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Factors that influence the successful marketing of bioplastic products in Zimbabwe: Towards a circular economy by 2030

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Abstract

Bioplastics are eco-friendly products that are not only highly bio-gradable and compositable, but also have robust rheological properties compared to fossil-based plastic products. Given the huge quantity of fossil-based plastics that are produced and consumed annually in Zimbabwe, consumers' acceptance of these products may assist the country to smoothly transitioning from the current linear economic system (LES) towards a circular economic system (CES). The main purpose of the study was to explore factors that might influence the successful marketing of bioplastic products by Zimbabwe firms. With the aid of a structural regression equation, the study used a correlational design where quantitative data were collected from a random sample of 100 respondents. The findings show that self-identity, perceived value, cognitive biases and self-congruity were all positive and statistically significant at various levels of confidence. Zimbabwe plastic firms should consider these factors if they are to successfully implement strategies that increase the acceptance of bioplastic products. The adoption of discontinuous green technologies that reduce the cost of producing bioplastic products is recommended in order to increase the perceived value of bioplastics. Marketing efforts that help to increase consumers' awareness and hence acceptance of bioplastic products must be adopted by firms.

Keywords: Bioplastic products, Circular economy, Cognitive biases, Marketing, Perceived value, Self-congruence, Self-congruity, Zimbabwe.

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1. Introduction and Background

In recent years, there has been insistent calls to create a missing market for alternative types of plastics such as bio-gradable plastics, which have gained significant traction within consumer discourses in Zimbabwe. Bioplastic products have a huge potential for reducing consumption of fuel-based plastics that are inherently damaging to the environment. Using technical terms, bioplastic products are also referred to as polyhydroxyalkanoates. In fact, bioplastic products are a composite term that encompasses various assemblages of plastic materials that are bio-gradable and can also be used in composts to

form fertile organic manure. Bioplastic products are produced from various sources, such as fuel-based resources, fatty acids, renewable resources, and from a combination of renewable and fuel-based resources [1-5]. Products made from bioplastics are efficient and have an extended shelf-life after first utilization [3, 6].

Many developing countries are frequently subjected to supply-side shocks that often disrupt production value-chains in downstream industries that use fuel-based plastic for packaging and conveyance of goods. The adoption of bioplastic products by consumers can help developing economies to shield their fragile economies against supply-side shocks that are exacerbated by profligate consumption of non-renewable resources, especially fossil-based fuels [7, 8]. In terms of their susceptibility to disintegration, bioplastics can be divided into two types: biodegradable and non-biogradable materials [9, 10]. Bioplastic products have a lower propensity of causing severe damages to the natural environment. This is because the bio-gradation time on land surface is almost two months compared to fuel-based plastics that can take five years [8, 11].

There is, therefore, an urgent need for developing countries like Zimbabwe to formulate marketing strategies for bioplastic products. This could also be an initial and less costly culvert for migrating the economy from the LES towards a CES that promote frugal use of non-renewable resources. Unlike in a LES, a CES encourages consumers to reuse, recycle and restore products, a process termed cradle to cradle solutions.

The Zimbabwe government has been using Pigouvian taxes as a way of restricting consumption of fuel-based (traditional) plastic products by consumers. Nevertheless, due to own price inelasticity of demand, the demand of fuel-based plastic products by consumers is still rising. Without alternative types of packaging, most consumers still consider fuel plastics hard-wearing, reasonably priced, and highly versatile, leading to the continued use of traditional plastics to package, preserve, store and transport goods. However, since most fuel-based products are manufactured from 90% fossil fuels, they pose serious damages to ecological systems [1, 7, 11, 12]. Furthermore, many studies have also revealed that fossil-based plastic have slow microbial disintegration and decomposition [13-18].

