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The three-century journey so far: internal attribution factors influencing consumer solid waste disposal in terrestrial ecosystem destruction

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Open and unsanitary solid waste disposal are major problems causing the drastic depletion of terrestrial ecosystems that have never occurred before in human social life. The internal attribution factors from the attribution theory were used to assess the terrestrial ecosystem destruction caused by consumers' solid waste disposal. With empirical data from 727 respondents selected conveniently, analysis was made using covariance-based structural equation modeling (CB-SEM). The study found that consumers' negative attitude of ability and effort significantly influenced terrestrial ecosystem destruction among consumers' solid waste disposal, while temperament was insignificant. The cultural space as a mediator was positively and significantly related to terrestrial ecosystem destruction. Again, consumer embodiment as a moderator was positively and significantly related to ecosystem destruction. The results and their proposed practical implications provide great insights into terrestrial ecosystem destruction among consumers' solid waste disposal.

KEYWORDS

three-century journey, terrestrial ecosystem destruction, solid waste disposal, attribution theory, internal attributions

1 Introduction

Open and unsanitary solid waste disposal are major problems causing the drastic depletion of terrestrial ecosystems that has never occurred before in human social life (Sparrow et al., 2020; Bhat et al., 2022). Globally, some countries are putting effort into achieving the sustainable consumption and disposal of solid waste, including waste energy, to reduce ecosystem destruction (Yeboah et al., 2023a). Studies reported that a similar objective has been set out by the United Nations of Sustainable Development Goal 12 for countries to aim to protect the planet (Diletta et al., 2024; Debrah et al., 2023). According to Tsujimoto et al. (2018), terrestrial ecosystems are biological systems made up of all the creatures interacting with one another in a specific physical context. The terrestrial ecosystem provides important services in natural and human systems, such as maintaining habitat, water security, and critical carbon storage (Garland et al., 2021; Quesnel Seipp et al., 2023). Nevertheless, considering the three-centuries journey so far, attaining a sustainable terrestrial ecosystem seems more complex and difficult-to-find lasting solutions due to the open and unsanitary ways and rates consumers dispose of solid waste, particularly in developing countries. The unsanitary ways

consumers dispose of solid waste pollute terrestrial ecosystems affect their functionality. Some solid waste constituents are plastics, metal, electronic waste, paper, textiles, food, leather, and other toxic ingredients (Bhat et al., 2022). In the 19th century, consumers in the Western World, for example, produced less solid waste. At the same time, leftover food used to be boiled by consumers to make soup and feed animals. Even items being discarded by adults curved to be useful for kids as playthings, repaired damaged items, and well-durable products such as table-and-wall clocks and home furniture were given from generation to generation (Mauch, 2016). Similarly, regarding agriculture and animal husbandry, manure served as organic fertilizer, reused straw in construction, rags in papermaking, bones found value in soap production, and ashes were used to control pests and fertilize the soil. More profoundly, dog excrement disposal was required as it served a purpose in tanning leather (Mauch, 2016; Chang et al., 2019; Kumah et al., 2020).

In the twentieth century, solid waste production and disposal have increased, resulting in the overstretching of waste management facilities. It has led to the inability of authorities to cope with the volume of solid waste produced daily (Nnaji, 2015; Gutberlet and Uddin, 2017; Mensah and Ampofo, 2021), nevermind the over 7–9 billion tons produced globally every year (Gutberlet and Uddin, 2017; Chang et al., 2019). Study shows that consumers are not ready to consider improving their terrestrial ecosystem with sustainable disposal as they often value existing ways of doing things (Scarpi et al., 2021). The terrestrial ecosystem crisis in the 1960s and 1970s was classified as a waste crisis for which no perfect solutions were found to resolve the problem. Thus, scientists, artists, journalists, and citizens denounced industrialization and the harmful effects of consumption (Agnoletti et al., 2024). The situation calls for zero solid waste disposal. This call was in reaction to an enormous increase in solid waste, which started approximately 100 years ago and accelerated after the Second World War. Paul Palmer proposed the zero-waste terminology in the 1970s and became the founding director of the Zero Waste Institute in Vacaville, California (Mauch, 2016).

The twenty-first century encountered several terrestrial ecosystem problems, such as diminishing natural resources, excessive pollution, soil erosion and contamination, loss of forests, and climate change. These problems have been fundamentally attributed to human social behavior (Macover, 2015). The world faces continuous and constant terrestrial ecosystem consequences due to urbanization and over-consumerism patterns. Many terrestrial ecosystem problems are due to the irrational disposal of solid waste. In addition, manufacturing firms contribute to environmental problems by boosting production capacity to meet market demands and consumers' consumption. It has led to the increased generation of harmful solid waste that is unauthorized to be disposed of in the environment. This has been noted to be a major problem as it is likely to affect the stability of the environment and social life of a society (Lissah et al., 2021; Raghu and Rodrigues, 2021; Rustiadi et al., 2021). The yearly consumption of the global market of solid plastic disposal has increased from approximately 2 million tons in the 1950s to nearly 368 million tons in 2019. This represents 180 times more plastics produced currently than 50 years ago. The global plastic consumption frequency calculated reached 400.3 million tons in 2022. The production of plastic is estimated to increase exponentially hereafter (Nayanathara Thathsarani Pilapitiya and Ratnayake, 2024).

It appears inevitable that the consequence of the high volume of solid waste disposals is due to the high level of consumer consumption. Disposables have also become very common at the global, regional, and local levels. The terrestrial ecosystem depletion in Ghana, especially in Sunyani (recorded 3833.9 tons per day), comprises illegal solid waste disposal, poor waste management, and the depletion of buffer zones (Yeboah et al., 2023b). This indicates that 15% of Sunyani households disposed of solid garbage in a close gutter and more than 78% anywhere (Yeboah et al., 2023b). Every record points to the fact that on the developmental rating, Ghana is retrogressing in areas such as sanitation, quality of life, and health (Cobbinah et al., 2017; Kyere et al., 2019; Paul et al., 2019). Private solid waste agencies are losing their lucrative jobs due to adopting a low-key approach, allowing waste to accumulate in the streets (Mauch, 2016; Cobbinah et al., 2017). Against inefficient structures and failed regulations, the proliferation of solid waste disposal in Ghana made garbage a sanitary, social, ecological, and economic issue (Agnoletti et al., 2024). solid waste disposal is outstripping authorities' ability to manage and dispose of waste in a sanitary way (Lissah et al., 2021). The conversion of natural land areas and improper disposal of solid waste is a problem in Ghana. For example, the beach at Wonsom has lost its beautification due to the continuous dumping of refuse at the shores (Cobbinah et al., 2017; Kumah et al., 2020). The activities of the consumers affect the water bodies, attracting insects and rodents and increasing flood incidence by blocking drainage water channels (Bhat et al., 2022). The stakeholders in Ghana need a more reliable approach to deal with terrestrial ecosystem destruction due to consumer disposal (Sharma and Jain, 2020; Kanhai et al., 2021).

Therefore, using a sample of individual consumer disposal experience, this study used internal attribution factors from the theory of attribution point of view in socio-psychology marketing of consumer attitudes toward terrestrial ecosystem destruction (Dugan, 1989; Wang and Hall, 2018). The internal attribution factors include ability, effort, and temperament, with the intervening variables cultural space and consumer embodiment. In addition, this is an opportunity to understand the consumers' behavior of continuous solid waste throwaway to suggest approaches that improve societies and solve terrestrial ecological system problems. Conspicuously missing from the terrestrial ecological system destruction in Ghana is the tough policy and compliance of implementing specific policies to control unsustainable consumer disposal of solid waste, internal attribution constructs contributing to the growing body of knowledge in consumer sustainable terrestrial ecosystem solid waste disposal attitudes of consumer research using attribution theory because it provides a perspective for inherent consumer participation in solid waste disposal practice. Thus, the study seeks to achieve the following research objectives:

- To examine the influence of consumers' internal attribution factors (i.e., ability, effort, and temperament) on consumer solid waste disposal in terrestrial ecosystem destruction.
- To assess the mediating effects of cultural space (CLP) in the potential relationship between consumers' internal attribution factors and terrestrial ecosystem destruction.
- To examine the moderating effects of consumer embodiment (CEDMT) on the relationship between temperament and terrestrial ecosystem destruction.

