International Entrepreneurship Review

2024, Vol. 10, No. 2

10.15678/IER.2024.1002.05

A study of zero-waste behaviour in Polish consumers of cosmetic and personal care products

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ABSTRACT

Objective: The objective of the article is to identify factors affecting zero-waste intentions and behaviour among consumers of cosmetic and personal care products in Poland.

Research Design & Methods: The research model framework was the theory of planned behaviour (TPB). In February and March 2022 in Poland, we surveyed 344 consumers. We analysed the results with structural equation modelling (SEM). We posited six research hypotheses. We confirmed four of them and falsified two.

Findings: The results showed that both attitudes and perceived behavioural control had a positive impact on zero-waste behavioural intentions regarding cosmetics and personal care products in Poland. On the other hand, the intentions were not affected by subjective norms or awareness of consequences. Regarding zero-waste behaviour, it is significantly determined by intentions and perceived behavioural control.

Implications & Recommendations: The article proposes recommendations for improving the acceptance of zero-waste-inspired innovation.

Contribution & Value Added: The article fills the research gap regarding the impact of zero waste on the implementation of the circular economy. The TPB model has been expanded with an additional construct awareness of consequences. Moreover, the study identifies factors that affect zero-waste intentions and behaviour in the cosmetics industry in Poland.

Article type:	research article
Keywords:	circular economy; sustainable cosmetics; zero-waste behaviour; theory of planned behaviour; structural equation modelling
JEL codes:	D45, D9, D91

Received: 18 October 2023 Revised: 28 February 2024 Accepted: 29 February 2024

Suggested citation:
Zdonek, I., Hysa, B., & Zdonek, D. (2024). A study of zero-waste behaviour in Polish consumers of cosmetic and personal care products. *International Entrepreneurship Review,* 10(2), 69-87. https://doi.org/10.15678/IER.2024.1002.05

INTRODUCTION

Innovations that support sustainable development are increasingly in demand (Javeed *et al.*, 2022; Nawrocki & Jonek-Kowalska, 2022). This trend is driven by dwindling resources and the climate crisis on the one hand and the growing population, leading to an even greater demand for resources on the other hand. Regrettably, the current economic model is linear. It collects resources, processes them, and disposes of them when they are no longer needed. An average household is estimated to dispose of paper equivalent to six trees, about 500 metal cans, 50 kg of glass, 35 kg of various metals, and 50 kg of plastics a year (Wojciechowski, 2019). According to Chawla *et al.* (2022), approximately 92% of the global industry follows a linear pattern (Chawla *et al.*, 2022).

The circular economy (CE) can be a way to put a stop to wasting valuable resources. Ellen MacArthur Foundation (2022) defined three principles of the circular economy: elimination of waste and pollution, circulation of products and materials, and regeneration of nature (Ellen MacArthur Foundation, 2022). This approach focuses on the sustainable management of resources, in which materials

are reused, shared, repaired, refurbished, regenerated, and recycled to form a closed circuit and minimise the consumption of natural resources (Khajuria *et al.*, 2022). Moreover, Murray *et al.* (2017) demonstrated that the circular economy is an economy model where planning, procurement, production, and reprocessing are designed and managed as both a process and a product (Murray *et al.*, 2017). The goal is to maximise the functioning of the ecosystem and the well-being of people.

The circular economy and effective waste management in particular are key aspects of the smart city concept (Jonek-Kowalska, 2022). Naturally, a successful conversion into the circular economy requires a systemic change in how goods are designed and manufactured. This entails a transformation of the entire supply and value chain and the involvement of multiple stakeholders and sectors of the economy in the circular production and consumption paradigm. The great importance has also been consumer perception, behaviour, and attitudes towards sustainable consumption (Pilch & Miśniakiewicz, 2022). Hence, changes are inevitable in all sectors of the economy, including the cosmetics industry. This branch of industry meaningfully affects the environment at the production and consumption stages. Cosmetic products are emitted into water ecosystems, where their environmental impact is related to bioactivity, toxicity, and bioaccumulation potential (Gao *et al.*, 2018). This is because the current conventional waste processing system has not been designed to handle pollution from cosmetic products. The structural complexity of these pollutions and their low concentrations make them undetectable, and hence difficult to remove with the current wastewater treatment methods. All this is further exacerbated by their reputation as a serious environmental threat (Patel *et al.*, 2020). In light of the above, changes in the cosmetics industry should focus on the production using more environmentally-friendly ingredients, removal of cosmetic substances from wastewater, and replacement of artificial packaging with a greener one (Rocca *et al.*, 2022).

