Smoking kills you, littering butts damages others too: analysing sustainable consumer behaviour in the era of circular economy

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Abstract
Although litter prevention has environmental, social and economic benefits, cigarette butts are the most littered item on earth. While there has been vast research into the relationship between different factors affecting consumer behaviour, further research is needed to examine the antecedents of consumer sustainable behaviour. The aim of this study is to test the impact of feared self and landfill awareness on the sustainable behaviour of consumers using a structural equation modelling approach. Primary data of consumers are used to validate the hypothesised model. The findings highlight that feared self has a positive impact on the sustainable behaviour of consumers, while feared-self congruency and landfill awareness do not affect consumer sustainable behaviour. As for the implications, the results can support academics and strategic managers in the design process of sustainable consumer awareness programs to achieve environmental, social and economic benefits in the era of circular economy.

Keywords Cigarette butt littering · Cigarette waste · Circular economy · Consumer behaviour · Environmental behaviour · Feared self · Landfill awareness · Littered cigarette butts · Sustainable behaviour · Structural equation modelling (SEM) · Sustainability · Tobacco industry

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1 Introduction

Starting from 1950s, cigarette butts or filters were developed to protect smokers from diseases such as lung cancer (US Department of Health and Human Services, 1981). The social and governmental components of environmental challenges have become increasingly influential, to the point of advocating for the implementation of specific policies that affect cigarette butts littering (Rajesh & Rajendran, 2020). Even after numerous health awareness campaigns, in 2018, the World Health Organization summed up the worldwide number of smokers to a total of 1.1 billion (WHO, 2018), and the production of cigarettes has increased to support the growing need (Zafeiridou et al., 2018). In the last years, there has been an increase in environmental social awareness (Rajesh, 2020), but smokers are wasting 5.8 trillion cigarette butts worldwide, causing serious landfill and economic issues (Leistikow et al., 2000; Novotny et al., 2009; Rahman et al., 2020). Furthermore, in the wake of an ever-growing sensitivity to environmental issues (Rajesh, 2018, 2020), the World Health Organization declared cigarette butts littering to be a landfill hazard, promoting several initiatives to find a reuse for the cigarette butts that are infesting the world's streets and landfills. For instance, cigarette butts could be used as fibre modifier in bitumen for asphalt concrete (Rahman et al., 2020), as a precursor for the preparation of mosquito pesticides and as tools for malaria vector management (Murugan et al., 2018), or as an eco-friendly row material in ceramic roofing tile (Maciel et al., 2020). If cigarette butts were collected separately, they could be recycled, and this aspect would have a positive impact on the environment. Unfortunately, it has been shown that only a tiny part is collected and that 75% of cigarette butts are often dumped on beaches, parks, footpaths, and other public spaces, posing a severe landfill threat (Al-Khatib et al., 2009; Novotny et al., 2009, 2011; Rahman et al., 2020). Due to the impossibility of separating cigarette butts from the rest of the waste collected on the ground, most countries dump them alongside other waste in landfills, while others incinerate them, emitting toxic fumes and causing severe air pollution (Knox, 2005; Krishna & Swamy, 2016). Landfill pollution control groups have attempted to raise the concern of environmental contamination by tobacco smokers through various methods (Abdul-Wahab, 2006). People have also been motivated to quit smoking by fear messaging (Laroche et al., 2001). According to new research, using anxiety appeals in conjunction with self-affirmation theory can help people feel better (Memish et al., 2017). As a result, if a person believes there is a link between his or her current activities and a prospective poor self-perception, he or she is more inclined to change his or her current behaviour. This pessimistic self-perception is known as a feared self.

Leveraging on the self-affirmation theory, user self-concept is a multidimensional model that has been extensively researched in the field of consumer behaviour (Sirgy et al., 2000; Ekinci & Riley, 2003; Back, 2005; Kressmann et al., 2006). Actual self, ideal self, social self, and ideal social self are four aspects that are often discussed in marketing studies (Back, 2005; Ekinci & Riley, 2003; Kressmann et al., 2006). Earlier research has established the consistency between self-concept and product name, brand image, or personality depending on the number of self-concepts (Hosany & Martin, 2012). However, no analysis of self-concept based on feared self and landfill perception, particularly concerning cigarette butts littering behaviour, has been conducted using the self-congruence hypothesis (Birdwell, 1968; Dolich, 1969; Hong & Zinkhan, 1995; Landon, 1974; Malhotra, 1988; Slaughter et al., 2010). Fear of oneself may be a valid, important antecedent for raising the consciousness of cigarette butts littering activity and quitting smoking (Gilbert, 1993).

In the social marketing literature, there are major theoretical and empirical gaps in our knowledge of cigarette butts littering behaviour (McKenzie-Mohr, 2011). There are few studies that look into the relationship between consumer self-concept (fearful self) and environmental consciousness. As a result, the aim of this research is to investigate how successful the idea of feared self is at minimising cigarette butts littering (Sobh et al., 2013; Aaker & Lee, 2001; Pennington & Roese, 2002).