The remaining study sections are structured as follows: Literature review and formulation of hypotheses are discussed in section 2. The methodology is identified in section 3. Analysis and results are

presented in section 4. Section 5 highlights the discussions for the study; Section 6 presents the study with conclusions and practical implications. Section 7 accomplishes the study with limitations and future research.

2 Literature review and hypothesis formulation

2.1 Attribution theory

The attribution theory proposed by Heider (1958) further created from a combination of six basic dimensions of traditions is prominent among widely used theories in ascertaining and predicting consumer terrestrial ecosystem destructions behaviors outcomes (Dugan, 1989; Hau and Salili, 1993; Wang and Hall, 2018). The theory proposes that individual behavior is grounded on the success or failure of a decision-making process (Jackson, 2019). Per the attribution theory, the experiences of behavior explain how individuals understand their actions characterized by attitudes (Thoron and Bunch, 2017). Attribution theory has served as a cogent theory in addressing specific social issues. It makes it suitable for this study as people's attitudes on disposing of solid waste after consumption are socio-psychology behaviors in consumer behavior that are picked up from their environment. The consumer buys, uses the item for personal or domestic purposes, and discards it (Medori, 2020), internal attribution refers to the person's actions being undertaken. As put by Weiner (2010) and Dugan (1989), ability, effort, and temperament represent internal attribution factors. The present study conceptualized these factors in terrestrial ecosystem destruction among consumers' solid waste disposal. Literature on internal attribution makes it clear that adopting an internal attribution can cause consumers to engage in ecosystem destruction (Munyon et al., 2019). Accordingly, Thoron and Bunch (2017) reported that internal attributions make a person behave in the particular way they do. Another approach to internal attribution refers to an individual using personal reason as the cause of action (Ahmad, 2017). Hence, consumer attitudes are often engendered by internal attribution factors. Internal attribution is a crucial component that is being positioned in the study as a foundational concept essential to enhance ecosystem destruction. It has been viewed that the internal attribution factors are the most influential in terms of predicting terrestrial ecosystem destruction (Jackson, 2019). As a result, the study examines how three (3) facets of internal attributions can relate to terrestrial ecosystem destruction: (i) ability, (ii) effort, and (iii) temperament. Therefore, linking the internal attribution factors in solid waste disposal could relate to terrestrial ecosystem destruction. This study also examines how a mediator variable (cultural space) will relate to the relationship between internal attributions and terrestrial ecosystem destruction. The formulation of internal attribution factors has been discussed with the proposed hypotheses.

2.2 Terrestrial ecosystem destruction among consumers solid waste disposal

A study defined terrestrial ecosystem destruction as the loss of the environment's capacity to meet ecological and social goals and requirements (Berg and De Majo, 2017). Terrestrial ecosystem destruction is mainly the outcome of environmental degradation in countries and places where disposal is the worst. The landfills have been multiplying at an alarming rate, with large amounts of solid waste generated daily in urban and rural areas. The generated garbage has contaminated the vegetation and soil, surface water, groundwater, and air in enormous amounts. The consumer effect on the natural world is substantial (Budjav, 2022). As Mandeng et al. (2019) put it, disposed items, such as metal objects, can seriously threaten water systems due to their toxicity, abundance, and persistence in the environment. Solid waste disposal in landfills generates gases, leachate, and contamination. The emissions produced by landfills affect human health and ecological quality (Sallam, 2020). In addition, terrestrial ecosystem destruction includes draining large quantities of domestic sewage into a river. Domestic sewage contains solid waste, toxicants, plastic litter, and bacterial containments, and these toxic materials cause water pollution (Kiliç, 2021). Furthermore, Maurya et al. (2020) indicate that human activity is the primary driver of ongoing environmental changes. For instance, landfills are increasingly located near town centers due to the large amount of solid waste produced by consumers. Landfills generate a foul smell when burned and cause huge terrestrial ecosystem destruction.

2.2.1 Ability and terrestrial ecosystem destruction

According to Dugan (1989), ability refers to individual talents and skills which reside in them. Ability can relate to how consumers act toward a specific activity or an object. The ability has been seen as a self-concept that refers to general impressions about one's capacity in the task domain Cook and Artino (2016). Another study described ability as the power to perform an observable activity at a point in time. The concept of ability can be seen through behavior found in the practices (Soma et al., 2021). Still, another approach suggests that ability is considered a stable internal disposition that has greater importance in causing internal behavior. Individuals with the ability can purposely demonstrate positive and negative behavior (Sakaki and Murayama, 2013). A similar study conducted by Adrita and Mohiuddin (2020) in Dhaka City (Bangladesh) reported that ability plays a crucial role in predicting consumer behavior from an individual's attitude toward environmental consumerism. Zhao et al. (2010) emphasize that ability and consumer attitude directly influence the dimensions of their movement. This view was corroborated by Carless and Waterworth (2012), who affirm that ability is perceived as uncontrollable consumer behavior, not the result of freedom of choice, and is associated with prosocial reactions. The causal dimensions of ability are more likely to be activated following negative behavior. Many of these studies perceive ability as one of the strongest determinants influencing individual behavior. It can be said that past studies did not examine the use of the ability in terrestrial ecosystem destruction among consumer solid waste disposal. As a point, the study does not depart from the various definitions put forward by other studies (Dugan, 1989; Cook and Artino, 2016; Soma et al., 2021). This current study proposed that consumers' negative attitudes are more likely to cause improper solid waste disposal behavior related to terrestrial ecosystem destruction. Based on this, the following hypothesis is formulated:

> *H1: Consumers' ability has a significant positive influence on consumer solid waste disposal in terrestrial ecosystem destruction.*

2.2.2 Effort and terrestrial ecosystem destruction

A study in Dhaka city of Bangladesh examines the relationship between commonly used efforts and terrestrial ecosystem destruction (Adrita and Mohiuddin, 2020). According to Van Iddekinge et al. (2023) and Dugan (1989), effort is a sign that ensures individuals are responsible for learning from and celebrating the results of the activity being performed. Thus, individual attribution can lead them to act positively and negatively about a probable action or reaction. In addition, it described the individual effort as a gained experience of life, which is often a direct reflection of the effort put into action. This can be found in fulfilling an expectation (Jenkins, 2014), and as Van Iddekinge et al. (2023) put it, effort constitutes the level of capacity a person displays in a given situation. In a similar study by Carless and Waterworth (2012) in Monash City (Australia), to determine consumer effort, it is perceived as controllable and associated with adverse outcomes. The negative behavioral aspect of effort can influence the environmental effects of unlawful disposal of solid waste. Following Charness et al. (2018), decoupling how individuals apply effort in activity is complex. Hence, effort is a critical component of an action done by a person, and it influences behavior. The performance outcomes can be linked to effort. This view was corroborated by Devine et al. (2023), who affirmed that the principle of least effort had shown the inadequacies of sheer minor work, to which least effort is closely related. In this case, some persons believe that minimal work has been the basic minimum of the living process as often seems to be the case in particular situations that are considered. Similarly, a study by Newman and Brucks (2018) on effort also established that efforts activate mental representations of the moral self that elicit specific self-conscious emotions. Consumer behavior is influenced by the degree of self-effort. As a point, the study does not depart from the previous definitions established by other studies (Jenkins, 2014; Van Iddekinge et al., 2023). Hence, there were no available data in the literature that suggests the study of effort and ecosystem destruction. The current study proposed that individuals' negative attitudes are likely to influence improper solid waste disposal behavior related to terrestrial ecosystem destruction. Based on the discourse above, the following hypothesis is formulated:

> *H2: Consumers' effort has a significant positive influence on consumer solid waste disposal in terrestrial ecosystem destruction.*

