires greater cognitive flexibility, which is a significant aspect of openness. Individuals with high levels of openness are more likely to engage in reduced consumption, reusing items, and efficiently utilizing resources in a flexible and creative manner to contribute to the environment. Reinecke Flynn et al. [53] found a significant correlation between openness and frugality. Building on the foregoing discussion, we propose that openness increases one’s tendency to be frugal.

H1b. *Openness positively influences frugality.*

Openness is correlated with green efficacy or sustainable efficacy, which is an individual’s self-efficacy in matters of sustainability. Perez [54] discovered that openness to experiences was a significant factor influencing recycling efficacy among college students. According to Markowitz et al. [55], individuals with high levels of openness exhibit positive attitudes toward the environment and engage in pro-environmental behaviors such as waste reduction. This is because the facets of openness, such as intellectual curiosity and aesthetic appreciation, influence an individual’s interest in nature and their appreciation for the natural world. Therefore, we posit that the personality trait of openness increases one’s efficacy in adopting sustainable behaviors.

H1c. *Openness positively influences green efficacy.*

2.3.3. Agreeableness

Agreeableness is a personality trait that revolves around helping others and fostering positive relationships [56]. It compasses qualities such as altruistic behavior, sympathy, cooperativeness, honesty, and modesty [57]. Individuals who possess agreeableness are typically considerate, truthful, kindhearted, respectful, and eager to support others in various ways [57].

Previous research has indicated that agreeableness is associated with increased self-efficacy concerning society and the environment. For example, among New Zealanders, Hopwood et al. [58] discovered a link between individuals’ personalities and their attitudes and behaviors concerning sustainability, including their beliefs and concerns about climate change, environmental efficacy, personal environmental sacrifices, and support for the Green Party. These researchers confirmed that the traits of agreeableness and openness, in particular, were positively associated with sustainable attitudes and behaviors.

Agreeableness significantly influences individuals’ environmental concerns, attitudes (e.g., beliefs, concerns, and values), and behaviors (e.g., purchasing and recycling) relevant to promoting a more sustainable environment [40,58]. Agreeable individuals are inclined to engage in sustainable practices because they believe that doing so contributes to societal well-being and feel a sense of responsibility toward the environment [55]. Based on these findings, we hypothesized that the personality trait of agreeableness enhances individuals’ efficacy in adopting sustainable behaviors.

H1d. *Agreeableness positively influences green efficacy.*

2.4. Self-Regulated Mindsets: Frugality and Green Efficacy

In this section, we review the relationship between two self-regulated mindsets, namely, frugality and green efficacy, and how each of these self-regulated mindsets, which are influenced by the personality traits of conscientiousness, openness, and agreeableness, plays a role as an important predictor of recycling behavior.

2.4.1. Duality of Frugality and Green Efficacy

Frugality is defined as a consumer lifestyle trait characterized by the acquisition and resourceful utilization of economic goods and services in a restrained manner, with the aim of achieving long-term goals [17]. Individuals who possess greater life resources but embrace frugality consciously refrain from acquiring unnecessary items, even when they have the capacity to consume more. However, individuals with limited resources employ frugality to meet their basic needs. One's frugality is associated with their green efficacy or green values. Corral Verdugo and Rascón Cruz [59] found a significant relationship between sustainable behaviors—pro-ecological, altruistic, frugal, and equitable actions—and the intrinsic consequences of satisfaction, self-efficacy, and autonomy among college students in Mexico. Studies conducted by Haws et al. [60] also demonstrated that green consumers are concerned about the judicious use of both environmental and personal resources. They strive to maximize the value derived from products before disposing of them and search for innovative ways to reuse and repurpose their possessions. A frugal lifestyle or consumption values increase environmental consciousness as well as efficacy related to the environment (e.g., people have confidence in saving environmental resources). Frugal individuals take pride in their ability to consume efficiently and effectively [61] by maintaining, restoring, sharing, reselling, or recycling existing products to reduce waste. Therefore, we propose the following hypothesis:

H2. *Frugality positively influences green efficacy.*

2.4.2. Frugality to Recycling Behavior

Pro-environmental behavior, including recycling, is reliant upon frugality as a fundamental trait [33]. Frugal individuals strive to minimize the impact of human behavior on natural resources and exhibit concern for waste disposal practices [62]. Previous studies examining frugality in relation to the environment have demonstrated that an individual's frugality is associated with their sustainable lifestyle choices and recycling behavior [63]. For example, research conducted by Lastovicka et al. [17] found that frugality predicts resource-saving behaviors, including recycling. Ribeiro et al. [42] and Wang et al. [64] also found that frugality positively affects consumers' recycling intention and recycling behavior. Additionally, several studies that conceptualize frugality in terms of consumption habits, emphasizing the optimal utilization of assets and minimizing waste, have established a positive correlation between frugality, green consumption, and recycling [65]. In Evers et al.'s study [61], frugality was positively related to consumers' finding of new ways of disposing of products, novel uses of old products, and different uses of products in the end-use of consumption. In the context of precycling behavior, Klug et al. [66] confirmed that frugality and mindfulness contribute to an increase in precycling behavior. Considering frugality as a trait determining recycling behavior, we propose the following hypothesis:

H3a. *Frugality positively influences recycling behavior.*

2.4.3. Green Efficacy to Recycling Behavior

Green efficacy, a form of self-efficacy for sustainability, refers to one's confidence that the decisions they make will have a positive environmental impact [67]. When individuals possess a high level of self-efficacy, they are more likely to engage in sustainable behaviors [68]. Previous studies have established a correlation between green efficacy and engagement in sustainable behaviors, including recycling. For example, Schutte and

Bhullar [69] found that individuals with greater self-efficacy for sustainability demonstrated higher levels of motivation and engagement in sustainable behaviors. Similarly, Kang et al. [70] discovered that consumers with a high level of sustainable efficacy were more inclined to purchase eco-friendly products as a means of reducing pollution through their consumption habits. According to Arias and Trujillo [38], recycling is a multifaceted task influenced by an individual’s beliefs, knowledge, and situational factors relevant to the environment. Through their empirical study, these researchers confirmed that pro-environmental beliefs (i.e., green effectiveness) influence consumers’ adoption of simple pro-environmental behaviors, such as using reusable shopping bags, which, in turn, predict their engagement in more demanding behaviors, such as recycling. Building on the aforementioned discussion, we propose the hypothesis below. Figure 1 displays our study’s conceptual model. Table 1 summarizes the literature most relevant to the hypotheses of our study.

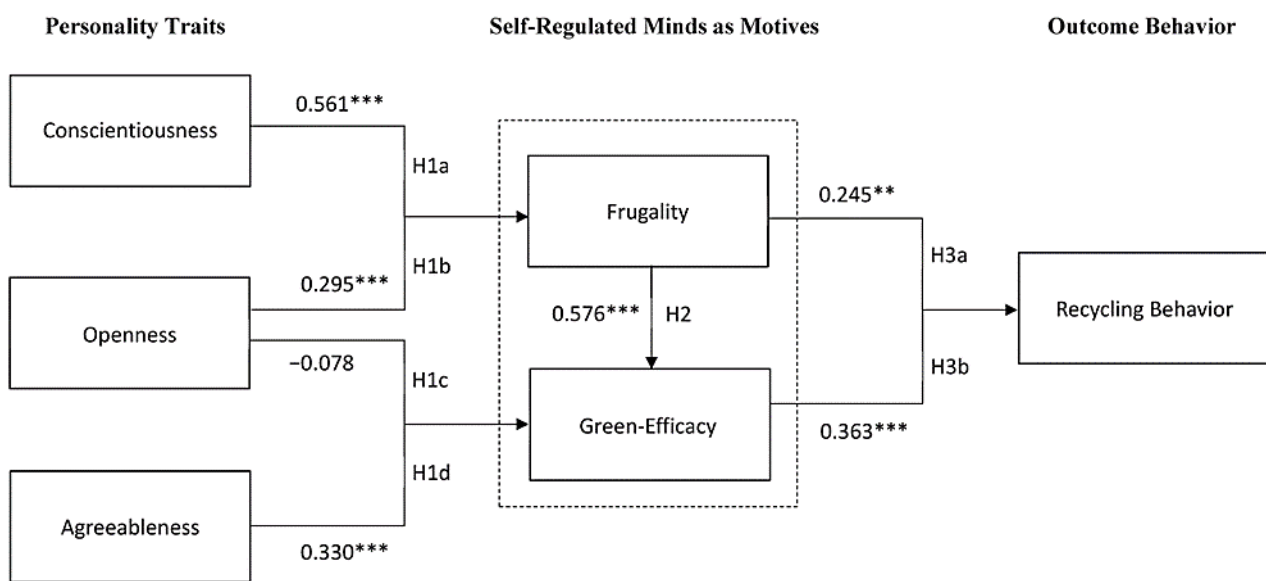


Figure 1. SEM Analysis results. Note: SEM model fit: $\chi^2(367) = 1012.49, p < 0.001$; CFI = 0.931; TLI = 0.923; RMSEA = 0.066 (90% C.I. 0.061–0.071), and SRMR = 0.042. ** $p < 0.01$, *** $p < 0.001$.