The aim of the study is to focus on the consumer self-concept that is rooted in the consumers' feared self and raise consciousness about cigarette butts littering. As a result, the problem statement was divided into three main sub-objectives: (1) investigate the effect of customer self-consciousness and environmental concern on cigarette butts littering, (2) explore the interaction between consumers' self-consciousness and environmental understanding, also known as congruity, and (3) analyse how the congruity between scared self and environmental consciousness influences customer cigarette butts littering behaviour. While feared self and consumer landfill consciousness are antecedents of consumer cigarette butts littering behaviour, the empirical findings challenge conventional wisdom. The results show a good association between feared self and landfill awareness, which supports in establishing the feared self-landfill awareness congruency. The congruity effect on customer cigarette butts littering behaviour is also highlighted in this study. Following the introduction, the second section presents the findings of a literature review. In the third section, the methodology is explored. In the fourth and fifth sections, the results of structural equation modelling are presented and discussed. Conclusions and implications are presented in the final section.

2 Literature review

2.1 Cigarette butts littering behaviour

Although several research contributions have been conducted to better understand cigarette butts littering behaviour, the majority has given only a limited insight and usefulness in reducing cigarette butts littering (Cope et al., 1993; Novotny et al., 2009; Smith & Novotny, 2011; Schultz et al., 2013; Lee et al., 2012; Rath et al., 2012; González-Salgado et al., 2020; Dehdari, 2020; Valiente et al., 2020; Rasool et al., 2021). Based on previous studies, Fransson and Gärling (1999) refer to personal values, landfill awareness, individual accountability, law enforcement, and education as critical factors influencing littering behaviour. Habits, disposal convenience, a lack of ashtrays, accidental tossing of the cigarette due to its tiny size, and a lack of awareness and assumption that cigarette butts are biodegradable are only a few of the causes for such behaviours (Cope et al., 1993; Lehman and Geller 2004; Novotny et al., 2009; Smith & Novotny, 2011; Williams, 2012; Mohajerani et al., 2020; Oliva et al., 2021).

As a self-identity behaviour, a frightened self is a multidimensional notion that encompasses many different aspects of an individual's self: an expected-self, an actual-self, a hoped-for self, a feared self, and an extended self (Markus & Nurius, 1986; Markus & Wurf, 1987; Belk, 1988; Markus & Ruvolo, 1989; Morgan, 1993; MacInnis & Chun, 2007). Self-identities are an important predictor of wide ranges of behaviours, examples of self-identities range from being a user of modern technology (Wolf & Seebauer, 2014; King et al., 2019) to being healthy (Heinen, 2016), as well as a pro-environmental and green

consumer (Cătălin & Andreea, 2014; Heinen, 2016; Gatersleben et al., 2019; Derikx & van Lierop, 2021; Rasool et al., 2021).

The phrases hoped-for and expected-self have a positive meaning, whereas feared-self has been associated with the risk of a negative outcome (Carver & Scheier, 2001; Ogilvie, 1987; Stefan, 2012; Vergara-Lopez & Roberts, 2012; Williams, 2012). A well-crafted fear message improves awareness of the problem and helps to convey the gravity of the situation to the target audience (Johnston & Warkentin, 2010; Rogers, 1975; Witte, 1992; LaTour & Pitts, 1989; Carver et al., 1999). Carver et al. (1999) discovered a close correlation between the feared self and customer behaviour in goods and service consumption. However, H1 is formulated from the above stance as follows:

H1 Feared self has a negative significant influence on cigarette butts littering behaviour.

2.1.1 Landfill awareness' effect on cigarette butts littering behaviour

Landfill awareness has a greater sense than just knowing about the environment. It also refers to people's attitudes, abilities, and values when it comes to addressing environmental issues (Baptiste, 2008; Kollmuss & Agyeman, 2002; Kollmuss & Agyeman, 2002; Xu et al., 2013). Landfill awareness should be prioritised in all government and private sectors to instil awareness in the public and reduce cigarette littering behaviour (Sengupta et al., 2010). It is shown that, generally, environmental awareness is a strong driver in achieving environmental goals (Mathiyazhagan, et al., 2018). For instance, awareness of nearby participation has proven large and favourable impact on customer intention to use renewable energy with low impact on the environment (Irfan et al., 2021) and adopt eco-friendly lifestyle behaviours (Cammarelle et al., 2021). Consumers' increased landfill consciousness resulted in improved social-environmental attitudes (Ziadat, 2010). There are programs aimed at raising awareness of the landfill effects of cigarette butts. In this study, landfill awareness was chosen as a predictor that could influence cigarette butts' littering activity (Lamb, 2001). As a result, H2 is proposed.

H2 Landfill awareness has a significant negative influence on cigarette butts littering behaviour.