2.2.3 Temperament and terrestrial ecosystem destruction

Earlier studies assess the relationship between the generally used temperament and the development of behavioral strategies and consumer behavior toward terrestrial ecosystem destruction (Rothbart, 2012; Liao et al., 2017). As Drabick and Rabinowitz (2017) put it, temperament is defined as usual individual behavior. The component of the temperamental traits includes their manifestation in life, genetic influence, and stability across time. Additionally, individual temperament is situated in moods and emotions. The way individuals control their temperament can lead to positive effects and vice versa. This view emphasizes that temperament is associated with a behavior that manifests in individual differences in the propensity to experience feelings and be involved in related thoughts and actions (Shackman et al., 2016). Similarly, this position was corroborated by the fact that temperament and character are strong determinants of human psychology and behavior. This also suggests that temperament act and character dimensions constitute a model with strong biological and neurological foundations. Again, temperament indicates an individual's tendency to show their emotional reactions to situations. Temperament has been classified into four dimensions: (i) novelty seeking, (ii) harm avoidance, (iii) reward dependence, and (i) persistence (Liao et al., 2017). According to Rothbart (2012), temperament tendencies form building blocks that underlie the development of individual personality differences. Temperament traits constitute an aspect of personality traits that include emotional and attentional reactive tendencies. The concept of temperament is the primary influence found in children and adults. Following Mincemoyer (2016), temperament has widely been recognized as one of the fundamental dimensions of the psychological mechanism of behavioral functioning. Interestingly, all persons (infants, children, adolescents, and adults) demonstrate individual behavioral characteristics. Thus, each personal ego is endowed with its peculiar dispositions and tendencies. In a study by Underwood et al. (2020), temperament differs from person to person across cultures. As a point, the study does not depart from the definition put forward by another study (Drabick and Rabinowitz, 2017). However, the literature has provided no evidence on temperament and waste disposables. From the literature perspective, it can be suggested that individuals' negative temperament facilitated improper solid waste disposal toward terrestrial ecosystem destruction, which is expected to be related to terrestrial ecosystem destruction. To this end, the following hypothesis thus stated:

> *H3. Consumers' temperament has a significant positive influence on consumer solid waste disposal in terrestrial ecosystem destruction.*

2.3 Mediator: consumers' internal attributions, cultural space, and terrestrial ecosystem destruction

According to a study by Silva et al. (2023), cultural space determines how people act and can be predicted by factors, including location, such as neighborhood, city, town, region, and personal relationships at home. Cultural activities, such as food, social networks, and religion, create an identity. According to Ferdous and Nilufar (2008), a community with its own culture is a cultural space. Cultural space is linked to the home individuals are raised, which manifests in behavior. The relationships within the home and how activities are formed can shape behavior. Furthermore, cultural space is a subjective assessment of the spatial characteristics of culturally advanced individuals. In a related study by Shavitt and Cho (2016), cultural space is linked to particular reasoning methods and attitudes that affect consumer behavioral decisions. A different perspective on the meaning and ways of interpretation is influenced by culture. In a study by Shavitt and Barnes (2020), cultural space offers a set of universal guidelines for perception, evaluation, interaction, and behavior. Culture is a mental construct; circumstances can trigger certain cultural conceptions in memory that affect perception, judgment, and conduct. Similarly, Guo et al. (2019) found that cultural space is one of the most popular and rapidly evolving concepts for concerns. The shared meaning for local people to display

their culture has long been regarded as cultural space. Additionally, it is well established as a location for cultural activities, including the consumption process. Based on its environment and regional culture, it offers local people a way of life. Consumer identity symbolizes the individual consumer environment interactions. As a point, the study does not depart from the various definitions put forward by other studies (Silva et al., 2023; Ferdous and Nilufar, 2008). This study proposed that cultural space among social practices is more likely to influence individuals' negative attitudes toward improper disposal behavior toward terrestrial ecosystem destruction. Thus, this hypothesis is proposed:

> *H4. Cultural space mediates the relationship between consumers' internal attribution factors and terrestrial ecosystem destruction.*

2.3.1 Moderator: consumer embodiment interacts with temperament and terrestrial ecosystem destruction

According to Lux et al. (2021), embodiment is the process of giving a spirit human form. The body serves as a canvas on which to paint ideas, feelings, and stories that will be presented to an audience. As a result, consumers have embodied brains whose conceptual frameworks are shaped by, emerge from, and are given meaning by human bodies. As Llewellyn (2021) put it, embodiment acknowledges what customers have learned via interaction with their bodies and embodied activities. Following Solér et al. (2022), the idea of embodiment helps consumers have experiences that mirror their personalities. In addition, Gilleard and Higgs (2015) contend that embodiment has always been contingent, with its rituals and stories historically embedded in both social and private time. Embodiment habits can develop from either the individual's history or from a history collectively developed over many generations. The study divided embodiment into two categories: (i) processes embodiment, which is focused on embodied self-care practices, and (ii) embodying identity, which refers to the representational use of the body to support distinct identities whose social realization is influenced by some physical differences. In a related study, Wallenborn and Wilhite (2014) argue that consumers exhibit embodied consumption behavior. Routines fashion its wants, preferences, and embodied knowledge that guides the choice and application of what has been purchased. Similarly, a study on embodiment by Vercel (2018) asserted that customers' judgments are influenced by environmental stimuli and interactions with other people, rather than being made in a vacuum of objectivity. The experiences and backgrounds of consumers have an impact on their purchase choices. The embodied socio-cultural past shapes their tastes and the cultural items they have an affinity for. Thus, consumer brains and embody make a whole human form. As a point, the study does not depart from the various definitions put forward by other studies (Lux et al., 2021; Llewellyn, 2021). This current study suggests that consumer embodiment is more likely to cause a significant intervention in the causal relationship when a consumer engages in terrestrial ecosystem destruction behavior. From the review of the literature, the following hypothesis is formulated:

> *H5. Consumer embodiment significantly moderates the relationship between temperament and terrestrial ecosystem destruction.*

2.3.2 Control variables

The study used the age, gender, and education of the participants as control variables. The use of age, gender, and education as control variables is limited in the current literature. However, the literature has suggested that the educated population is critical for individuals to comprehend and appreciate the changing needs. It is expected that a large education population can help reduce the threat of terrestrial ecosystem destruction (Nation et al., 2020). Hence, age, gender, and education factors were not found to be either directly or indirectly used in terrestrial ecosystem destruction. Thus, in line with the proposed hypotheses, age, gender, and education are used as control variables.

2.4 Research model

Following the above conceptual model development, the current study hypothesized research model in Figure 1.

3 Methodology

3.1 Data collection

The study used face-to-face surveys to gather data within specific areas of Bono Regional Capital in Sunyani, and a convenient sampling process was adopted. The men and women aged 18–60 years and above who are literate and can comprehend written and spoken languages were the representative categorization under this study. The unknown sampling frame of consumers who can read, write, and comprehend written on terrestrial ecosystem destruction in Ghana led to the adoption of a convenient sampling process (Malhotra et al., 2017; Skowronek and Duerr, 2009; Jager et al., 2017). In addition, the selection of characteristics depends on the objectives of the current study and contextual information. The data were gathered over 5 weeks, measuring attitudes (i.e., internal attribution factors—ability, effort, and temperament) and the intervening influences of variables such as cultural space and consumer embodiment in consumer experience of solid waste disposal toward terrestrial ecosystem destruction that allowed the population interest to relate to what the research intends to investigate by this empirical study. Generally, just one approach was employed in comparatively smaller communities and multiple times for bigger communities, but at different vantage places during the data collection process to prevent obtaining biased information while remaining objective of the convenient sampling process. The research maintains a convenient sampling process to reach the respective population. The study used a 10:1 calculation ratio based on structural equation modeling. The parameters (items) used in this study are 35 based on the five cases per parameter estimate, so the sample size was $10 \times 35 = 350$ responses were deemed sufficient. However, as the methodological literature suggests, a larger sample is preferable to overcome sampling error (Attiq et al., 2021). The returned survey responses were cross-checked to eliminate incomplete responses, yielding 727 valid responses for assessment, representing 91%.