Table 1. Literature overview: Previous research most relevant to the hypotheses of this study.

| Hypothesis | Sources | Methods | Findings (Relevant to Our Hypotheses) |
|------------------------------------|----------------------------|---------|--|
| H1a: Conscientiousness → frugality | Xu [46] | Survey | Conscientiousness influenced frugality among adolescents. |
| | Puente-Diaz & Arroyo [71] | Survey | Conscientiousness had a positive effect on frugality in the research on people’s well-being. |
| | Ribeiro et al. [42] | Survey | Conscientiousness was positively related with natural resource saving behavior. |
| H1b: Openness → frugality | Awais et al. [48] | Survey | Openness to experience positively affected e-mavenism, which subsequently influenced frugality and sustainable consumption behaviors. |
| | Reinecke Flynn et al. [53] | Survey | There was a correlation among Openness to experience, market mavenism, and frugality. |
| H1c: Openness → green efficacy | Perez [54] | Survey | Openness to experience was found as a significant factor influencing recycling efficacy, serving as a covariate in research on recycling behavior. |
| | Hopwood et al. [58] | Survey | Increases in Openness were associated with personal environmental efficacy. |

Table 1. Cont.

| Hypothesis | Sources | Methods | Findings (Relevant to Our Hypotheses) |
|---|------------------------------|---------------|---|
| H1d: Agreeableness → green efficacy | Soutter et al. [40] | Meta-analysis | Agreeableness was associated with pro-environmental attitude and behavior. |
| | Hopwood et al. [58] | Survey | Agreeableness was significantly related to personal environmental efficacy. |
| H2: Frugality → green efficacy | Ribeiro et al. [42] | Survey | Frugality mediated the effects of self-efficacy on ecologically correct purchase and natural resource saving behavior. |
| | Coşkun and Yetkin Özbük [72] | Survey | Three consumer segments, characterized by varying levels of environmental values and self-efficacy, exhibited significant differences in terms of frugality. |
| H3a: Frugality → recycling behavior | Wang et al. [64] | Survey | Frugality affected consumers' recycling intention. |
| | Awais et al. [48] | Survey | Frugality positively affected sustainable consumption behavior as a self-regulated consumer behavior. |
| | Ribeiro et al. [42] | Survey | Frugality positively influenced recycling behavior. |
| | Evers et al. [61] | Survey | Frugality is positively related to consumers' finding of new ways of disposing of products, novel uses of old products, and different uses of products in the end-use of consumption. |
| H3b: Green efficacy → recycling behavior | Perez [54] | Survey | A positive relationship between recycling efficacy, climate change beliefs, and pro-environmental behavior was found. |
| | Ribeiro et al. [42] | Survey | Self-efficacy was positively related with ecologically correct purchase and natural resource saving behavior. |
| | Schutte and Bhullar [69] | Survey | Self-efficacy had a direct relationship with sustainable behavior and was also mediated by approach motivation for sustainable behaviors. |

H3b. *Green efficacy positively influences recycling behavior.*

3. Methods

3.1. Respondents and Procedure

To test the research model (Figure 1), we conducted an online survey, using U.S. consumer panelists from a market research firm. The respondents consisted of consumers aged 18 years or older and were recruited via an e-mail invitation to complete the survey. Each respondent was paid 3 USD to their earning account as compensation after completing the survey. We collected 483 responses over ten days. After excluding 83 incomplete and careless responses from straight-liners with the same repeated answers until the end of the survey, 400 responses were retained for the final data analysis. The participants' gender was evenly distributed (45.7% were male, and 54.3% were female), with a median age of 38 (mean age of 40.3). The majority were employed (75.8%), either full-time or part-time. The participants were distributed widely along the income spectrum, with the median annual household income being 60,000–79,999 USD. The majority were Caucasian participants (60.5%), followed by African American (18.0%) and Hispanic participants (9.3%). Figure 2 displays our method flow diagram, representing stages of our methodological research process.