Previous research has shown a strong connection between smokers' concerns and their awareness of diseases like heart disease, lung cancer, and blindness (Solberg et al., 1998; Woo & Au, 2008; Bidwell et al., 2005). Researchers looked into the connection between the concept of customer feared-self and knowledge of smoking-related diseases (Solberg et al., 1998; Woo & Au, 2008; Bidwell et al., 2005). The act of smoking is not only dangerous to smokers' health, but it is also harmful to the environment concerning landfill activities (Healton et al., 2011). Users are also concerned about tobacco usage and cigarette butt disposal in the environment (Puls et al., 2011). As a result, hypothesis H3 indicates that consumers' self-consciousness and landfill awareness are linked to smokers' cigarette butts littering.

H3 There exists a congruity between feared-self and consumers' landfill awareness.

Purchase decisions are heavily influenced by a consumer's self-concept (Sirgy & Samli, 1985; Kressmann et al., 2006). Congruence or matching is the result of a consumer's

self-concept and awareness coming together (Sirgy et al., 1991). "The degree to which one's personality matches one's actions in a specific situation" identifies the congruence construct (Sherman et al., 2012). Researchers utilised self-concept with the aspects provided in self-congruence theory to examine client purchasing behaviour in a commercial setting (Hong & Zinkhan, 1995; Polegato & Bjerke, 2006). Several researchers concluded that the customer's real and desired selves are significantly congruent with the consumer's advertising appearance and have a favourable impact on consumer brand tastes and loyalty (Kressmann et al., 2006). Similarly, Mandilya et al. (2020) demonstrate that a consumer with low materialism and a positive attitude towards both environmental sustainability and environmental advertising is more likely to buy environmentally sustainable products in order to have eco-friendly impact on the environment. In a marketing setting, consumer congruence between self-concept and product image is examined (Chon, 1992; Li, 2009; Quan & Wang, 2004). Congruity has a significant impact on consumer satisfaction, according to prior studies. From the literature evidence, H4 could be derived as follows:

H4 There is a significant negative impact of feared self and landfill awareness congruence on cigarette butts littering behaviour.

In summary, the four research hypotheses formulated above have been integrated into a research model (Fig. 1).

3 Methodology

3.1 Data collection

The current study was completed using a quantitative analysis approach. Quantitative analysis allows researchers to put a current or newly established hypothesis to the test (Bryman, 2016). Because the study needed to validate the impact of feared self, landfill awareness, and congruency on cigarette butt littering activity, a quantitative technique was acceptable.

Fig. 1 Conceptual framework and hypotheses

To collect data from smokers, a cross-sectional survey approach was adopted, with temporal grouping in mind. Purposive sampling was used to select Sarawak universities from among the major universities in Malaysia, as the cigarette consumers here can provide information related to queries. A self-administered survey ($n = 1600$) was organised and performed. A study of smokers aged 18 and older from three institutions was done due to the excessive tobacco consumption among university students (Tamim et al., 2003). Students from three major universities in Kuching, Sarawak, East Malaysia (UNIMAS, MARA University of Technology—UiTM, and Swinburne University) provided data on the study's variables. The questionnaire's pre-adopted edition was written in English and translated into Bahasa Malaysia. Back translation later confirmed the content of each concept employed in the questionnaire (Son, 2018). Both statistical tools were carried out using two type of software: (1) the Statistical Package for Social Science (SPSS) version 20 and (2) Analysis of Moment Structures (AMOS) version 21. SPSS software was used for data cleaning, descriptive statistics, and exploratory factor analysis. AMOS was used for primary research, such as correlation and regression. In such cases where the study hypothesis examines the associations between variables and the strengths of these associations, multivariate regression is a suitable method of data analysis. Structural equation modelling is an effective method for multivariate regression for both research confirmative and exploratory issues (Centobelli et al., 2019; Ho, 2006). There are two significant covariance-based (CB-SEM) and partial least square (PLS-SEM) methods of conducting SEM (Batista-Foguet et al., 2019; Hair et al., 2011). The most suitable method depends on the study objectives and the nature of the data collected. Due to the sample size, concept model novelty, and analysis of models focused on exploring and predicting associations among a series of constructs relatively small, PLS-SEM was considered the most suitable, as recommended by Hair et al. (2011). They have developed a method of testing latent continuous variables by producing multiple indicator variables to investigate the interactive relationship between latent variables (Li et al., 1998). SEM models consist of two main categories: manifest variables (measured in the questionnaire) and latent variables, which show the structures underlying manifest variables (Ho, 2006). As a result, the breadth and integrity of the indicator domain are crucial for ensuring an adequately covered structure and capturing all aspects (Hair et al., 2011).

3.2 Common method bias test

Furthermore, common method bias was validated following Gligor (2016), and Lii & Kuo (2016). To evaluate common method bias, researchers used Harman's one-factor test (Podsakoff et al., 2003; Zu et al., 2010). Exploratory factor analysis (EFA) was used in this study to look at all of the observed variables (Yarimoglu & Binboga, 2019). According to Podsakoff & Organ (1986), common bias is eliminated when (1) EFA extracts a single factor that encompasses all variables, or (2) the first extracted factor accounts for the bulk of the total variance (i.e. a value equal or above 0.50). In our case, the EFA discovered five unique variables with eigenvalues larger than 1.0 and a total variance of 66.13 per cent. The first extracted component accounted for 34.09 per cent of the variance, or less than 0.50 per cent of the total variance. The results indicated that both criteria had not been met and that the study had no common method bias.