Various concepts are promoted to facilitate the transformation into a circular economy (Borusiak *et al.*, 2021; Nowicki *et al.*, 2023). One of them is zero waste. It is perceived as an innovative and visionary approach to waste management (Zaman & Ahsan, 2019). Zero waste has become part of the sustainable development programmes of many communities, organisations, and cities. The traditional waste management system often destroys the product and its material value, because it focuses on the safe disposal of waste. On the contrary, zero waste strives to preserve the product and resource value by promoting such solutions as reduction, reuse, repair, and recycling (Zaman & Newman, 2021). This way, it implements the principles of the circular economy. Zero waste counters the disposability prevalent in the linear economy and thus opens the way for the marketing of innovative products and solutions. Some examples of zero waste in practice are the sale of refurbished electronics, second-hand clothes, upcycled clothing, water filters to replace bottled water, household compost bins to reduce biodegradable waste in landfills, etc. Therefore, zero waste induces new market behaviour in communities, generating potential business opportunities. The effect is boosted by zero-waste communities' tendency to form associations, hold flea markets, or other occasions to swap things people no longer need. They also educate each other on what is and what is not environmentally friendly. Thus, zero waste is an opportunity for many new business models and initiates a specific type of innovation, open innovation. These innovations are based on the exchange of knowledge and collaboration to obtain solutions to limit waste generation at resource sourcing, production, product distribution, use, and disposal.

According to Fortunati *et al.* (2020), cosmetic businesses also strive to protect the environment and biodiversity through such efforts as the commitment to reduce CO2 emissions, waste, and water and/or plastic consumption (Fortunati *et al.*, 2020). The organisations declare further that their future goal is to improve the share of natural or organic resources to 80%-100%. They also believe that the reduction of the volume, weight, packaging, and materials used in products can be an important step towards environmental protection. Therefore, they are involved in sourcing reusable containers and using recycled materials (Fortunati *et al.*, 2020). Studies by Diaczek and Gardula (2019) and Firek and Dziadkowiec (2020) on the Polish cosmetics market also identified good practices regarding environmental-friendly solutions and methods for inspiring consumers to recover used packaging (Diaczek & Garduła, 2019; Firek & Dziadkowiec, 2020). The examples above show that the cosmetics industry strives to propose a more sustainable cosmetic product by changing production, packing, and waste disposal. Rocca *et al.* (2022) and Suphasomboon and Vassanadumrongdee (2022) concluded that a

growing demand for sustainable products is one of the drivers of this effort (Rocca *et al.*, 2022; Suphasomboon & Vassanadumrongdee, 2022).

Many researchers (Askadilla & Krisjanti, 2017; Ghazali *et al.*, 2017; Sheehan, 2013; Yeon Kim & Chung, 2011) stressed that motivation to purchase sustainable products depends on attitudes, values, and sociocultural factors. The natural cosmetics market is growing dynamically in Poland. The compound annual growth rate (CAGR) for the natural cosmetics market is forecast to exceed 10% from 2021 to 2026 (Industry Report, 2021). Such strong market growth opens ample opportunities. Nevertheless, there is still a need for multifaceted research in this specific cosmetics and care product sector in Poland, especially in the context of the circular economy. For example, there is virtually no research on what drives consumers to buy natural cosmetic products in Poland. We noted a particular gap regarding the impact of zero waste on the motivation to purchase sustainable cosmetic products.

Therefore, considering the above, we aimed to identify factors affecting zero-waste intentions and behaviour among consumers of cosmetic and personal care products in Poland. We pose the following research question:

Research Question: What factors affect zero-waste intentions and behaviour regarding cosmetics and personal care products in Poland?