In addition, the production of fuel-based plastics has a high dependency on inputs such as carbon and glucose that have a highly prone to contamination [9, 19-21]. In contrast, bioplastics are biopolymers that are highly recyclable, compositable and biodegradable after their useful lives. This due to the fact that they are made from renewable resources such as aliphatic polyesters, polylactide and polysaccharides [11, 22]. The paper argues that consumers' acceptance of bioplastic products as substitutes for fossil-based plastic products may reduce negative environmental externalities such as carbon emissions and global warming. The successful adoption of bioplastic products has helped other developing countries to reduce carbon dioxide emissions by at least two kilograms per every fossil-plastic product produced each month [14, 23]. Many studies also demonstrate that successful marketing of bioplastic products contributes to savings of thirty megajoules for every one kilogram of fossil-fuel plastics that is produced [24].

Whilst bioplastic products are friendly to the environment, they are expensive to produce [14, 23]. Zimbabwe plastic firms manufacture at least 300,000 tons of fossil-based plastics annually, of which at most two percent are kept in use in the economy. An estimated three percent are recovered and reused in the informal sector. The problem is the 93 percent that is not recycled or regenerated, but dumped in rivers, dams and in landfills. It is evident that the rate of recycling of fossil-based plastics in this country is very low and environmentally unsustainable. As a consequence, the damage caused by traditional plastics in terms of human, plant and animal health, as well as food production is rising prodigiously. This makes the country an emblematic case study for exploring how bioplastic products can be successfully produced, marketed and accepted by consumers. The technical and production feasibility of producing bioplastic products using green innovations is now well-established in many developing countries [25-28]. In countries like Zimbabwe, the main challenge is on the marketing side. This study is significant for several of reasons. Prior empirical studies have revealed that they are enormous advantages in terms of environmental protection if consumers use bioplastic products instead of fuel-based products [3, 10, 29-31]. The successful adoption of bioplastic products by Zimbabwe consumers is likely to bring in substantial benefits to the economy, such as optimizing waste production, transforming local industries and hence, allowing for eco-designing of plastic products. In other countries, the use of bioplastic products has become a sustainable strategy for reducing the use of energy intensive fossil-based products that cause global warming. In recent years, Zimbabwe has suffered terrible episodes of floods and prolonged drought that are both linked to global warming. The study is therefore a timely enjoinder to policymakers to consider banning fossil-based plastics completely in favour of bioplastic products that that have lower carbon emissions. Adopting bioplastic products can be also a solution for dampening endogenous supply-side and resource price shocks that are linked to libertine utilization of non-renewable resources. The rest of the paper is organised as follows: Section 2 reviews theoretical literature, Section 3 presents the methodology, Section 4 presents findings and the last section gives the research implications.

2. Theoretical and Empirical literature Review

Linear economic systems encourage the make, use and waste of products [32, 33]. On the contrary circular economic systems aim to maximise extraction of value from materials [6, 34-36]. CEs are purposively designed to regenerate and restore products and thus, replace the end of life concepted associated with LES [37, 38]. A CES allows firms to design innovative business models that minimise resource wastage [9, 39]. It contributes to the development of responsible and accountable consumers [40]. CES has gained important acknowledgement as one of the major strategies that can be used by developing countries to protect the environment [41].

In this regard, in many countries adopting a CES is now seen as a critical conduit for promoting sustainable economic growth and development [2, 36]. CES allows firms to remanufacture new products as part of recycling process [16, 42, 43]. They also allow for collaborative consumption by building a sharing economy where non-renewable resources are consumed abstemiously [44, 45]. Promoting the use of bioplastic products within the CES concept may help plastic firms not only to

reduce brand hate, but also to improve on their brand equity, resonance, and consequently enhanced their financial performance [46]. In a CES, plastic firms can extract maximum value from products and materials at the end of their useful life [1, 2]. Extending the life of products and materials helps to close resource loop and slow non-renewable usage cycles Russo, et al. [14]; Salo, et al. [47]; Kant Hvass and Pedersen [18]. Wang, et al. [48] identify cognitive biases as important factor that influence the purchase of products. They argue that cognitive biases are responsible for building mental short-cuts and heuristics that influence consumer behaviours [18]. Psychological processes enable consumers to form and express their identities when making purchasing decisions [49]. Key constituents of consumption are correlated to the symbolic, aesthetic, and hedonic nature of buyer behaviour [50]. However, Singh and Giacosa [49] establish that CES does not fulfil the social, psychological, and cultural needs of consumers. [51] and Wang, et al. [48] also link cognitive biases to green self-identity.