Furthermore, when the source of bias was not identified a priori, researchers used the single-method-factor methodology established by Podsakoff et al. (2003) and Podsakoff et al. (2005) to validate this conclusion. As a result, we used confirmatory factor analysis

(CFA) to generate two models: one with and one without a single shared component. The regression weights of both models ranged from 0.146 to 0.195 for feared self, 0.065 to 0.178 for landfill awareness, 0.118 to 0.173 for cigarettes butts littering behaviour, 0.078 to 0.181 for congruency, and showed no statistically significant differences. Doluca et al. (2017) suggested a threshold (0.2) for standardised regression weight differences. Common method bias is not a concern in this study, according to the data (Podsakoff et al., 2003).

3.3 Measures

The survey utilised in our study, which includes the measures in "Appendix", was created using questionnaires culled from the literature. Previous research used a 5-point Likert scale with a Cronbach's alpha of 0.81 as a metric for feared self, landfill awareness, and cigarette butts littering behaviour (Davidson, 2000; Mollema et al., 2000; Smith et al., 2011).

Rath et al. (2012) developed a customer landfill awareness instrument to assess cigarette littering behaviour: it had seven items with a 5-point Likert scale ranging from strongly disagree (1) to strongly accept (5), and the remainder were dichotomous (No/Yes). With a Cronbach's alpha of 0.85, the scale was considered stable.

Rath et al. (2012) adapted a 5-point Likert scale for cigarette butts littering activity that was used to anchor all things of the feared self and landfill awareness scale: it had a reliability of 0.71 Cronbach's alpha. Ericksen (1996) established the following equation for measuring the congruence between consumer feared self-concept and landfill awareness in this study:

$$\text{FESLFA}_K(\text{Congruence}) = \sum_{i=1}^{n} |\text{LFA}_{ik} - \text{FES}_{ik}| \tag{1}$$

Congruence $_k$ = Feared Self Landfill Awareness Congruity score for respondent (k). KFA_{ik} = Landfill Awareness score of respondents (k) along with the item (i). FES_{ik} = Feared Self-score of respondents (k) along with the item (i).

3.4 Pilot test one

A complete version of the questionnaire was distributed to the 50 respondents in Kuching, Sarawak, Malaysia. This pilot test had three objectives: firstly, to evaluate comprehensibility and clarity of the indicators which were in the instrument; secondly, to examine the time required to fill out the questionnaire by respondents; and thirdly, to test the internal reliability of the measure. There was a portion at the end of the questionnaire for personal opinions on needed improvement.

3.5 Pilot test two

Two questions were modified based on the suggestion provided by the respondents as highlighted earlier in pilot test one. At this stage, the modified questionnaire was distributed to another 50 different respondents. The objective of this second pilot study was to identify the reliability and validity of the items and constructs by testing Cronbach's alpha. The reliability and validity of all the measures observed with a strong reliability with Cronbach's alpha 0.7 before conducting the survey for the main study are shown in Table 1.

Table 1 Reliability for Pilot Test I and II

Constructs	Alpha reliability value for Pilot test I (N = 50)	Alpha reliability value for Pilot-test II (N = 30)	Number of items
Feared self	0.79	0.78	7
Landfill awareness	0.81	0.77	6
Cigarette butts littering behaviour	0.77	0.79	4

4 Analysis and results

This study depends upon a self-administered questionnaire. Hence, response error was an issue that is not under the researcher's control as stated by Highman (1955). Therefore, the applicable data screening techniques as descriptive statistics, treatment of missing data and detection of outliers are discussed in this section. The data were collected from smokers of universities students in Sarawak, Malaysia. A total of 1600 questionnaires were distributed in these four major universities of Sarawak. There were 446 questionnaires found to be incomplete, and responses that were more than 5% incomplete in the questionnaire were disqualified from the sample size of this study. After screening the data, 1072 responses were obtained. The percentage of those that responded was 67% (Malhotra & Grover, 1998; O'Leary-Kelly & Vokurka, 1998). According to Ding et al. (1995), the minimal sample size for assessing the research framework and testing the research hypotheses using a SEM technique should be between 100 and 150.

Data normality is a basic assumption for SEM. Several steps were carried out for the normality of the data. Three methods were used to ascertain the normality of the data, namely Q-Q plots, Skewness and Kurtosis calculation and Kolmogorov-Smirnov test (Hair et al., 2011). Outliers were detected with the help of Box Plot after the screening process in this study. The outliers appeared within the one per cent of prescribed limits. On that basis, no re-coding was required. Hence, all the 1072 responses of each construct were converted into standard 143 Z-scores, and further outliers were identified. In this study, 93 responses were accounted as outliers within the prescribed limit. Subsequently, 979 responses were calculated after removing the univariate outliers. After transforming the data into standardised Z-Score, all the values were found in the range of −3 and +3, such as from −2.93 to 2.64, as suggested by Tabachnick & Fidell (2007). Hence, the values being in the field ensured that the data in hand have a normal distribution in this study.