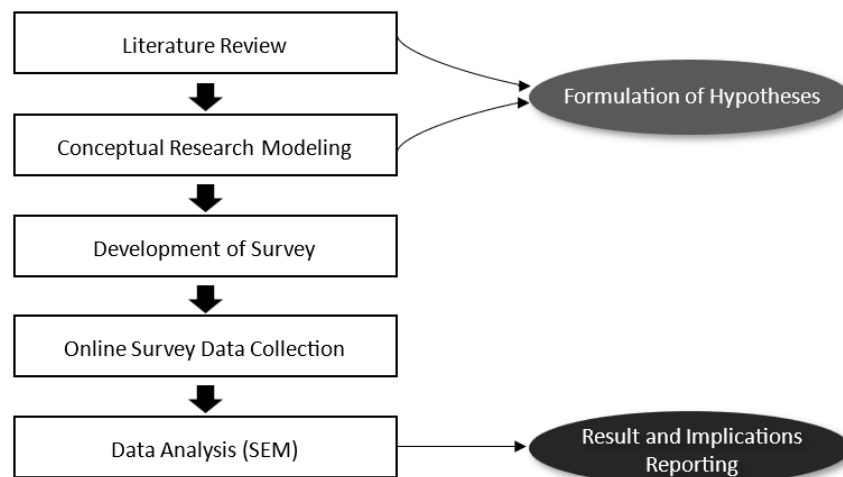


Figure 2. Method flow diagram.

3.2. Measures

The survey instrument measured three personality traits, two self-regulated mindsets, and recycling behavior. All scale items were modified from existing scales of previous studies and measured on a 7-point Likert-type scale, anchored by “strongly disagree” (1) and “strongly agree” (7). For personality traits, the scale items of the Big Five factors of conscientiousness, openness, and agreeableness were derived from Goldberg et al. [73] and Donnellan, Oswald, Baird, and Lucas [74]. Regarding self-regulated mindsets, the frugality scale items were derived from Lastovicka et al. [17], and the green efficacy scale items were adopted from Antil [75]. Lastly, the recycling behavior scale items were derived from a sub-factor of Socially Responsible Purchase and Disposal Behavior (SRPD) scale items, with the household items (i.e., cardboard, plastic containers, magazines, aluminum cans, steel/tin cans, and paper) from Webb, Mohr, and Harris [76]. Three researchers in the retail and consumer sciences field conducted a content analysis of the survey items at a major university in the southeastern United States. Based on their feedback, the scale items were revised for readability and clarity (Table 2).

Table 2. Measurement items and confirmatory factor analysis (N = 400).

| Scale Items | Item Factor Loading | Composite Reliability | AVE |
|--|---------------------|-----------------------|------|
| Conscientiousness | | | |
| I am always prepared. | 0.83 *** | 0.82 | 0.52 |
| I pay attention to details. | 0.80 *** | | |
| I like order. | 0.81 *** | | |
| I follow a schedule. | 0.76 *** | | |
| I am exacting in my work | 0.84 *** | | |
| Openness | | | |
| I have a vivid imagination. | 0.69 *** | 0.90 | 0.60 |
| I spend time reflecting on things. | 0.68 *** | | |
| I am full of ideas. | 0.85 *** | | |
| I love to think up new ways of doing things. | 0.81 *** | | |
| I am quick to understand things. | 0.72 *** | | |
| I have excellent ideas. | 0.86 *** | | |
| Agreeableness | | | |
| I am interested in people. | 0.79 *** | 0.90 | 0.64 |
| I have a soft heart. | 0.74 *** | | |
| I take time out for others. | 0.81 *** | | |
| I feel others' emotions. | 0.83 *** | | |
| I make people feel at ease | 0.82 *** | | |

Table 2. Cont.

| Scale Items | Item Factor Loading | Composite Reliability | AVE |
|---|---------------------|-----------------------|------|
| Frugality | | | |
| If you take good care of your possessions, you will definitely save money in the long run. | 0.83 *** | 0.87 | 0.62 |
| Making better use of my resources makes me feel good. | 0.79 *** | | |
| I believe in being careful in how I spend my money. | 0.81 *** | | |
| There are things I resist buying today so I can save for tomorrow. | 0.72 *** | | |
| Green efficacy | | | |
| It is worthwhile for the individual consumer to do something about pollution. | 0.87 *** | 0.88 | 0.72 |
| Since each consumer can make a positive effect upon pollution and natural resource problems, it makes a difference what I do. | 0.89 *** | | |
| Each consumer's behavior can have a positive effect on society by purchasing products sold by socially responsible companies. | 0.79 *** | | |
| Recycling behavior | | | |
| I recycle cardboard. | 0.90 *** | 0.95 | 0.77 |
| I recycle plastic containers. | 0.90 *** | | |
| I recycle magazines. | 0.88 *** | | |
| I recycle aluminum cans. | 0.86 *** | | |
| I recycle steel/tin cans. | 0.84 *** | | |
| I recycle paper. | 0.91 *** | | |

Note: CFA model fit: $\chi^2(362) = 1001.48$, $p < 0.001$; CFI = 0.931; TLI = 0.923; RMSEA = 0.066 (90% C.I. 0.062–0.071); and SRMR = 0.041. *** indicates $p < 0.001$.