The novelty of the article is founded on the following:

1. It fills the research gap regarding the impact of zero waste on the implementation of the circular economy. Similar studies have been conducted in foreign literature (Zaman & Ahsan, 2019; Zaman & Newman, 2021)
2. It identifies factors that affect zero-waste intentions and behaviour in the cosmetics industry in Poland. This will be an extension of research into intentions to buy green cosmetics conducted by researchers such as Askadilla and Krisjanti (2017), Chin *et al.* (2018), Fatoki (2020), and Hsu *et al.* (2017).
3. It proposes recommendations for improving the acceptance of zero-waste-inspired innovation. Our recommendation can strengthen efforts to build environmentally friendly attitudes in organisations, including the promotion of the Zero Waste concept in Poland. As it happens on the international stage (Askadilla & Krisjanti, 2017; Bilal *et al*., 2020; Fortunati *et al.*, 2020).

The main means for answering the research question and achieving the aim was a quantitative survey of 344 people conducted in February and March 2022 in Poland. The theoretical background was the theory of planned behaviour (TPB). The data were analysed with structural equation modelling.

The article is structured as follows. Section two discusses zero waste as an external source of innovation opportunities and presents natural cosmetics as an innovation to foster sustainable development. We then present the development of the research hypotheses using TPB. Section three introduces the research method. Results and discussion are recorded in section four. There are then conclusions in section five together with theoretical and practical implications, limitations and further research.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Zero Waste as an External Source of Innovation Opportunities

Innovation can be a product, process, service, or method that should satisfy the needs of its users and improve business competitiveness. Taking the environmental aspect into consideration, one can discuss innovation for sustainable development or, in broader terms, eco-innovation. Innovation for sustainable development is the commercialisation of a new product or service, a system of product services, or a pure service that yields environmental, social, or economic benefits (Charina *et al.*, 2022; Love & Roper, 2015; Pichlak & Szromek, 2021). The majority of definitions of eco-innovation emphasize that the implementation of new solutions takes into account curbing negative environmental impact. Note that literature on eco-innovation has yet to work out a unified terminology. Most researchers use environmental innovations, green innovations, sustainable innovations, or innovations for sustainable development as equivalents of eco-innovations (Cecere *et al.*, 2014; Forsman *et al.*, 2013; Javeed *et al.*, 2022). Pichlak and Szromek (2021) consider eco-innovation to be a new solution in a business that leads to removing or limiting adverse environmental impact (Pichlak & Szromek, 2021). Note here

that what is commonplace for one organisation at a given point in time and space may be an innovation in another business (Carrillo-Hermosilla *et al.*, 2010).

We may also perceive eco-innovation as the creation of new knowledge and combination of the existing knowledge in a novel way. In this context, knowledge used to generate eco-innovation can be created inside the organisation or come from its environment. This approach is consistent with the open innovation concept considered a critical paradigm in innovation management (Pichlak & Szromek, 2021). Open innovation is a holistic approach to innovation management by 'systematically encouraging and exploring a wide range of internal and external sources for innovation opportunities, consciously integrating that exploration with firm capabilities and resources, and broadly exploiting those opportunities through multiple channels' (West & Gallagher, 2006). The open innovation process consists of three subprocesses: outside-in, inside-out, and mixed processes. Each type requires different stakeholders (Cecere *et al.*, 2014; Charina *et al.*, 2022). Doran and Ryan (2016) indicated that access to knowledge and information from the market was particularly important in generating and implementing eco-innovations. Therefore, broad collaboration and interactions with customers and suppliers, research institutes, universities, and other businesses are very important (Doran & Ryan, 2016).