Green self-identity has multi-dimensional facets, such as ideal self, social self and actual self [52]. The term self is used to describe how consumers perceive themselves in relation to products [52]. However, Kang, et al. [53] argue that green self-identity encompasses how consumers perceive themselves in relation to personal motivations, social interactions and expectations when buying products. As a result, green self-identity assists consumers in differentiating their buying decisions from other consumers [54]. Green self-identity also enables an individual consumer to associate with group buying behaviour [9, 39].

A positive relationship between perceived value of bioplastic products and green self-identity has been reported in many studies Kang, et al. [53]; Wang, et al. [48]; Çifci, et al. [55]. Kang, et al. [53] found that that self-identity leads to a higher behavioural intention to purchase bioplastic products. However, other studies have shown that perceived value and self-identity are moderated by self-congruity [9]. Self-congruity refers to how buyers of a product evaluate their relationship with a product they intent to buy, as explained by Kang, et al. [53].

According to Sirgy, et al. [52], self-congruity enables consumers to use brand stimuli to retrieve product attributes from their memories. The process of buying a product involves comparing its attributes with the buyer's self-concept. When there is a match between self-concept and product attributes, consumers are more likely to develop positive intentions towards purchasing the product [9]. Several studies have identified social self-image, ideal self-image, self-image and ideal social self-image as major components of self-congruity, including those by Sirgy, et al. [52]; Sirgy, et al. [56]. Additionally, Çifci, et al. [55] have demonstrated that self-congruity helps buyers to assess products they intent to purchase. Therefore, self-congruity is a key factor in building customer-based brand equity [57, 58].

As a result, self-congruity is a critical antecedent that shape consumers' behavioural intention to purchase and utilize a product, as it reduces brand hatred and increase customer satisfaction [55]. As reported by Çifci, et al. [55] and Van Quaquebeke, et al. [59], self-congruity assists in defining major product attributes, hence helping firms to improve their marketing effort and in turn, the acceptability of a product by customers. Another important factor that is important in the adoption of bioplastics is what is termed perceived value [60], which Kumar and Noble [60] define as a consumer's perceptions of a brand or product. Nevertheless, self-identity is also a key factor in enhancing perceived value of green products [4].

3. Conceptual Framework and Hypotheses Development

The relationship among self-identity, cognitive biases, perceived value and self-congruity is conceptualized in Figure 1 below.

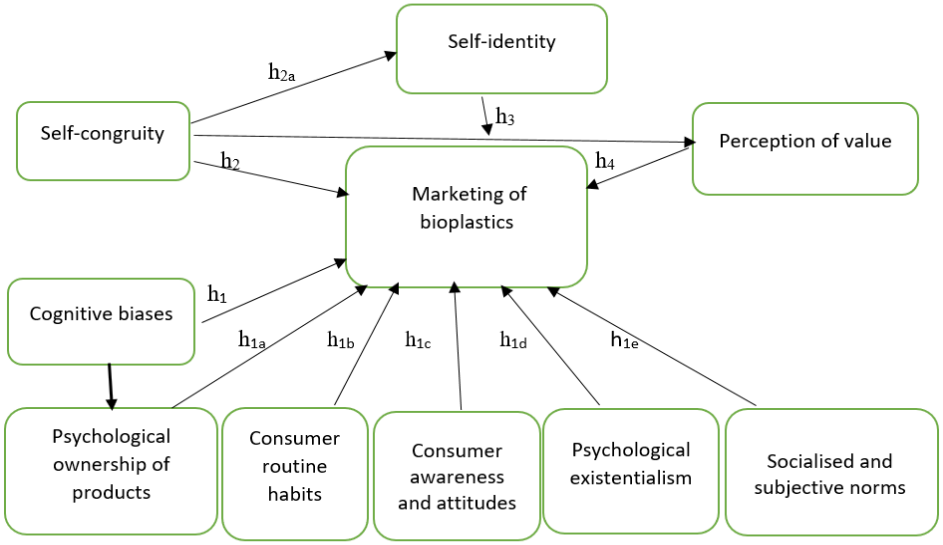

Figure 1.
A framework for marketing of bioplastic products in Zimbabwe.