Respondents' profile

In order to sample the demographics, respondents' characteristics were varied widely (Morgan & Hunt, 1994). In this study, the profile of respondents consisted of five variables such as gender, age, education, ethnicity, and religion. In this study, demographic information has no impact on the level of analysis, which provides a general view concerning gender, age, current marital status, number of family members living at home, highest education completed, ethnic group, religion, and income participation. The results of all the profile variables are summarised in Table 2.

Table 2 Respondent profile

Variables		Number	Percentage (%)
Gender	Female	565	57.71
	Male	414	42.29
	Total	979	100
Age	Less than 20	61	6.23
	21–25 Years	298	30.44
	26–30 Years	395	40.35
	32–35 Years	80	8.17
	36–40 Years	93	9.50
	41–45 Years	27	2.76
	46–50 Years	11	1.12
	Above 51 Years	14	1.43
Education	High School or Less	386	39.43
	Bachelor degree	463	47.29
	Master	72	7.35
	Doctorate	25	2.55
	Other	33	3.37
	Total	979	10
Ethnicity	Malay	456	46.58
	Indian	18	1.84
	Chinese	281	28.79
	Iban	68	6.95
	Melanau	35	3.58
	Orang Ulu	45	4.60
	Bidayuh	34	3.47
	Other	42	4.29
	Total	979	100
Religion	Muslim	458	46.78
	Hindu	18	1.84
	Christian	319	32.58
	Buddhist	158	16.14
	Other	26	2.66
	Total	979	10

4.1 Exploratory factor analysis (EFA)

Kim & Muller (1978) explained EFA as "a variety of mathematical methods whose common purpose is to interpret a series of variables in terms of a smaller number of hypothetical variables". The EFA attempts to limit the dimensionality of variables by grouping those that have a high similarity with each other in variables (Tabachnick & Fidell, 2007; Joliffe & Morgan, 1992). The principal component analysis (PCA) is the most commonly used predictive analysis tool, and it is part of the EFA. PCA is a technique for reducing the dimensions of a set of continuous variables (Bryant & Yarnold, 1995). The PCA aims to minimise the amount of data required for determining the variables that lead to more significant variance in this study. As a result, when conducting an EFA on our collected results, we used a basic PCA with no rotation as an extraction tool. And there are no hard

and fast rules for whether or not to use rotation or what type of rotation to use. The aim of using rotation, or a specific form of rotation, according to Brown (2009), is to expose a basic structure that makes it easier to understand the extracted variables. Until a simple structure has been discovered, rotation is not necessary. As a result, the variables were standardised using the SPSS version 23 program before running the PCA.

To determine the appropriate number of aspects, this study used EFA with principal axis factoring (PAF) extraction and the Varimax system of rotation for six items of feared selves, seven items of landfill awareness, and four items of cigarette butts littering behaviour constructs. The association between the FRS_5 elements of feared self was much weaker, which was less than 0.3 (Field, 2009). As a result, the feared self item FRS_5 was omitted from further data processing. The factor loadings for the remaining items were greater than 0.5 (Hair et al., 1998). Commonly, there are four methods that verify a data matrix to see whether the present data matrix can support the factor analysis.

The assessment of the correlation matrix indicates that a suitable correlation exists within the data matrix. The low correlations throughout a correlation matrix indicate that factor analysis is inappropriate (Stewart, 1981). Hardy and Bryman (2009) stated that the correlation matrix has cut-off values to indicate its appropriateness for factor analysis—a correlation range from 0.10 to 0.30 is considered appropriate and inappropriate if less than that inappropriate (Hardy and Bryman, 2009). Pallant (2007) recommended that when significant correlations are more than 0.30 within a data matrix, then time factor analysis has its applicability. Otherwise, the data matrix cannot be accepted for factor analysis.

The anti-image correlation matrix means that a partial correlation has a negative value (Brace et al., 2006). When the influence of other variables is accounted for, a partial correction between variables is unexplainable. Therefore, high partial correlations indicate that the data matrix has high unexplained correlations (Hair et al., 2011). Namely, there is no adequate latent factor (Brace et al., 2006). The lowest anti-image correlations indicate that a data matrix is suitable for factor analysis (Field, 2009; Tabachnick & Fidell, 2007).

Bartlett's test of sphericity is a statistical test that analyses either a correlation matrix has meaningful correlation among the variables or not (Hinton et al., 2004). The computation of Bartlett's test of sphericity is based on the following equation:

$$-\left[(N-1)-\left(\frac{2P+5}{6}\right)\right]\mathrm{Log}e^{|R|}$$

N is the sample size. P is the number of variables and. $|R|$ is the determinant of the correlation matrix.

Hinton et al. (2004) and Pallant (2007) highlighted that when Bartlett's test of spherical is statistically significant at sig. < 0.05, there exists sufficient correlation among the variables to implement factor analysis in a data matrix. Furthermore, the data matrix is not suitable for factor analysis. According to that, this study passed the criteria of Bartlett's test.