Hence, we may consider eco-innovations an important tool for sustainable development, and zero waste can be a significant external source of innovation opportunities, leading to a new business model open to innovations. Many cosmetics and personal care businesses have already implemented new business models founded on zero waste. Fortunati and colleagues investigated cosmetics companies in the context of this concept (L'Orèal Group, Clarins Group, Guerlain Group, Shisei-do Group, Lush Group, Yves Rocher Group, Pierre Fabre Group, and Chanel Group) (Fortunati *et al.*, 2020). Their results demonstrated that international corporations perceived the design phase as crucial and that eco-design, that is the use of sustainable materials in production, was already popular. Research by Diaczek and Gardula (2019) and Firek and Dziadkowiec (2020) on the Polish market also shows interest in zero waste (Diaczek & Garduła, 2019; Firek & Dziadkowiec, 2020). For instance, Lush Botanicals offers discounts for sending back five used product bottles or a new product of the customer's choice for ten bottles. Yope allowed its customers to refill plastic bottles with cosmetics at refilling stations. Therefore, one of the leading focal areas for the cosmetics industry is to replace the existing packaging materials with sustainable alternatives and raise customer awareness of packaging recycling and reuse.

Natural Cosmetics as an Innovation to Foster Sustainable Development

Cosmetics consumers and their everchanging expectations drive the need for new, better ingredients that are safer for people and the environment (Chin *et al.*, 2018; Ghazali *et al.*, 2017). Various research and development programmes cover all possible aspects of the industry: consumer behaviour and cosmetics aspirations, the biology of the skin, hair, teeth, and oral cavity, and new innovative technologies and improved models of sustainable development. Innovations follow various directions in the cosmetics industry. Some researchers create new products with traditional materials (such as ginseng). Others use molecular-level materials (nanotechnologies) to invent a completely new generation of ingredients. Some examples include stem-cell research to help in skincare at the molecular level by protecting the DNA or oral cavity hygiene research to find a new generation of products against plaque (Cosmetics Europe, 2022). Cosmetics industry innovations are all but short-lived because it may take over five years of innovative research and recipes to market a new product. The European cosmetics and personal care industry is a leader in the sector. It provides about 28 800 jobs for researchers representing diversified fields, like physics, microbiology, biology, dermatology, oral medicine, toxicology, rheology, analytical chemistry, or genetics. There are at least 77 innovative research centres in Europe investigating cosmetics (Cosmetics Europe, 2022).

The growing consumer environmental awareness pushes a business towards innovation and promotion of green cosmetics, also referred to as natural or organic cosmetics (Limbu *et al*., 2022). Such cosmetics are free of chemicals or non-natural admixtures and additions. Their ingredients are natural and fruit-derived. Moreover, their objective is to protect the environment and animal well-being. Therefore, they are made with no pesticides, synthetic chemicals, or tests on animals (Shimul *et al.*, 2022). Green cosmetics cover a broad array of personal care products, such as environmentally-friendly creams, make-

up, and beauty products. The demand for green cosmetics has been growing worldwide. The global green cosmetics market was estimated at USD 34.5 billion in 2018 and is expected to reach USD 54.5 billion by 2027 at a compound annual growth rate of 5.2% from 2018 to 2027 (Statista, 2020).

Determinants of Acceptance of Zero-Waste-Inspired Innovation in the Cosmetics Industry in the Framework of the Theory of Planned Behaviour

The theory of planned behaviour (TPB) is based on the theory of reasoned action (TRA) (Ajzen & Fishbein, 1977; Ajzen & Fishbein, 1980). It helps better understand relationships among attitudes, intentions, and behaviour and defines the impact of an individual's subjective norms and attitudes on the intention. The TPB adds one more factor, perceived behavioural control (Ajzen, 1991a; Ajzen & Driver, 1991), affecting intentions and behaviour. The TPB is successfully employed in environment management (Fielding *et al.*, 2005; Grilli & Notaro, 2019; Wach & Wojciechowski, 2016). It is a well-founded theory applicable to accounting for ethical and environmentally motivated behaviour among consumers (Han & Stoel, 2017; Han, 2020; Onwezen *et al.*, 2013; Han, 2021). It is applied to behaviour connected with recycling (Aguilar-Luzón *et al.*, 2012; Chan & Bishop, 2013; Khan *et al.*, 2019), green shopping (Arvola *et al.*, 2008; Albayrak *et al.*, 2013), water and energy conservation, public transport, and avoidance of disposable products (Untaru *et al.*, 2016; Paiano *et al.*, 2020; Moon, 2021).