In addition, cognitive biases can be further broken into sub-factors such as psychological existentialism, socialised and subjective norms, consumer routine habits, and psychological ownership of products as demonstrated above.

3.1. Cognitive Biases

These factors include buyer habits, buyer routines, cultural, social, attitudes, and psychological ownership, which encourage buyers to try novel products in the marker [61]. In most cases, cognitive biases are also driven by other factors, such as reflectivity, customer brand equity, self-identity, and self-concept. The paper suggests that consumers are more likely to accept new products like bioplastics if these products provide them with a sense of psychological ownership. This suggests that successful marketing efforts that encourages consumers to buy bioplastic products need fundamental changes in consumers' attitudes, habits, behavioural intentions, and subjective social norms (see [3, 62]).

Consumer attitudes can be perceived as learned tendencies that permit them to filter, scan, retrieve product from memory, leading to better purchasing decisions. Social factors like cultural beliefs, demographics and values, exert societal pressures that compels consumers to buy or not to purchase certain products when marketed (see also [61, 63]). In this paper, we argue a linkage between social factors and subjective norms in driving consumer behaviour and creating positive attitudes toward a product. Subjective norms are related to psychological essentialism, and assumes that some products possess underlying attributes that buyers want to associate with (Singh and Giacosa [49]; Newman and Knobe [62]; Lakatos, et al. [64]). However, Singh and Giacosa [49] also argue that psychological essentialism undermines the principle of product recyclability, authenticity and product exclusivity, which are likely to have a negative impact on perceived value and self-identity. Therefore, we propose the following main and subsidiary hypotheses:

H_1: There is a positive relationship between consumer cognitive biases and the successful marketing of bioplastic products in Zimbabwe.

H_{1a}: Psychological ownership of products has a positive effect on the acceptance of bioplastic products in Zimbabwe.

H_{1b}: There is a negative relationship between consumers' established habits and acceptance of marketed bioplastic products in Zimbabwe.

H_{1c}: There is a negative relation between psychological existentialism and acceptance of bioplastic products in Zimbabwe

H_{1d}: Social norms have a positive impact on the acceptance of bioplastic products in Zimbabwe.

3.2. Self-Congruity

In many countries, self-congruity has been reported to have a significant effect on the marketing of bioplastic products [35, 61, 65]. Self-congruity affects how a consumer behaves towards and relate to marketed bioplastic products. If there is an alignment between consumers and their perception of the brand or product, consumers are likely to have a positive disposition towards that brand or product. We further argue that if consumers perceive high self-congruity with bioplastic products, this may also enhance self-identity and perceived value of these products. Therefore, we propose the following hypotheses:

H_2: There is a positive relation between self-congruity and the successful marketing of bioplastic products.

H_{2a}: Self-congruity positively influences self-identity leading to acceptance of bioplastic products.

H_{2b}: Self-congruity positively influences perceived value of bioplastic products.

3.3. Perceived Value of Bioplastic Products

Consumers' purchasing decisions are driven by perceived value of marketed products [9, 66, 67]. The values of products represent antecedents of individuals' preference judgements with regards to their purchasing behaviour [60]. Therefore, we believe that if consumers perceive value of bioplastic products is high, they are more likely to change their purchasing decisions.

H_3: There is a positive relation between perceived value and marketing efforts of bioplastic products.

3.4. Self-Identity

Self-identity has often been used as a key construct in the marketing of green products, such as bioplastic products (see [41, 68, 69]). Self-identity contributes to the formation of preferences and is also part of the product value building process [2, 4, 46, 70]. In recent years, consumers in Zimbabwe have become more conscious of damages caused by fuel-based products on the environment. Thus, a strong self-identity could be considered a contributary factor to consumers' acceptance of innovative green products.