3.2 Instrument and measures

The structured closed-ended questionnaire was applied to collect the data containing the variables investigated. Measurement items from

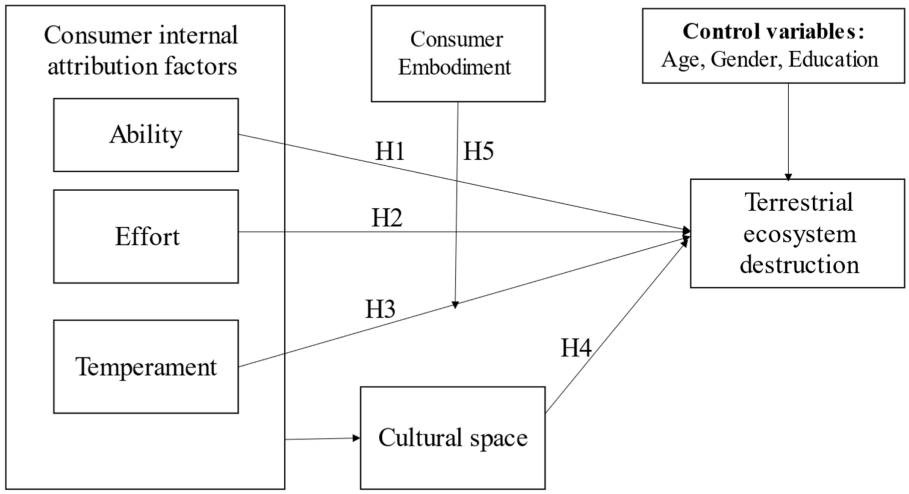

FIGURE 1
Research model.

earlier literature were used. Thus, a structured questionnaire was designed with previously validated multi-item scales (Malhotra et al., 2017). The existing multi-item measures were adopted and modified to measure all items in this study using a 5-point Likert scale, with 1 being strongly disagree and 5 being strongly agree. The scales for internal attribution factors (i.e., ability, effort, and temperament) were taken from Dugan (1989), Russell (1991), Hau and Salili (1993), and Rettew and McKee (2005). The scales for cultural space were taken from Karadag et al. (2018). The scales for consumer embodiment (Peck and Gonzalez-Franco, 2021; Romano et al., 2021), while the scales on terrestrial ecosystem destruction were adopted from DeChano (2006), Feld et al. (2009), and Greenland et al. (2023).

3.3 Data analysis

The study used the covariance-based structural equation modeling (CB-SEM) for analyzing the proposed conceptual model as it was more appropriate concerning the data requirements, model complexity, and relationship specifications. A statistical analysis was performed. The software packages SPSS 29, AMOS 29, Microsoft Excel, and the Stats Tools Package were employed. To perform the test of hypotheses, the data for evaluating the linked constructs gathered through the survey were verified. In addition, the study assessed exploratory factor analysis (EFA) with Kaiser–Meyer–Olkin (KMO), the latent common factor (LCM), and Cronbach's alpha was used to test the reliability and robustness of the instrument (Hair et al., 2014; Malhotra et al., 2017). In addition, in SEM, all of the relationships in the hypothesized model are tested simultaneously, which adds to the robustness of the results. The two-step approach was applied to ensure stability as part of the SEM methods. First, the current research assessed a measurement model of confirmatory factor analysis (CFA) to ascertain the questionnaire parameters loadings of the constructs. The goodness-of-fit measurement indices and discriminant validity (HTMT) used in this study are presented. This was followed by step 2, that is, path analysis, and mediation and moderation analysis, which was developed to quantify the relationships among multiple variables (Hair, 2011; Fan et al., 2016).

4 Results

4.1 Demography of respondents

The characteristics of respondents to the study were 727 using SPSS 29. The gender disparity ratio of participants (male to female) was 55.7%:44.3%. The majority of the mean age of the respondents was 27.71 years: 259 respondents representing 35.6% fell within the age range of 25–31 years, and 5 (0.7%) of the respondents fell within the age range of 60 and above; 448 of the total participants (61.6%) were single, 261 (35.9%) married, and 18 (2.5%) were divorced. Regarding education level, 46.8% for the first degree, 31.4% for diplomas, 11.6% for masters, 5.1% for professionals, 1.1% for doctorate, and 4.1% for other qualifications. Employment category, 30.8% in the public sector, 29.8% in the private sector, 13.5% looking for work, 20.4% students, and 5.5% in other faculties.

4.2 Terrestrial ecosystem destruction among consumers solid waste disposal

The participants' responses about the solid waste types being the types disposed into the environment. Regarding the eight items examined, 90.88 was the mean score found. Most participants, 54.2%, participate in plastics disposal, 20.4% of food leftover, 7.0% leather, 6.9% metal, 4.3% paper, 3.1% textile, 2.9% e-waste, and 0.8% glass.

4.3 Model estimation procedure

As part of the measures to ensure robust results, exploratory factor analysis (EFA) with Varimax rotation in principal axis factoring analysis was performed. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was 0.939 with a p-value <0.000 for Barlett's test of sphericity (Temel et al., 2018; Azman Ong et al., 2022).

4.4 Common latent factor (CLF)

Evaluating a common latent factor in confirmatory factor analysis (CFA) by giving it all the items of the constructs included in the model is the most popular strategy for reducing common method bias (Ranaweera and Jayawardhena, 2014). Using Microsoft Excel, the latent common method factor (CLF) is calculated as the estimate with CLF minus without CLF in order to ascertain the estimate difference. CLF constructs in a model are retained or maintained if the difference between them is greater than 0.2. The observations of the results showed that the method bias does not exist in the proposed research model. Thus, all the values below the suggested threshold are given in Table 1 and Figure 2 (Afthanorhan et al., 2021).

4.5 CFA and measurement of validity and reliability

Confirmatory factor analysis was performed to evaluate the reliability and validity measurement model, including composite reliability (CR) and convergent and discriminant validity (HTM) (see Table 2 and Figure 3 of the measurement model). Using the proposed criterion of composite reliability (CR), convergence is realized when the estimate is more than or equal to 0.70, and the average variance extracted (AVE) recommended threshold for cutoff points is more than 0.50 (Hair et al., 2019). After the first run, the recommended value for AVE of cultural space was less than 0.50. Hence, the value 0.631, cultural space item 5 (my social life does not contribute to how I throw away solid waste) was removed. Still, upon the first removal, AVE was <0.50. Another value, 0.675, was deleted for cultural space item 4 (my home interaction does not control how I throw out trash/garbage). Finally, the value of AVE of cultural space was attained (Fornell and Larcker, 1981). Hence, the statistical integrity of the path analysis or structure of the model is based on the fit of the model (Fornell and Larcker, 1981; Lim and Brooks, 2009). Thus, indicators of the goodness of fit of the measurement model, such as the chi-square (x2/df) (Hair et al., 2010), the goodness-of-fit index (GFI), the adjusted goodness-of-fit index (AGFI) (MacCallum and Hong, 1997), the standard root mean residual (SRMR) (Hu and Bentler, 1999), the Normal Fit Index (NFI) (Hu and Bentler, 1999), the Tucker–Lewis Index (TLI) (O'Rourke and Hatcher, 2013), the Comparative Fit Index (CFI) (O'Rourke and Hatcher, 2013), and the root mean squares error of approximation (RMSEA) (Hu and Bentler, 1999) were assessed. The use of the indices served as a mechanism to know any shortfall for the study sample grounded on population discrepancy for the study. The values for the fit indices all meet the suggested standardized thresholds with respect to X^2/df = 2.219(x2 = 1051.676, df = 474), GFI = 0.918, AGFI = 0.903, SRMR = 0.060, CFI = 0.973, TLI = 0.970, NFI = 0.953, and RMSEA = 0.041. This shows that the results were satisfactory. In addition, Table 3 highlights the result of discriminant validity. As Henseler et al. (2015) demonstrated, measuring discriminant validity using AVE, MSV, or MaxR(H) square roots is insufficient, particularly when indicator loadings vary little. As a result, they developed the heterotrait–monotrait ratio of correlations (HTMT) analysis. The discriminant validity among all the study constructs was within the recommended threshold value of 0.9 or 1. All the HTMT values fall within the suggested reflective measure criteria. Hence, this study had no discriminant validity issues.