According to Stewart (1981), the Kaiser–Meyer–Olkin measure of sampling adequacy is an index that quantifies the intensity of inter-correlations among the variables. To calculate the Kaiser—Meyer–Olkin, the following equation is used:

$$MSA = \frac{\sum \sum_{j \neq k} r_{jk}^2}{\sum \sum_{j \neq k} r_{jk}^2 + \sum \sum_{j \neq k} q_{jk}^2}$$

r_{jk}^2 = Square of the off-diagonal elements of the original correlations. q_{jk}^2 = Square of the off-diagonal anti-image correlation matrix.

The range of Kaiser–Meyer–Olkin measure of sampling adequacy value is from 0 to 1. When Kaiser–Meyer–Olkin measure of sampling adequacy value is reached at 1, it shows that variables are entirely predicted without any error from the other variables. Kaiser & Rice (1974) stated that the data matrix is suitable for factor analysis using the Kaiser–Meyer–Olkin measure of sampling adequacy.

4.2 Confirmatory factor analysis (CFA)

The reliable, convergent, and discriminant validity of the constructs feared self, landfill awareness, and consumer cigarette butts littering behaviour were examined using a structural model. As proposed by Anderson & Gerbing (1988) and Werts et al. (1974), composite reliability (C.R) was used to determine the accuracy of the constructs. Several scholars (Nunnally & Bernstein, 1994; Mollema et al., 2000) proposed a composite reliability cut-off value of greater than 0.70. As seen in Table 1, composite reliability ranges from 0.884 to 0.912.

The observed variables of feared self, landfill awareness, cigarette butts littering behaviour had substantial factor loading, and average variance extracted (AVE) was used to assess convergent validity. With t values ranging from 3.56 to 79.42, factor loadings are greater than 5.7 and important ($p < 0.01$). However, factor loading of all observable variables for latent variables is important, so AVE is greater than 0.50 (Table 1), indicating that latent variables such as feared self, landfill awareness, and cigarette butts littering behaviour have convergent validity (Fornell & Larcker, 1981).

The diagonal value of the correlational matrix is assumed to be greater than the off-diagonal value for appropriate discriminant validity (DV) (Barclay et al., 1995). The diagonal value of the individual latent variable, on the other hand, was greater than the off-diagonal factor, indicating strong DV in this study, as seen in Tables 3, 4.

4.3 Results of hypothesis testing

The r-square value was used to measure the relationship between feared self and Landfill perception. With the aid of a structural model, the impact of feared self, environmental awareness, and congruence of feared self and landfill awareness on cigarette butts littering behaviour was studied using standardised path coefficient (β) and significance level (*t-statistics*). Table 5 and Fig. 2 demonstrate the impact.

Out of four hypotheses with large beta values, one was accepted in light of the structural model. *H1* was rejected with a value of 0.36 and a *p-value* of 0.000, indicating that fear of self does not substantially negatively impact customer cigarette butts littering. Similarly, at = 0.39 and p = 0.000, *H2* was not supported by the results. *H2* is also evaluated until the congruence is tested. It found substantial *r = 0.65* and *p = 0.000* values, confirming the structural model's significant correlation. The high worth of *r* suggested that consumers feared self of landfill awareness is strongly linked together. As a result, the H3 result is consistent with the findings of many studies (Woo & Au, 2008; Gould et al., 2015). *H4* had a significant finding of *β = 0.512* and *p = 0.000*, indicating that the congruity between feared self and landfill awareness has affected cigarette butts littering behaviour.

Table 3 Summary of the measurement model

Items	Standardised Loadings	t-value	Constructs	AVE	C.R
FRS_1	0.76	19.11***	Feared Self	0.604	0.884
FRS_2	0.85	20.72***			
FRS_3	0.77	18.31***			
FRS_4	0.71	19.27***			
FRS_6	0.79	24.38***			
LFA_1	0.71	14.18***	Landfill Awareness	0.635	0.912
LFA_2	0.77	12.11***			
LFA_3	0.81	18.37***			
LFA_4	0.88	15.86***			
LFA_5	0.79	13.54***			
LFA_6	0.81	10.51***			
CBLB_1	0.68	13.31***	Cigarette Butts Littering Behaviour	0.650	0.880
CBLB_2	0.84	18.11***			
CBLB_3	0.81	14.10***			
CBLB_4	0.88	12.04***			
Achieved Fit Indices					
	CMIN/DF($\times 2$/df)	RMSEA	TLI	GFI	CFI
Final values	3.8245 (415.288/246)	0.078	0.928	0.991	0.917

FRS, Feared Self, *LFA*, Landfill Awareness, *CBLB* Cigarette Butts Littering Behaviour, *C.R* Composite Reliability, *AVE* Average Variance Extracted

Table 4 The discriminant validity summary

	FRS	LFA	CBLB
FRS	0.604		
LFA	0.51	0.81	
CBLB	0.582	0.71	0.68

FRS Feared Self, *LFA* Landfill Awareness, *CBLB* Cigarette Butts Littering Behaviour