H4: Self-identity positively influences the acceptance of bioplastic products in Zimbabwe.

3.5. Data Collection

Using simple random sampling, a cross-section of 100 respondents who closely work with the plastic manufacturers were selected, and a structured questionnaire was employed to collect quantitative data. The questionnaire included questions on key study constructs examined in empirical literature, including perceived value, cognitive bias, self-congruity and self-identity [9, 71]. Before, estimating the structural regression equation, model diagnostic tests such as multicollinearity, goodness of fit, convergent and discriminant validity were performed to avoid estimating a spurious measurement model.

4. Findings

4.1. Measurement Model

The measurement model, discriminant and convergent validity were evaluated using confirmatory factor analysis (CFA) (see [72, 73]). Table 1 shows that for all constructs the thresholds for Cronbach Alpha and composite reliability are greater than 0.70. The AVE for all factors is also above 0.50, indicating acceptable validity and reliability of the measurement model reliability [72, 74, 75].

Table 1.
Descriptive statistics, convergent, discriminant and average variance extraction.

Construct	Descriptive statistics		*CA*	*CR*
	Mean	Standard deviation		
Self-identity	3.15	0.85	0.75	0.85
Self-congruity	3.20	0.87	0.70	0.86
Cognitive biases	3.35	0.85	0.85	0.84
Perceived value	2.85	0.78	0.80	0.88
Psychological ownership	2.80	0.81	0.90	0.91
Established habits	2.65	0.82	0.92	0.92
Consumer attitudes	2.71	0.85	0.92	0.95
Psychological existentialism	3.28	0.80	0.87	0.92
Social norms	3.30	0.88	0.85	0.90

Table 2.
Inter-construct correlations.

Factor	SI	SC	CB	PV	PO	EH	CA	PE	SN
SI	0.85								
SC	0.32	0.87							
CB	0.30	0.41	0.82						
PV	-0.25	0.06	0.10	0.82					
PO	0.05	0.12	0.14	0.40	0.86				
EH	0.08	0.13	0.35	0.51	0.28	0.87			
CA	0.45	0.17	0.25	0.43	0.45	0.50	0.85		
PE	0.11	0.25	0.27	0.38	0.55	0.41	0.35	0.82	
SN	0.23	0.21	0.22	0.44	0.60	0.45	0.23	0.41	0.84

Note: Bene: all entries that are under diagonals are the latent construction and entries that are bolded on the diagonals are average variance extracted (AVE). SI-self-identity; SC-self-congruity, CB-consumer behaviour, PV-perceived value, PO-psychological ownership, EH-established habits, CA-consumer attitudes, PE-psychological existentialism, SN-social norms.

4.2. Latent Variable Inter-Construct Correlations

Table 2 shows that on all measurement items, discriminant validity exists as the AVEs exceed the corresponding correlation coefficient values. There is also no multicollinearity since all correlation values on all constructs are below the threshold of 0.80.

4.3. The Convergent Reliability Measures

4.3.1. The Goodness of Fit diagnostic Tests

Table 3 presents the Normed Fit indices a measure of goodness of fit test. The NFI test is 0.08 and meets the recommended threshold of being not less than 0.08 and above 0.9 [76].

Table 3.
Goodness of fit model.

NFI	SRMSR
0.85	0.08

Additional baseline comparison for goodness of fit were also carried out using indices that include Tucker-Lewis, Comparative Fit, Incremental Fit, Non-Normed Fit, Relative Fit and the Chi-Square goodness of fit (CMIN/DF) Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Non-Normed Fit Index (NNFI), the Incremental Fit Index (IFI), the Relative Fit Index (RFI) and the chi-square goodness-of-fit (CMIN/DF).

4.3.2. Baseline Comparative Tests for Goodness Fit

Table 4 shows that all the values of the indices exceed the threshold of 0.90, which is an indicator of acceptable model fit. A number of studies demonstrate that for goodness of fit to be acceptable, the indices should be close to 1 [75].

Table 4.
Baseline comparison tests.