5 Structural model

After confirming the validity and reliability of the data, the study tested the SEM to measure the structural path analysis. In addition, the assessed results regarding the mediating path or indirect relationship are shown in Table 4 (Zhao et al., 2010; Schreiber et al., 2006). Additionally, the study tested the moderating effects using the approach by Ali Memon et al. (2019) as highlighted in Table 5. The model fitness has been checked already and is fit for purpose.

5.1 Direct hypotheses testing

The direct path hypothesized relationship and control variables were examined based on the significance test of the study theory model as highlighted in Table 6 and Figure 4. The study proposed model 1 that consumers' ability has a significant positive influence on consumer solid waste disposal in terrestrial ecosystem destruction (H1). The study found that ability statistically and significantly influenced terrestrial ecosystem destruction among consumer solid waste disposal ($\beta = 0.080$, t-value = 3.509, $p < 0.000$). Thus, the consumer's negative attitude of ability influences their disposal in terrestrial ecosystem destruction.

Additionally, the study argued that consumers' effort has a significant positive influence on consumer solid waste disposal in terrestrial ecosystem destruction (H2). The study supported H2 as an effort statistically and significantly influences terrestrial ecosystem destruction among consumer solid waste disposal ($\beta = -0.088$, t-value = −3.869, $p < 0.000$). This indicates that the consumers' negative attitude of effort influences their disposal in terrestrial ecosystem destruction.

Furthermore, the study proposed that temperament of consumers has a significant positive influence on consumer solid waste disposal in terrestrial ecosystem destruction (H3). The finding disconfirms H3 as there was no statistical and significant influence on terrestrial ecosystem destruction among consumer solid waste disposal ($\beta = -0.035$, t-value = −0.833, $p > 0.405$). This seems to suggest that consumers may not view the degree of their temperament behavior to terrestrial ecosystem destruction among disposables.

Regarding the control variables, the results showed a significant controlling influence of age on terrestrial ecosystem destruction ($\beta = 0.133$, $p < 0.000$). In addition, gender was found a significant controlling influence on terrestrial ecosystem destruction ($\beta = 0.258$, $p < 0.000$). The results indicate that the socio-demographic variables significantly drive terrestrial ecosystem destruction. Education variables did not exert any significant controlling influence on the terrestrial ecosystem destruction.

5.2 Mediation analysis—indirect hypothesis results

The study sought to ascertain the mediating effect of cultural space in the relationship between internal attribution factors and terrestrial ecosystem destruction (H4), as highlighted in Figure 5. The results in Table 4 indicate that the relationship between internal attribution factors and terrestrial ecosystem destruction was statistically and significantly mediated by cultural space in path 4: $\beta = 0.077$, t-value = 4.514, $p < 0.000$. This means that when consumers

TABLE 1 Common method bias using latent common method factor.

Standardized regression weight	Variables	Estimate with CLF	Estimate with No CLF	Difference
ABT1 < ---	Ability	0.717	0.866	0.149
ABT2 < ---		0.830	0.900	0.070
ABT3 < ---		0.867	0.901	0.034
ABT4 < ---		0.873	0.851	−0.022
ABT5 < ---		0.849	0.888	0.039
EFT1 < ---	Effort	0.780	0.889	0.109
EFT2 < ---		0.0.831	0.889	0.058
EFT3 < ---		0.844	0.916	0.072
EFT4 < ---		0.869	0.907	0.038
EFT5 < ---		0.847	0.896	0.049
TPM1 < ---	Temperament	0.831	0.832	0.001
TPM2 < ---		0.764	0.764	0.000
TPM3 < ---		0.845	0.845	0.000
TPM4 < ---		0.787	0.788	0.001
TPM5 < ---		0.795	0.794	−0.001
CLP1 < ---	Cultural space	0.698	0.694	−0.004
CLP2 < ---		0.694	0.701	0.007
CLP3 < ---		0.743	0.739	−0.004
CLP4 < ---		0.669	0.675	0.006
CLP5 < ---		0.627	0.631	0.004
EBD1 < ---	Consumer embodiment	0.770	0.879	0.109
EBD2 < ---		0.871	0.911	0.040
EBD3 < ---		0.893	0.902	0.009
EBD4 < ---		0.851	0.905	0.054
EBD5 < ---		0.793	0.862	0.069
ITA1 < ---	Internal attribution	0.917	0.918	0.001
ITA2 < ---		0.869	0.869	0.000
ITA3 < ---		0.849	0.850	0.001
ITA4 < ---		0.879	0.880	0.001
ITA5 < ---		0.849	0.847	−0.002
ESD1 < ---	Terrestrial ecosystem destructions	0.893	0.892	−0.001
ESD2 < ---		0.851	0.852	0.001
ESD3 < ---		0.826	0.828	0.002
ESD4 < ---		0.874	0.785	0.001
ESD5 < ---		0.813	0.814	0.001

have a negative cultural environment, it indirectly affects their disposables toward terrestrial ecosystem destruction.

5.3 Moderation analysis

The moderation analysis was performed hierarchically. As a result, the moderation was created by multiplying the independent, dependent, and moderating variables using SPSS 29 to create the interaction term. The results in Table 5 and Figure 6 indicate that the consumer embodiment positively moderates the significant relationship between temperament and terrestrial ecosystem destruction ($\beta = 0.002$, t-value = 37.434, $p < 0.000$). The interaction effect presented here implies that consumer embodiment mainly strengthens their negative disposables of consumer attitude toward terrestrial ecosystem destruction.