4. Results

A confirmatory factor analysis (CFA) was conducted to validate the measurement model and evaluate construct validity. We used structural equation (SEM) modeling (H1a–H3b) to test the hypotheses proposed in this study. Both analyses were performed using Mplus v. 7.31. The parameters were estimated using the maximum likelihood method. The models were evaluated with the Chi-square test (χ^2), comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) [77].

4.1. Measurement Model

The CFA results showed that the measurement model had a satisfactory fit: $\chi^2(362) = 1001.48$, $p < 0.001$; CFI = 0.931; TLI = 0.923; RMSEA = 0.066 (90% C.I. 0.062–0.071); and SRMR = 0.041. All factor loadings ranged from 0.68 to 0.91, exceeding the 0.60 cut-off value (Table 2). The construct validities were evaluated via both convergent and discriminant validities. The findings confirmed the study constructs' convergent validity: (1) all path weights were significant ($p < 0.001$) [78]; (2) the composite reliabilities of all constructs ranged from 0.82 to 0.95, meeting the minimum criteria of 0.70 [79]; and (3) the values of the average variance extracted (AVE) were greater than the threshold value of 0.50 (ranged from 0.52 to 0.77) [80]. As illustrated in Table 3, discriminant validity was also confirmed, as the AVE values were greater than the shared variance (i.e., squared correlation coefficients) between all possible pairs of latent variables [80]. Table 2 presents the results of the CFA.

Table 3. Construct validity of the final measurement model.

| | Construct | 1 | 2 | 3 | 4 | 5 | 6 |
|---|--------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 1 | Conscientiousness | 0.52 | | | | | |
| 2 | Openness | 0.38 | 0.60 | | | | |
| 3 | Agreeableness | 0.45 | 0.50 | 0.64 | | | |
| 4 | Frugality | 0.46 | 0.38 | 0.36 | 0.62 | | |
| 5 | Green efficacy | 0.27 | 0.29 | 0.36 | 0.43 | 0.72 | |
| 6 | Recycling behavior | 0.15 | 0.13 | 0.12 | 0.21 | 0.24 | 0.77 |

Notes: The diagonal entries (bold) show the average variance extracted (AVE) for each construct. The off-diagonal entries represent the variance shared (squared correlation) between constructs.

4.2. Structural Model

With one exception of the hypothesized relation between openness and green efficacy (rejected H1c, $p > 0.05$), the results of the SEM support our proposed relations depicted in our research model: $\chi^2(367) = 1012.49$, $p < 0.001$; CFI = 0.931; TLI = 0.923; RMSEA = 0.066 (90% C.I. 0.061–0.071); and SRMR = 0.042. Except for the hypothesis of H1c (openness \rightarrow green efficacy), all other path coefficients were significant ($p < 0.01$), supporting the hypothesized relations (Figure 1). Specifically, frugality was significantly influenced by conscientiousness ($\beta = 0.561$, $p < 0.001$) (H1a) and openness ($\beta = 0.295$, $p < 0.001$) (H1b). Green efficacy was significantly influenced by agreeableness ($\beta = 0.330$, $p < 0.001$) (H1d) but not by openness ($\beta = -0.078$, $p < 0.326$) (H1b). In turn, both frugality ($\beta = 0.245$, $p < 0.01$) (H3a) and green efficacy ($\beta = 0.363$, $p < 0.001$) (H3b) have significant and positive effects on recycling behavior. Table 4 summarizes the results from the SEM.

Table 4. SEM model hypotheses testing (N = 400).

| Hypothesis | Structural Paths | Standardized Estimate (S.E.) | Est./S.E. (Z-Values) |
|--------------------|---|------------------------------|----------------------|
| H1a: supported | Conscientiousness \rightarrow frugality | 0.561 (0.055) | 10.212 *** |
| H1b: supported | Openness \rightarrow frugality | 0.295 (0.058) | 5.064 *** |
| H1c: not supported | Openness \rightarrow green efficacy | -0.078 (0.079) | -0.982 |
| H1d: supported | Agreeableness \rightarrow green efficacy | 0.330 (0.075) | 4.375 *** |
| H2: supported | Frugality \rightarrow green efficacy | 0.576 (0.060) | 9.545 *** |
| H3a: supported | Frugality \rightarrow recycling behavior | 0.245 (0.076) | 3.217 ** |
| H3b: supported | Green efficacy \rightarrow recycling behavior | 0.363 (0.075) | 4.851 *** |

Note: ** $p < 0.01$, *** $p < 0.001$.