5 Discussion

According to consumer research, the impact of actual and ideal self-congruence differs depending on the behavioural domain, therefore it must be validated each time (Huber et al., 2018; Zhu et al., 2019). Based on the earlier contributions, it was predicted that H1, H2, and H4 would be confirmed (Mollema et al., 2000; Davidson, 2000; Smith et al., 2011; Rath et al., 2012). Previous studies on the links and congruence between feared-self, landfill awareness, and cigarette butts littering behaviour, however, disputed the findings. Contrary to previous research, it was observed that the construct of feared-self had a beneficial impact on cigarette butts littering behaviour, and that the congruence of the feared self and landfill knowledge did not help reduce cigarette butts littering behaviour (Gatersleben et al., 2019; Mathiyazhagan et al., 2018). Recent studies examined the moderating effect of social awareness (Kaufmann et al., 2016; Mathiyazhagan

Table 5 Hypothesis testing

	Constructs	Path	Constructs	Estimate	S.E	C.R	P-Value	Result
H1	Feared Self	--->	Cigarette Butts Littering Behaviour (CBLB)	0.361	0.051	7.129	0.000	Not Accepted
H2	Landfill Awareness	--->	Cigarette Butts Littering Behaviour (CBLB)	0.394	0.03	3.317	0.000	Not Accepted
H3	Feared Self	<--->	Landfill Awareness	0.650	0.039		0.000	Accepted
H4	FRS_EA_Congruence	--->	Cigarette Butts Littering Behaviour (CBLB)	0.512	0.038	3.583	0.000	Not Accepted
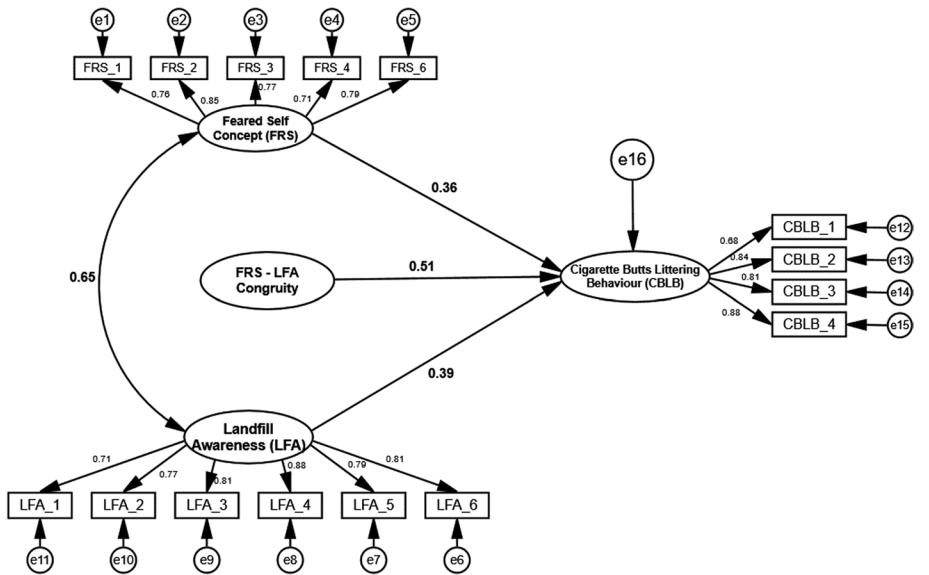
Fig. 2 Structural model

et al., 2018; Zogaj et al., 2021), and this effect was consistent with previous research findings (Baptiste, 2008; Kollmuss & Agyeman, 2002; Kollmuss & Agyeman, 2002; Rasool et al., 2021; Xu et al., 2013). As for the originality of our research outcomes, they shed new light on the landfill awareness context by demonstrating that it is occasionally a strong driver. This aspect could be connected to the nature of the respondents. The survey participants are represented by university students who may be unable to recognise or understand the impact of the feared self on cigarette butts littering behaviour. The scared selves of young university students were not receptive enough to lessen the negative repercussions of cigarette butts littering behaviours. The threat of negative consequences from cigarette butts littering may outweigh the social or peer normative impact. People's perceptions, as well as a misalignment between people's and society's expectations regarding the activity, lead to youth engaging in risky behaviours (Smith & McDaniel, 2011; Mead et al., 2014).

According to the principle of reasoned action, individuals' incentive to accept a supposed norm alters the effect of the standard on associated perceptions and actions (Montano & Kasprzyk, 2015). The force of social exposure, or the signals that an individual receives from his or her physical, social, and symbolic settings, is a distinct source of knowledge that transmits norms and molds consumers' attitudes and behaviours secondary (Chearskull, 2010; Nunnally, 1994).

According to the acceptance theory, the feared self and landfill perception are linked (H3). However, the level of consumer agreement is insufficient to recognise the fear of the detrimental impacts of cigarette butts littering and the implications for the environment. Fear-based advertising is effective in lowering consumer smoking and littering (Tannenbaum et al., 2015). In conclusion, the results demonstrate that combining scared self and landfill knowledge has a bigger impact on consumers' cigarette butts littering behaviour than either feared self or landfill awareness alone.