Model test	NNFI	IFI	CFI	RFI	TLI
Default model	0.91	0.90	0.99	0.91	0.99
Saturated model	1.00	1.00	1.00	1.00	0.00
Independence model	0.00	0.00	0.00	0.00	0.00

4.3.3. The RMSEA

Table 5 confirms validity and convergent (see also Hu and Bentler [77]). The RMSR, which is a measure of non-centrality compares the size of the sample and degrees of freedom, is 0.0045, below the cut-off of 0.05. The independence model values all below 0.50, indicating that the model is also acceptable.

Table 5.
The RMSEAS model diagnostic test.

Model	RMSR	Lo90	Hi90	Pclose
Default model	0.01	0.00	0.00	1.00
The independence model	0.15	0.14	0.14	0.00

Note: RMSEA- root mean square error of approximation; Lo90 lower boundary; Hi90 higher boundary (all at 90% confidence interval)

Table 6.
Structural model path coefficients.

Hypothesis	Relation	Coefficient	T-stat	P	Decision
H_1	SC -> SI	0.05	2.07	0.00	Supported
H_2	S1 -> BP	0.01	1.48	0.01	Supported
H_3	SC -> BP	0.15	2.45	0.00	Supported
H_4	CB -> BP	0.10	2.88	0.04	Supported
H_5	PV -> BP	0.14	1.45	0.08	Supported
H_{4a}	PO -> CB	0.02	2.40	0.00	Supported
H_{4b}	EH -> CB	0.05	1.78	0.01	Supported
H_{4c}	PE -> CB	0.04	1.88	0.05	Supported
H_{4d}	CA -> CB	0.01	2.66	0.00	Supported
H_{4e}	SN -> CB	0.02	2.05	0.01	Supported

Table 6 shows that there is a positive relationship between self-congruity and self-identity (α=0.005, p<0.005). Self-identity is a positive factor in the successful marketing of bioplastic products (α=.001, p<.005). Self-congruency positively influences acceptance of bioplastic products (α=0.005, p<0.004), while Cognitive Biases have a positive relationship with acceptance of bioplastic products (α=0.10, p<0.004). Perceived value has a positive effect on the successful marketing of bioplastic products in Zimbabwe (α=0.14 p<0.002. In addition, psychological ownership, established habits, social norms, psychological existentialism and consumer habits were all statistically significant at various levels of significance.

4.3.4. Construct, Items, Standard Factor Loadings, Individual Item and Composite Reliabilities

Table 7 shows that convergent validity was achieved. Individual item reliabilities were all beyond 0.5 [78]. Composite reliabilities for all constructs were also above .70 limit [79]. All standard factor loadings were significant at 0.001 and exceeded the minimum threshold of 0.60 (see Bagozzi and Yi [78]).

Table 7.
Construct, items, standard factor loadings, individual item and composite reliabilities.

Construct	Items	Standard factor loadings	Individual item reliabilities	Composite reliabilities
Self-identity	Consumer attitudes	0.88***	0.78	0.95
Self-congruity	Cognitive biases	0.85***	0.82	0.94
	Psychological existentialism	0.93***	0.76	0.95
	Social norms	0.78***	0.65	
	Established habits	0.85***	0.71	
Cognitive biases	Customer habits	0.75***	0.70	
Perceived value	Established habits	0.77**	0.79	0.92

Note: *** Significant at P<0.001: ** Significant at P<0.05

4.3.5. Research Model

The final model was specified as shown in Figure 2.