5. Discussion and Implications

The current study investigated the relationship between personality traits, self-regulated states of mind (i.e., frugality and green efficacy), and recycling behavior. As hypothesized in H1a and H1b, our study found that frugality is significantly influenced by personality traits, particularly conscientiousness and openness. This aligns with previous research showing that individuals with high levels of conscientiousness tend to exhibit greater engagement in frugal behaviors [42,44,46,48,53,71,81–83]. This finding suggests that conscientious individuals, who tend to be organized, responsible, and reliable, may be more likely to engage in frugal behaviors because they prioritize behaving in a responsible and orderly manner. They may be more inclined to save money, plan for the future, and make deliberate and thoughtful decisions concerning resource utilization (for both personal assets and natural resources) [42]. Moreover, individuals with high levels of conscientiousness may be more self-disciplined, enabling them to resist impulsive or wasteful behavior choices and instead opt for frugal and resource-efficient alternatives [82]. Considering such characteristics of conscientious consumers, we might expect that designing a societal campaign with compelling visuals and clear statistical evidence to demonstrate how one's recycling helps conserve environmental resources and reduce climate change would be effective in appealing to their sense of personal responsibility toward future generations. Further, our findings

suggest that framing the campaign messages highlighting social norms and sharing peers' testimonials of active recycling behavior will inspire other conscientious individuals to participate in the norm. Further, marketing campaigns highlighting the economic benefits of recycling, such as cost savings or resource conservation, may appeal to individuals who prioritize frugality.

Similar to previous studies (e.g., [48,53,54]), frugality is also influenced by openness. Openness may lead individuals to engage in frugal behaviors because it is associated with a willingness to explore and accept new and novel ideas and experiences [44]. This trait can make individuals more open to information about the benefits of frugal and environmentally responsible behaviors, subsequently increasing their likelihood of adopting such behaviors. Open individuals may be more likely to engage in frugal behaviors because they are imaginative and innovative, which may make them more receptive to trying or experimenting with new/alternative approaches to conserving natural resources and minimizing waste. Therefore, policy interventions tailored to harness their innovative and imaginative tendencies may effectively promote their environmentally responsible behaviors. For example, offering educational workshops, along with resourceful online platforms, social media, and public events; tailoring personalized messages with language that appeals to consumers' curiosity and desire to learn; and explaining various methods of best recycling practices help empower others who share the same trait of openness to tap into their inherent motivation to adopt a new sustainable lifestyle. Further, as Psokus and Zukauskiene [25] found that adolescents with adaptive personality traits are more environmentally friendly, interventions to promote sustainability should be more targeted to adolescents who have greater capacity or willingness for change.

In examining the influence of openness and agreeableness on green efficacy, as hypothesized in H1c and H1d, we found that only agreeableness significantly facilitated it. People who are agreeable are more altruistic and eager to help others. These behaviors align with their values and reflect their pursuits of collective goals, supporting societal well-being and promoting sustainability. Therefore, they are often helpful, supportive, and affectionate enough to be more attentive to what people ask of them. In line with previous studies (e.g., [40,55,58]), the current study confirms that the personality trait of agreeableness significantly influences green efficacy, which ultimately increases the likelihood of pro-environmental behavior. Agreeable individuals, characterized by empathy and consideration for other's needs and feelings, are more likely to engage in sustainable practices such as recycling or green purchasing behaviors. To encourage individuals with agreeableness to participate in recycling behavior, emphasizing the social and community benefits of environmentally responsible actions in the campaign can be effective. For instance, promoting recycling through joint initiatives of donations or fundraising events with nonprofit organizations can attract agreeable consumers to voluntarily participate, and showcasing such efforts in public may increase their feeling of pride and psychological warmth.

In contrast, our H1c was unsupported, indicating that openness was not significantly related to green efficacy in this study. While several studies have shown that openness to experience is a significant factor in influencing personal environmental efficacy [54,58], the current study found that openness is not substantially associated with green efficacy. The possible reasons could include different sample characteristics and the contextual or temporal changes under which the past studies were conducted. Theories can also evolve over time. Furthermore, the strength of the variable relations, based on each study model's configuration, can influence the results. For example, a study conducted in Germany [84] found that the effect of openness on the decision to adopt residential solar systems was mediated by environmental concern and risk propensity, and that the direct influence was minimal.