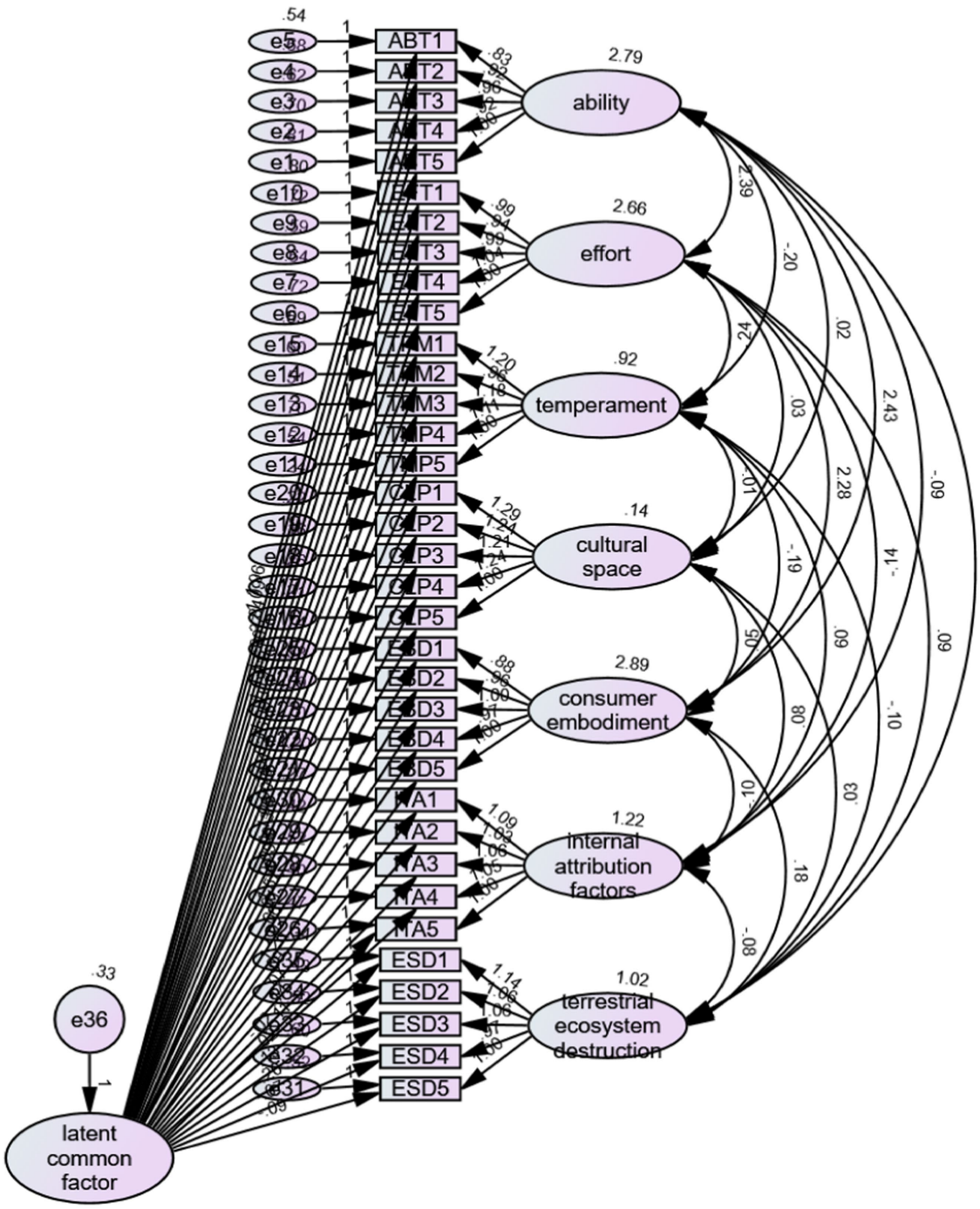

FIGURE 2
Measurement constructs of common method bias of latent common method factor.

6 Discussion

This study investigated socio-psychological variables in attribution theory towards terrestrial ecosystem destruction among consumers of solid waste disposal. The findings confirm that this proposed conceptual model is valuable in understanding variables contributing to terrestrial ecosystem destruction, as demonstrated in the three-centuries journey so far. The conceptualized ability was discovered to have a statistically significant relationship with terrestrial ecosystem destruction. The results support the view that consumers' ability as a negative attitude contributes to the terrestrial ecosystem destruction of disposal of consumer solid waste in Ghana. This underscores that ability plays a crucial role in causing the effect on consumer social behavior from an individual's attitude regarding ecosystem destruction (Adrita and Mohiuddin, 2020). According to a prior study, negative social behavior increases the likelihood that causal dimensions of the ability would be triggered (Carless and Waterworth, 2012). Furthermore, it can be affirmed that negative

TABLE 2 Factor loading of measurement items.

First-order constructs	Item code	Factor loading	CR (>0.7)	AVE (>0.5)	Cronbach's alpha (>0.7)
Ability (Russell, 1991; Hau and Salili, 1993)					
My behavior coincides with how I abandon waste/garbage	ABT1	0.866	0.946	0.777	0.945
I see myself consistent with how waste/garbage is being rejected	ABT2	0.900			
My behavior is not concerned about the area I left waste/garbage	ABT3	0.901			
My behavior describes places where I abandon waste	ABT4	0.851			
My actions do not favor waste/garbage thrown away	ABT5	0.888			
Effort (Dugan, 1989; Russell, 1991)					
The throwaway solid waste is not something particular to me	EFT1	0.889	0.955	0.809	0.955
Throwaway solid waste is something easy to be done	EFT2	0.889			
I throw away solid waste without spending much time	EFT3	0.916			
The time spent does not describe my throwaway solid waste	EFT4	0.907			
Solid waste does not require a special focus	EFT5	0.896			
Temperament (Dugan, 1989; Russell, 1991; Rettew and McKee, 2005)					
I do not consider anything when throwing away trash/garbage	TPM1	0.832	0.902	0.648	0.901
I abandon solid waste wherever without taking into consideration much thought	TPM2	0.764			
The throwaway solid waste has nothing to do with anyone	TPM3	0.845			
It is not anyone's concern how I reject trash/garbage	TPM4	0.788			
I do not care about how I handle trash/garbage	TPM5	0.794			
Cultural space (Karadag et al., 2018)					
My neighborhood plays a part in how I throw out trash/garbage	CLP1	0.746	0.764	0.512	0.817
The community I live in contributes to how I throw out trash/garbage	CLP2	0.644			

(Continued)

TABLE 2 (Continued)

First-order constructs	Item code	Factor loading	CR (>0.7)	AVE (>0.5)	Cronbach's alpha (>0.7)
My brought up is not in line with how I throw out trash/ garbage	CLP3	0.769			
Embodiment (Peck and Gonzalez-Franco, 2021; Romano et al., 2021)					
I do not see myself the same as how I throw out waste/ garbage	EBD1	0.879	0.951	0.796	0.950
I felt my body move towards how I throw out waste/ garbage	EBD2	0.911			
Waste/garbage is a critical issue for my living	EBD3	0.902			
I felt my body controls the way I throw away solid waste	EBD4	0.905			
I felt I could control the way I throw away solid waste	EBD5	0.862			
Internal attributions (Russell, 1991; Hau and Salili, 1993)					
Much strength is not required when throwing out waste/ garbage	ITA1	0.918	0.941	0.762	0.941
There is not anything at stake to consider when abandoning waste/garbage	ITA2	0.869			
I cannot identify who I am and how I approach the throwaway waste/garbage	ITA3	0.850			
I only fulfill the duty to abandon waste/garbage	ITA4	0.880			
I will not gain anything from how I throw out waste/ garbage	ITA5	0.847			
Terrestrial ecosystem destructions (DeChano, 2006; Feld et al., 2009; Greenland et al., 2023)					
The way I abandon waste/ garbage has the greatest impact on reducing the threat of clean land.	ESD1	0.892	0.920	0.697	0.920
I approach waste/garbage thrown out differently, which greatly reduces the threat to animals and plants.	ESD2	0.852			
My approach in abandoning waste/garbage severely affects clean drinking water.	ESD3	0.828			
The consumer approach of abandoning waste/garbage often produces disastrous consequences.	ESD4	0.785			
The consumer engagement with waste/garbage abuses the environment.	ESD5	0.814			

Confirmatory factor analysis (CFA), SEM, Structural equation modeling.