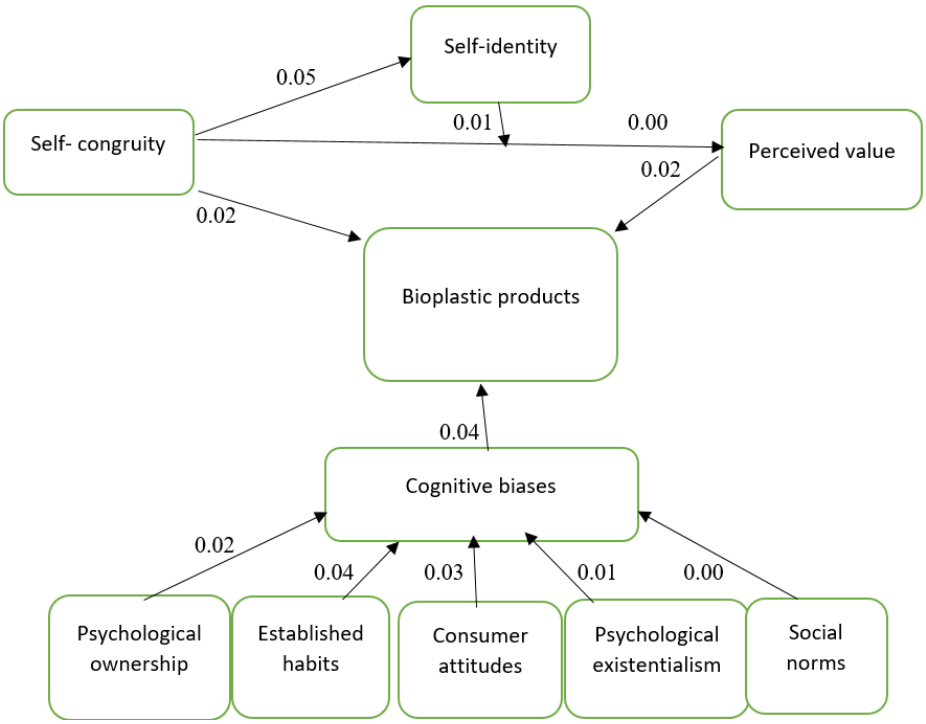

Figure 2.
Final theoretical model specification.

5. Discussions and Policy Implications

Our findings support all hypotheses that were proposed for this research and also suggest managerial and policy implications for successful marketing of bioplastic products in Zimbabwe. The results show that perceived value, cognitive biases, self-identity and self-congruity all positively influence the acceptance of bioplastic products in Zimbabwe. If consumers perceive bioplastic products as attractively priced compared to fuel-based plastic products, there are likely to switch to the former. If consumers identify themselves with bioplastic products, a higher self-congruence also arises, leading to more acceptance of bioplastic products. These findings are supported in the literature [31, 43, 48].

These findings also support contemporary literature on the importance of consumer biases, self-identity, self-congruence and perceived value in influencing the acceptance of bioplastic products by consumers in Zimbabwe (see for example, Papadas, et al. [2]; Dermody, et al. [4]; Khalid, et al. [80]; Cho and Baskin [46]). The findings expand the empirical literature on the need for plastic manufacturing companies to adopt consumer-centric strategies if they are to successfully market bioplastic products. In particular, these companies should also consider factors like social norms, consumer attitudes, psychologic ownership of products, and established consumer habits. These factors are critical ingredients for modifying consumer behaviours towards greater acceptance of bioplastic products.

We also urge policy makers to focus more on policies that reduce the cost of green technologies to enable the production of bioplastic products at competitive costs. Such policies could enable countries like Zimbabwe to quickly move towards a circular economy that encourages protection of ecological systems.

6. Conclusions

Bioplastic products can be produced from organic waste. If starch products and organic waste are fermented through hydrothermal treatment, they produce fatty acids that are volatile and also rich in liquors. These are precursors for producing biodegradable and compostable plastics. Zimbabwe is blessed with excessive organic waste, and hence there is a need for plastic producing firms to embrace green technologies that can enable these firms to easily migrate from fuel-based plastics towards bioplastic products. The advantage of bioplastic products is that they are less damaging to the natural environment since they can be used in compost. This paper uses structural regression equation to investigate how plastic firms can successfully market bioplastic products in Zimbabwe.

7. Future Research implication

The study is one of the few that investigates how successful marketing efforts of bioplastic products can assist developing countries to shift their economies from linear economic systems that promote wasteful consumption of non-renewable resources, towards circular economies that promote recycling, restoration, and regeneration of products. The study used a fairly small sample; however, studies that employ structural regression equations often use large sample. Therefore, more studies should be conducted in other developing countries using large sample size to increase generalizability of findings.

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