It is possible that open-minded consumers may perceive recycling challenges as highly complicated tasks, which might have contributed to their uncertainty about the effectiveness of their recycling behavior [85,86]. They may be more receptive to information about the environmental impact of their actions, but they may not necessarily prioritize recycling

due to the uncertain results of making positive changes, and, thus, their green efficacy may be diminished. Moreover, openness is associated with an individual's inclination to try new things. Those who score high on this "openness" dimension tend to show universalistic attitudes with a tolerance for and reflection on investment in the search for novel solutions and benefits [87]. Therefore, open-minded individuals may prefer exploring new or innovative approaches to protect the environment rather than relying solely on traditional methods such as recycling. Another possible explanation is that openness may be more strongly associated with general self-efficacy than efficacy specifically related to sustainability (i.e., green efficacy), which requires a long-term engagement and a sustained commitment to the environment. As these explanations are speculative, we suggest that future studies conduct empirical testing to confirm such a relationship by specifically examining the different influences between self-efficacy in one's own ability and green efficacy focused on sustainability. It is noteworthy to mention, however, the level of openness among people and mediating effects with other types of personality traits may be important to consider in predicting the relationship between openness and environmental efficacy. For instance, Basic-Sontic et al. [88] found that introverts had higher levels of openness relative to extroverts. This suggests the possibility that there are other characteristics which influence green efficacy, and they may interact with openness in their effects. It highlights the possibility that these factors may have a stronger impact on openness than the one primarily considered.

As hypothesized in H2, concerning two self-regulated mindsets, frugality plays an important role in shaping an individual's green efficacy, which is consistent with many previous studies (e.g., [42,72]). This result especially supports Evers et al.'s [61] finding that frugal individuals take pride in their ability to consume efficiently and effectively by reusing or recycling existing products. As Haws et al. [60] mention, frugal consumers carefully utilize their physical assets and environmental resources, striving to derive as much value as possible from products before discarding them. Frugal individuals possess green values and engage in recycling behaviors as a means to conserve environmental resources and reduce waste, demonstrating confidence in their ability to perform these actions. The results suggest that a practical approach to promoting recycling could be providing positive reinforcement to consumers, such as praise, acknowledgment, and financial incentives or tax credits. Research by Xi and Bagchi [89] has shown that consumers are more likely to recycle when they receive positive evaluations for their recycling behaviors, highlighting the importance of positive reinforcement in motivation [90,91]. Positive feedback is likely to appeal to individuals with high frugality and green efficacy. For instance, a recycling reward program offered by grocery stores can encourage frugal consumers to recycle more to receive monetary incentives, which will also increase their confidence to make a difference at the societal level when the program accompanies collaboration with local community organizations providing peer acknowledgment.

Finally, as hypothesized in H3a and H3b, both frugality and green efficacy positively influence recycling behavior. This relation highlights the duality of the self-regulated mindset as a motivation for recycling behavior (H2, H3a and H3b). Despite each variable's direction being corroborated by previous studies [42,48,54,61,64,69], the integration of these variables in our study represents a significant and novel finding. Frugal individuals tend to be goal-directed, planning and taking action to achieve their goals [81]. This self-regulatory disposition helps individuals overcome barriers or challenges and persist in engaging in environmentally responsible behaviors, such as recycling, to achieve their sustainability goals. Further, frugality is also associated with particular emotional states. Frugal individuals may experience feelings of accomplishment and pride when they engage in behaviors that align with their values and goals. By recycling, they may service the aim to save money by limiting new product purchases and reducing waste disposal in a way that is also environmentally responsible. In this way, frugal individuals may experience feelings of accomplishment and pride when they engage in behaviors that align with their values and goals, and they may feel guilt or shame when they do not act by these values. Policymakers may want to consider targeting frugal individuals in their efforts to promote

pro-environmental behaviors, as they may be more receptive to messages highlighting both the economic and environmental benefits of such behaviors.

Our findings also suggest that consumers' green efficacy is crucial for their participation in recycling behaviors. We suggest that organizing recycling competitions or community-based challenges with prizes or rewards can efficiently appeal to individuals with green efficacy to engage in recycling behavior, as such events may stimulate their competitive nature.

The results of our study not only provide practical insights, but also contribute theoretical implications that enhance our understanding of the various factors that influence recycling behavior. Self-regulation theory (SRT) emphasizes the role of individual decision-making and motivation in shaping behavior, making it a useful framework for understanding and promoting recycling behavior. According to SRT, individuals possess the capacity to regulate their thoughts, emotions, and behaviors to achieve their goals. SRT also suggests that self-regulation is influenced by personality traits [36]. The current study's findings reflect these underlying concepts of SRT by demonstrating how an individual's self-regulatory mindsets, such as frugality and green efficacy, are influenced by certain personality traits, and they also predict that recycling behavior aligns with personal green values and goals. For instance, self-regulatory dispositions such as conscientiousness (i.e., one's tendency to be goal-directed and behave in a responsible and orderly manner) and self-efficacy (i.e., one's willpower or willingness to overcome barriers and challenges in doing something) are key factors motivating one's recycling behavior. Individuals with these dispositions regulate their behavior to achieve their goals, which, in this case, are to protect the environment.