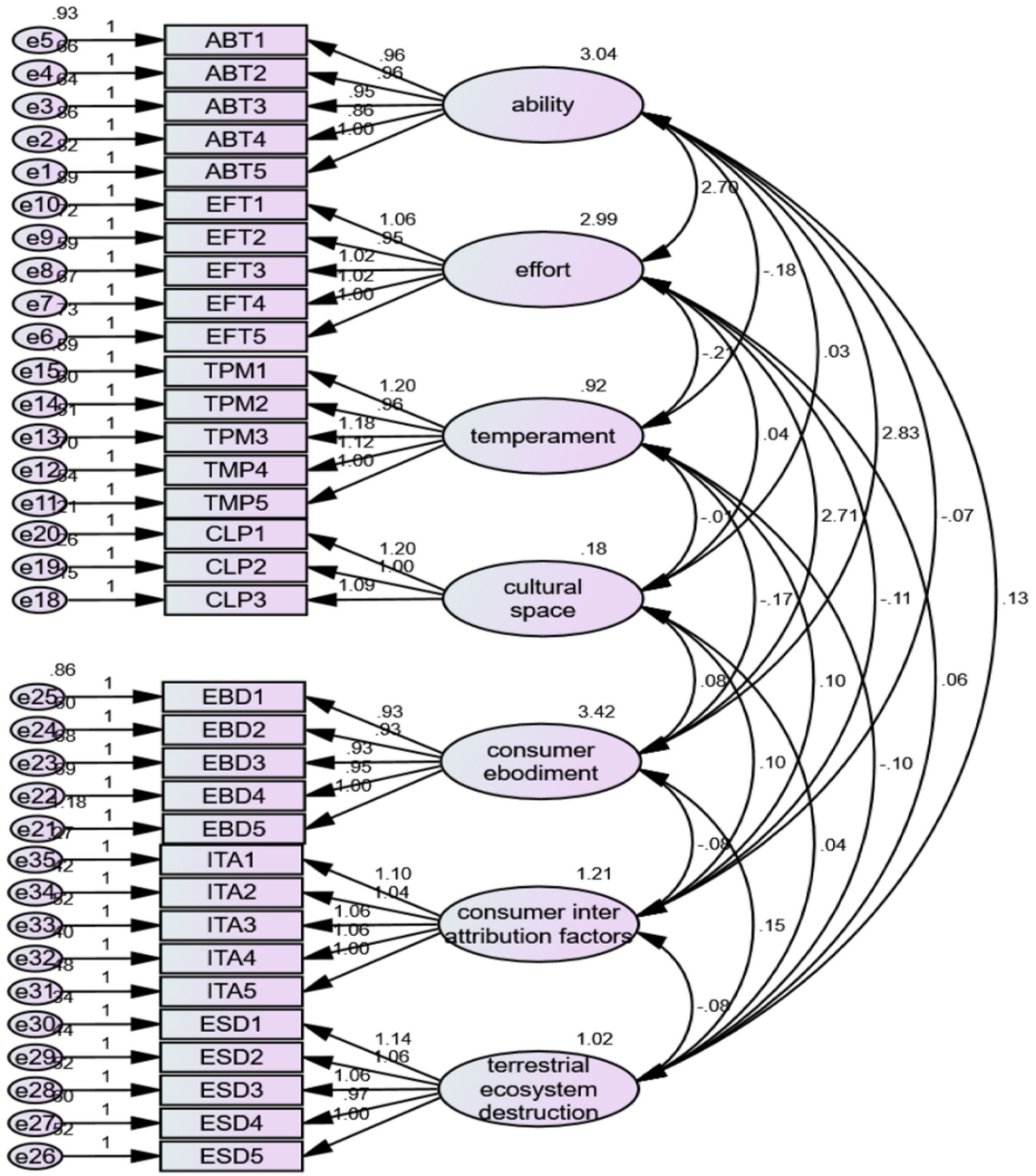

FIGURE 3
Measurement model of internal attribution factors, cultural space, consumer embodiment, and terrestrial ecosystem destruction.

behavior in solid waste disposal causes terrestrial ecosystem destruction (Attiq et al., 2021).

The finding implies that the conceptualized effort significantly affected the terrestrial ecosystem destruction of solid waste. Nevertheless, when it comes to consumer effort, this implies that notable consumers who engage in solid waste disposal relate to the ecosystem destruction behavior engendered by negative attitudinal effort. This underlying negative social consumer attitude, such as effort, has not been at variance with the claims in the literature that lack of consumer effort leads to negative outcomes and inadequacies of sheer least work in the field of environment (Carless and Waterworth, 2012; Rothbart, 2012; Charness et al., 2018).

Temperament did not have a statistically significant effect toward terrestrial ecosystem destruction, having the experience and readiness to dispose of solid waste behavior. This means consumers in Ghana do not show a negative commitment to solid waste disposal with respect to temperament. The finding did not corroborate the literature views that an individual's temperament can lead to negative effects (Rothbart, 2012; Liao et al., 2017). Despite this outcome, there is an underlying potential that temperament can affect consumers' mindsets by stimulating their knowledge to cause terrestrial ecosystem destruction. The contention that temperament is not influenced by terrestrial ecosystem destruction could be a divergent conceptualization

TABLE 3 Discriminant validity of heterotrait–monotrait ratio (HTMT).

	Terrestrial ecosystem destruction	Ability	Effort	Temperament	Cultural space	Consumer embodiment	Internal attribution
Terrestrial ecosystem destruction							
Ability	0.072						
Effort	0.033	0.897					
Temperament	−0.102	−0.107	−0.126				
Cultural space	0.086	0.045	0.057	−0.020			
Consumer embodiment	0.079	0.876	0.848	−0.097	0.105		
Internal attribution	−0.071	−0.034	−0.058	0.090	0.202	−0.037	

TABLE 4 Mediation results.

Relationships		95% confidence interval for β			
		β Estimate	S. E	T-value	*P*-value
H4	Consumer internal attributions → Cultural space → Terrestrial ecosystem destruction	0.077	0.017	4.514	0.000

**$p < 0.05$; **$p < 0.010$, ***$p < 0.1$.

TABLE 5 Moderation results.

Relationships		95% confidence interval for β			
		β estimate	SE	*T*-value	*P*-value
H5	Temperament → Terrestrial ecosystem destruction	−0.783	0.029	−27.474	0.000
	Consumer embodiment → Terrestrial ecosystem destruction	−0.406	0.018	−22.761	0.000
	Interaction → Terrestrial ecosystem destruction	0.002	0.000	37.434	0.000

**$p < 0.05$; **$p < 0.010$, ***$p < 0.1$.

TABLE 6 Structural parameter relationships.

Standardized regression path		95% confidence interval for *β*			
		β estimate	S.E.	*T*-value	*P*-value
H1	Ability → Terrestrial ecosystem destruction	0.080	0.023	3.509	0.000
H2	Effort → Terrestrial ecosystem destruction	−0.088	0.023	−3.869	0.000
H3	Temperament → Terrestrial ecosystem destruction	−0.035	0.042	−0.833	0.405
Control variables					
Age → Terrestrial ecosystem destruction		0.133	0.031	4.340	0.000
Gender → Terrestrial ecosystem destruction		0.258	0.077	3.344	0.000
Education → Terrestrial ecosystem destruction		0.017	0.032	0.539	0.590

**$p < 0.05$; ** $p < 0.010$, *** $p < 0.1$.

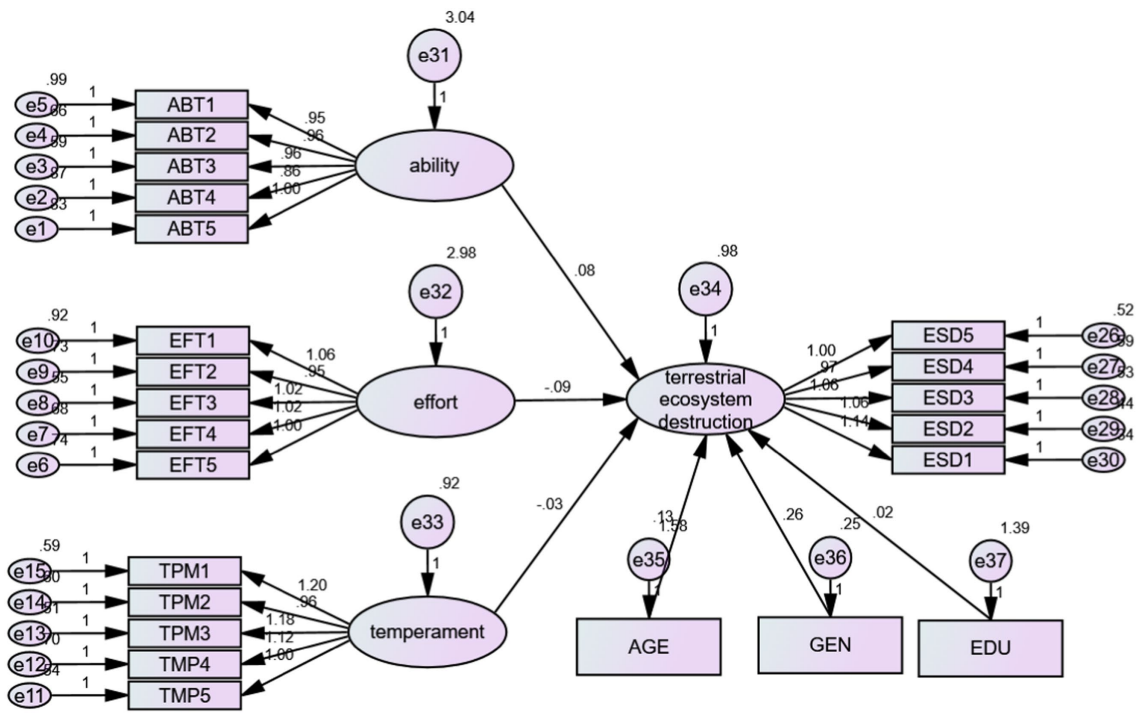

FIGURE 4
Analysis of hypothesized direct paths of internal attribution factors on terrestrial ecosystem destruction.