Although the TPB is generally believed to be an effective tool for behavioural studies, some researchers do mention its limitations. One of them is that it fails to ensure sufficient accuracy in predicting intentions and behaviour (Ogden, 2003). Some research with the TPB demonstrated no influence or very low influence of the disposition or subjective norms on intention and behaviour. Nevertheless, Ajzen and Fishbein (2004) explained that the predictive value of the three main predictors may differ depending on the type of behaviour and population (Ajzen & Fishbein, 2004). Moreover, the model can be expanded with other predictors if they improve the model's predictive power, considering the current variables of the theory (Ajzen, 1991b; Han & Stoel, 2017).

The central concept of the TPB is a behavioural intention, the intention to perform a certain behaviour. It is a strong predictor of actual behaviour. In TPB, the behavioural intention defines the motivation to perform a given behaviour with three conceptually independent factors: attitudes, subjective norms, and perceived behavioural control related to the specific behaviour (Ajzen, 1991a; Ajzen & Driver, 1991; Ajzen & Fishbein, 1977).

Perceived behavioural control affects both the intentions and the actual behaviour. The first construct determining behavioural intention is attitude. It is defined as the disposition and belief about a behaviour (Ajzen, 1991a). In the context of zero-waste behaviour, it will be beliefs and dispositions towards such behaviour. According to recycling researchers (Botetzagias *et al.*, 2015; Chu & Chiu, 2003), attitude is a significant predictor of behavioural intention concerning recycling. Moreover, research by Askadilla and Krisjanti (2017), Chin *et al.* (2018), Fatoki (2020), Hsu *et al.* (2017), Yeon Kim and Chung (2011) demonstrated that attitude is the key factor in intentions to purchase green cosmetics (Askadilla & Krisjanti, 2017; Chin *et al.,* 2018; Fatoki, 2020; Hsu *et al.*, 2017; Yeon Kim & Chung, 2011). Therefore, we may expect attitude to have a significant effect on zero-waste behaviour (ZWB) in general, including in the context of cosmetics and personal care products.

According to Arvola *et al.* (2008), attitude covers cognitive and emotional components. Therefore, the zero-waste attitude will be determined by the knowledge of this behaviour and emotions towards it (Arvola *et al.*, 2008). Hence, attitudes towards ZWB regarding cosmetics and personal care products will hinge on the individual's knowledge of the benefits of this behaviour, that is health, environmental, and economic benefits, and emotions regarding the behaviour. The attitudes can be positive or negative. The individual may perceive ZWB positively or, on the contrary, as a tool for greenwashing. This is the foundation for the first research hypothesis:

H1: Attitudes towards zero waste significantly affect zero-waste behaviour intentions regarding cosmetics and personal care products.

Considering that the TPB can be expanded with additional constructs, we decided to use 'awareness of consequences' as an additional determinant of behavioural intention following the example

of (Khan *et al.*, 2019). It is important for investigating human behaviour according to Schwartz's altruistic behaviour model (Schwartz, 1977). People more readily exhibit behaviour that brings better results. According to Bianchi and Birtwistle (2012), people who care about the environment tend towards more environmentally friendly behaviour and exhibit behaviour that does not harm the environment (Bianchi & Birtwistle, 2012). The awareness of the consequences of ZWB will be connected to the prevention of the effects of excessive consumerism and the health, environmental, and economic benefits of that prevention. This leads to the second hypothesis:

H2: The awareness of the consequences of zero-waste activities significantly affects zero waste-behaviour intentions regarding cosmetics and personal care products.

Another construct to determine behavioural intention is subjective norms. It is defined as the social pressure perceived by the individual when performing a behaviour (Ajzen, 1991a). The pressure comes from family and friends. The individual leans towards behaviour preferred by their closest circle. Many recycling researchers believe subjective norms to be an important behaviour predictor (Chen & Tung, 2010; Wan *et al.*, 2014). Moreover, research by Hsu *et al.* (2017) on green skin-care products also demonstrated that subjective norms are an important factor in accounting for intentions to purchase green cosmetics (Hsu *et al.*, 2017). It can be assumed to be a significant predictor for zero-waste behaviour related to cosmetics.