Importantly, as mentioned earlier, self-regulated mindsets related to recycling behavior (frugality and green efficacy) help explain the "green gap", which refers to the discrepancy between individuals' environmental attitudes and their actual behavior [37]. In our study, we found the significant roles of these self-regulated mindsets to be factors that "connect" or "bridge" the gap in between personality traits and recycling behavior. Therefore, the SRT theory provides a comprehensive mechanism for understanding one's decision-making processes regarding recycling behavior, explaining the important role of self-regulatory mindsets as a key medium.

Based on our study results, future studies can delve deeper into the application of SRT, investigating other challenges in making a recycling decision. For example, varying the levels of accessibility, convenience, and other external factors of recycling facilities and infrastructure may influence consumers' self-regulatory mindsets that ultimately change their willingness to recycle. The research could investigate how such challenges diminish individuals' intentions and actual behavior regarding recycling. Such potential theory studies would expand the understanding of recycling behavior within the framework of SRT.

5.1. Limitations and Directions for Future Research

Our study is not free from limitations. First, it should be noted that our study did not encompass an exhaustive examination of all potential personality factors that contribute to a comprehensive understanding of the underlying motivations driving recycling behaviors. Identifying the underlying motives for behaviors requires more complex analyses and interpretations when it comes to environmentally responsible behaviors such as recycling. For instance, some individuals may recycle because of their belief that it positively impacts personal health (e.g., reducing air pollution) or their strong sense of civic responsibility and the desire to contribute to their community's well-being. Others may be influenced by peer pressure or normative pressure to recycle. Thus, future studies should incorporate the concept of social sustainability in understanding environmental sustainability, as one's recycling behaviors can be influenced by personal well-being, social norms, cultural values, accessibility to recycling facilities, and other community capacities to engage in recycling. While employing longitudinal designs should allow the exploration of temporal relation-

ships among personality traits, self-regulated mindsets, and recycling behavior, utilizing more diverse data collection methods, such as incorporating a qualitative component into the current study, could further enhance the findings. This way, a more robust causal inference of recycling behaviors can be developed.

Another limitation of this study is that it relies on self-reported data, including measures of personality traits, self-regulated states of mind, and recycling behaviors. This means that the findings may be influenced by social desirability bias, in which individuals are more likely to report engaging in environmentally responsible behaviors, such as recycling, when they are aware that their responses are being observed. This potential bias could affect the internal validity of the study or the extent to which the results can be attributed to the factors being studied. However, self-report measures are commonly used to assess a wide range of topics, including attitudes, beliefs, values, and behaviors. The current study employed instrument measures driven from existing studies to ensure reliability in research. Additionally, the anonymity of our study is expected to reduce the potential for social desirability bias.

Another limitation of this study is that it focused on U.S. consumers primarily consisting of Caucasian participants as the research population, which may limit the generality of our findings to the broader population. Future studies should aim to include a more diverse sample that reflects the racial and ethnic diversity of the population, as cultural differences in recycling practices and policies may lead to different attitudes toward environmental conservation. Despite these limitations, our study makes valuable contributions to the field of environmental sustainability by identifying key factors that influence recycling behaviors and providing practical implications for the design of behavioral interventions to promote recycling among consumers. Our findings confirm previous research on the relationship between frugality, green efficacy, and recycling behaviors, and they offer insights into the potential roles of personality traits in shaping environmental attitudes and behaviors. Future research should continue to explore the relationship among these factors, using a broad range of methodologies. Such research can help inform the development of policies and interventions aimed at promoting recycling and can contribute to the advancement of environmental sustainability.

5.2. Conclusions

This study examined the influences of personality traits (conscientiousness, openness, and agreeableness) on the self-regulated mindsets of frugality and green efficacy, and the influence of these self-regulated mindsets on subsequent recycling behavior. With the aim of gaining a deeper understanding of the mechanism of recycling, our study discovered that the self-regulated mindsets of frugality and green efficacy, which were influenced by certain personality traits, are significant predictors of consumers' engagement in recycling behavior. In terms of academic contributions, our findings extend previous recycling studies by identifying the complex and simultaneous effects of individual components (i.e., personality traits, frugality, and green efficacy) on consumer recycling behavior. These findings contribute to the design of effective public promotion strategies and behavioral interventions to facilitate consumers' frugal and sustainable lifestyles. Future research should continue to investigate the complex relationships between consumers' traits, beliefs, attitudes, and behaviors related to environmental sustainability in order to develop more effective interventions and policies for promoting recycling and other environmentally responsible behaviors.

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