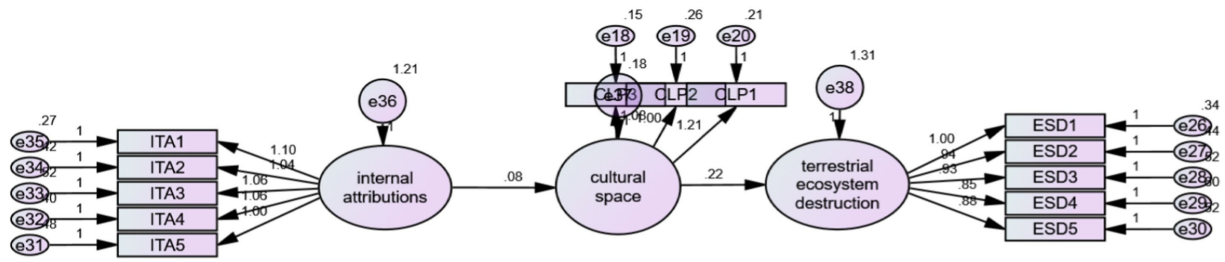

FIGURE 5
Indirect structural model pathway of hypothesized results of internal attributions, cultural space, terrestrial ecosystem destruction.

attributed to the usefulness of literate consumers and lack of knowledge information.

Accordingly, cultural space found a positive and statistically significant relationship between consumers' internal attributions and terrestrial ecosystem destruction. This finding practically suggests that negative aspects of cultural space engender ecosystem destruction of solid waste disposal by consumers. This implies that the way consumers are raised or brought up, the town lives, and neighbors' behaviors all have more negative consequences toward their solid waste disposal. The finding agrees with the literature assertions that culture is learned, and whatever consumers watch influences their attitude (Ferdous and Nilufar, 2008; Silva et al., 2023). Still, the findings support the literature position that an individual's behavior can be predicted by the influence of location, such as neighborhood, city, town, region, country, and particular personal relationships at home (Shavitt and Barnes, 2020). Culture is psychological in that it provides a common set of standards for perceiving, assessing, interacting, and acting (Shavitt and Cho, 2016), as location significantly affects solid waste disposable (Guo et al., 2019). The finding further supports the literature position that urban dwellers had higher mean scores than rural societies for poor solid waste disposal situations in principal streets and dumping sites (Cobbinah et al., 2017).

Examination of the moderation effect of the embodiment consumer and its relationship with terrestrial ecosystem destruction has a significant interaction effect. This aligns with Lux et al. (2021), where consumers engage in solid waste disposal based on their embodied brains whose conceptual frameworks are shaped by, emerge from, and are given meaning by human bodies. Thus, in solid waste disposables, embodiment acknowledges what customers have learned via interaction with their bodies and embodied activities (Llewellyn, 2021). Further, the result is in line with Vercel (2018) and Solér et al. (2022), the idea of embodiment helps consumers have disposable experiences that mirror their personalities. Moreover, customers'

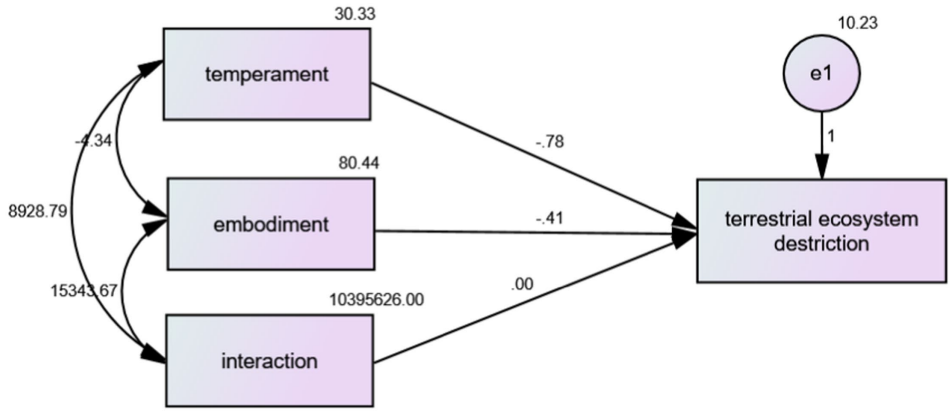

FIGURE 6
Moderation structural model pathway of hypothesized interaction results in the embodiment of consumer between temperament and terrestrial ecosystem destruction.

judgments are influenced by environmental stimuli and interactions with other people, rather than being made in a vacuum of objectivity.

The findings regarding control variables showed that age and gender have a significant controlling influence on terrestrial ecosystem destruction. This implies that these variables influence consumers to engage in disposables, leading to terrestrial ecosystem destruction. The other control variable, education, was not found significant.

7 Conclusion and practical implications

This study has advanced our understanding of negative consumer attitudes about solid waste disposal by demonstrating how these views have played a key role in the terrestrial ecosystem destruction in Ghanaian towns and cities across the three-centuries journey so far. The study made the point that, when properly utilized, the stakeholders in the social-behavioral environment can make a positive and important contribution by managing the disposal of solid waste at the individual level.

Considering that disposal of solid waste forms part of consumer consumption buying behavior. This investigation contributes to understanding consumers' attitudes, which is significant for the sustainable terrestrial ecosystem. The attribution theory portrayed in this study showed how knowledge about solid waste disposal is formed and conceptualized in the terrestrial ecosystem destruction when deciding to dispose. The application of this theory was limited in most of the prior studies. Nonetheless, its implications are significant because of how consumers' attitudes and decisions to dispose of solid waste toward terrestrial ecosystem destruction. The results of the study empirically contribute to the existing social marketing literature on ecosystems by demonstrating that terrestrial ecosystem destruction is influenced by ability and effort, with the presence of cultural space as mediation and embodiment as a significant moderator among age and gender as control variables. The uniqueness of the study evaluated internal attribution factors (ability, effort, and temperament) under the attribution theory, cultural space, and consumer embodiment.

The study promotes the introduction and operationalization of strict regulatory procedures for the government to set up a commission for consumer solid waste disposal for terrestrial ecological sustainability. The study aimed to focus at the gaps in the compliance process of existing institution that turned out to be stretching their responsibilities. For instance, charging consumers with ecological offenses about wrongful disposal could reduce the level of human pressure of fast depleting the environment. This approach should align with the solid waste collection agencies for proper measures and maintenance of the landfill site of ecological quality.

Terrestrial ecosystem destruction is largely a human-stimulated problem as depicted in the three-centuries journey so far. For conserving the ecology, required attention has to be given to institutional development, such as the marketing body and practitioners, to advocate and promote social acquisition to enhance capacity for proper disposal of solid waste. The goal cannot be reached if the marketing body is not equipped. Success in the markets for disposable solid waste depends on it. Therefore, marketing institutions and practitioners must build this enforcement to improve their capacity more efficiently. Additionally, it is critical to comprehend the internal attribution elements (ability and effort) as it gives players in the ecological business new perspectives on what approach to use to tackle the internal parasite of negative consumer 1attitudes toward disposables.

8 Limitations and future research

The study faced some limitations that may have impacted the results. First, this study was conducted in Sunyani, Ghana, and may have generalizability issues regarding the target population differences. In addition, it is believed that other qualitative methods could come into play in determining consumers' experiences and attitudes on this subject. Additionally, this study does not reflect on the external reasons for individuals' behavior toward terrestrial ecosystem destruction. Based on this, future research can also replicate this study and look at other factors that may influence terrestrial ecosystem destruction that could produce new findings.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

AY: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. EKA: Conceptualization, Supervision, Writing – review & editing. VO-P: Conceptualization, Writing – review & editing. EK: Conceptualization, Formal analysis, Methodology, Writing – review & editing. OA: Conceptualization, Data curation, Software, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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