However, some authors (Fatoki, 2020; Suphasomboon & Vassanadumrongdee, 2022) demonstrated that subjective norms may not be a significant predictor of intentions to purchase green cosmetics. Thus, we hypothesised further to investigate the issue:

H3: Subjective norms significantly affect zero-waste behaviour intentions regarding cosmetics and personal care products.

The next construct that determines behavioural intention under the TPB is perceived behavioural control. It is the degree of control the individual has over their behaviour. Research by Hsu *et al.* (2017) lists perceived behavioural control as a significant predictor of intentions to purchase green products (Hsu *et al.*, 2017). Oom Do Valle *et al.* (2005) determined that the degree of control depends on external and internal conditions (Oom Do Valle *et al*., 2005). External conditions are defined as the ease and convenience of performing a behaviour. External conditions refer to the individual's perceived abilities, including their understanding and familiarity with the behaviour. Therefore, perceived behavioural control hinges on the capabilities and resources available to the individual and their sense of effectiveness. Hence, the decision regarding a behaviour depends on the associated ease and difficulties (Ajzen, 1985). Considering that perceived behavioural control determines both intentions and actual behaviour, we posed the fourth and fifth research hypotheses:

H4: Perceived behavioural control significantly affects zero-waste behaviour intentions regarding cosmetics and personal care products.

H5: Perceived behavioural control significantly affects zero-waste behaviour regarding cosmetics and personal care products.

As mentioned above, behavioural intention is a strong predictor of actual behaviour (Ajzen, 1991a; Ajzen & Driver, 1991; Ajzen & Fishbein, 1977). The greater the intention to engage in a behaviour, the greater the probability of performing it. Consequently, an intention regarding a specific behaviour is a reliable predictor of whether or not it will be performed. In the case of zero-waste behaviour, a greater intention of a consumer to perform a zero-waste behaviour is expected to result in a greater chance of the behaviour. This led us to the sixth research hypothesis:

H6: Zero-waste behaviour intentions concerning cosmetics and personal care products significantly affect zero-waste behaviour.

RESEARCH METHODOLOGY

Research Model

The analyses employed structural equation modelling (SEM). The SEM involved a series of such tests as factor, discriminant, and regression analyses to investigate the dependencies among the constructs defined herein. They are shown in Figure 1. Such constructs as attitudes, awareness of consequences, subjective norms, and perceived behavioural control account for the construct of zero-waste behaviour intention. Consequently, zero-waste behaviour intention and perceived behavioural control are predictors for zero-waste behaviour. The specific type of SEM used here is PLS-SEM, which is SEM based on variance. We used SmartPLS for this purpose.

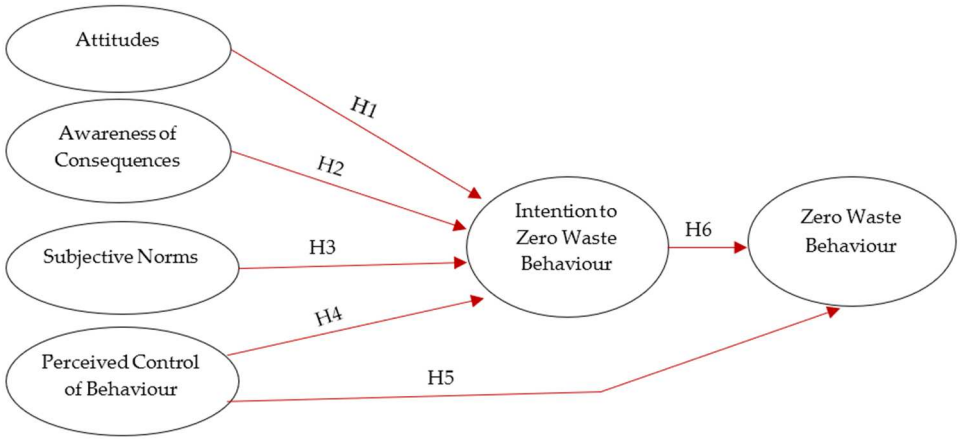

Figure 1. Research model for determining the factors of zero-waste behaviour among Polish consumers of cosmetics and care products

Source: own elaboration.