6 Conclusions and implications

This study looked into the impact of consumers' feared self and consumer landfill awareness on cigarette butts littering behaviour, as well as the relationships between consumers' feared self and landfill awareness and the impact of congruence between feared self and landfill awareness on consumer cigarette butts littering behaviour. In the past, fear has been used to persuade people to quit smoking (Laroche et al., 2001). Recent research reveals that by emphasising the negative consequences of one's activities that jeopardise one's ability to regard oneself favourably, the effectiveness of such anxiety appeals can be improved (Memish et al., 2017). Previous research looked at whether a self-concept may be compatible with a product image, brand image, or personality (Hosany & Martin, 2012). However, no analysis of self-concept centred on feared self and landfill information, particularly involving cigarette butts littering behaviour, has been undertaken utilising the self-congruence theory (Al-Khatib et al., 2009; Slaughter et al., 2010). The study showed feared-self and landfill awareness, feared-self and cigarette butts littering behaviour, landfill awareness, and cigarette butts littering behaviour. A major commitment of this research is the presence of congruence between feared-self and landfill consciousness. The feared-predicted self's response to landfill awareness, however, was insufficient to reduce cigarette butts littering behaviour among consumers, according to data analysis and interpretation.

The current results clearly show that litter begets litter. This finding is not new, and indeed, it was noted in the early studies of littering (e.g., Cialdini et al., 1990; Keizer et al., 2008). The results of this study suggest several litter prevention strategies. These strategies combine structural and motivational activities. Waste managers should therefore include a cognitive solution to litter prevention. Researchers are consequently recommended to participate in the design of litter prevention strategies. This aspect ensures that behavioural problems are taken into account in such scenarios. There is the possibility to create anti-littering measures. As a result, even if individuals are willing and determined to behave correctly, they are constrained by circumstances (e.g. lack of adequate facilities). This aspect suggests additional studies to investigate the role of situational limitations in litter behaviour specifically. In the light of what has been highlighted so far, we suggest what could be valuable ideas for new research and a new implementation of strategies to tackle the phenomenon. It has already been indicated above that a considerable effort should be carried out to address the problem of littering cigarettes. In this case, a more significant presence of public ashtrays and an intense use of raising awareness could represent practical measures to reduce the phenomenon and mitigate the damage. In addition, the idea of inserting or enhancing the presence of anti-littering messages, textual or sign, could be considered, inviting the consumer to act correctly.

In addition, the improvement of the cleaning and collection system can certainly make the places where it is implemented cleaner; however, it hides a possible undesirable effect. With a better collection system, those who accept littering can relax their guard, knowing that their waste will only be left in the environment for a short time. The strengthening of road litter bins would counteract the phenomenon, especially those currently lacking or not served in a way that is not adequate for the needs. However, even in this case, it is not uncommon to find waste abandoned outside the bins. As for the awareness campaign, it could appear to be an educational way that is useful only for training children or young people of school age, contrary to how adults would accept it.

Indeed, without diminishing the potential effectiveness of the educational intervention dedicated to the youngest, we suggest evaluating solutions aimed at raising awareness of the phenomenon also towards adults since many are not fully informed on the issue.

Appendix: Measurement instrument

Construct	Item name	Remark	Item	Source
Feared Self	FRS_1	Omitted	I am afraid of disaster in the world	Davidson (2000) Mollema et al. (2000); Smith et al. (2011)
	FRS_2		I am bothered by doing the wrong thing in front of me,	
	FRS_3		am afraid of doing something when people might be watching	
	FRS_4		Fear of something bad's consequences making me scares	
	FRS_5		When I have to do illegal work, I get restless due to its bad effect on society	
	FRS_6		When I have to dispose of my cigarette butt on ground, sewer/gutter, I get fear of its result	
Landfill Awareness	LFA_1	Omitted	The single most collected items in beach waste cleanup each year is: beverage containers, cigarette butts, fishing nets, plastic bags	Rath et al. (2012)
	LFA_2		Cigarette butts are toxic	
	LFA_3		Cigarette butts are biodegradable	
	LFA_4		Cigarette butts are harmless when eaten by humans	
	LFA_5		Cigarette butts are harmless when eaten by animals/ marine life	
	LFA_6		It can be dangerous to throw a cigarette butt in a trashcan	
	LFA_7		Cigarette butts are considered to be litter	

Construct	Item name	Remark	Item	Source
Cigarette Butt Littering Behaviour	CBLB_1		Did you ever dispose of your cigarettes in the way?	Rath et al. (2012)
	CBLB_2		Did you ever dispose of your cigarette butt in the car and throw them out from the car window?	
	CBLB_3		Did you ever dispose of your cigarette butt on the ground, in the sewer/gutter or down a drain?	
	CBLB_4		Do you prefer to waste your cigarette butt on the public ashtray?	

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