Research Process

The analyses were divided into two stages (Figure 2). Firstly, we built and verified the measurement model (outer model) and then the structural model (inner model) (Hair Jr *et al.*, 2014; Hair, 2014; Hair *et al.*, 2019; Hair *et al.*, 2011; Ramli *et al.*, 2019).

The measurement model (outer model) encompassed variables and constructs. We built it by assigning variables measured in the survey to the constructs identified in the literature search. We verified the model with reliability and validity tests for each construct. We calculated factor loadings for variables constituting each construct. We assumed that factor loadings should be greater than 0.5. The internal consistency of the constructs was investigated with Cronbach's alpha and composite reliability (CR). Both should exceed the cut-off value of 0.7. The convergent validity was measured with the average variance extracted (AVE). The AVE should exceed the cut-off value of 0.5. We measured the discriminant validity with the Fornell-Larcker criterion and the Heterotrait-Monotrait Ratio (HTMT).

We built the inner model by calculating path coefficients (β) for constructs that are predictors. The coefficients' significance was verified with t-test statistics and p-values. The significance level was set at $\alpha = 0.05$. We computed R^2, Q^2, and f^2 for the model. R^2 specifies the variance of the endogenous variable accounted for by predictors. Q^2 specifies the predictive power of the model. Finally, f^2 specifies the effect of predictors on the endogenous variable.

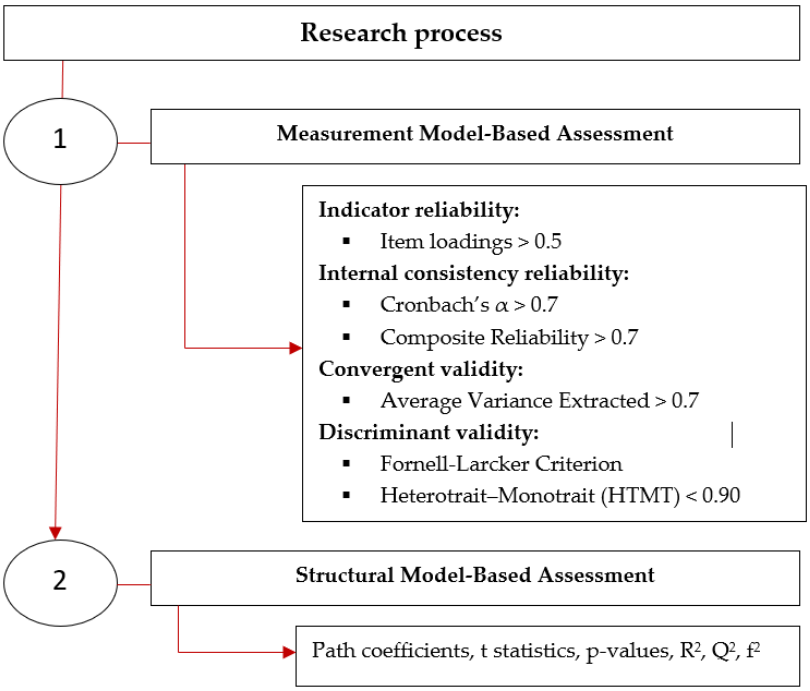

Figure 2. Research process in structural equation modelling for data collected during surveys
Source: own elaboration.

Structure of the Questionnaire

Table 1 presents questions from the questionnaire. These were five-point Likert scale questions ('Strongly agree,' 'Agree,' 'Don't know,' 'Disagree,' 'Strongly disagree').

Table 1. A survey questionnaire used to examine the factors determining zero waste behaviour among Polish consumers of cosmetics and care products

Construct	Question	Reference
Attitudes	Att_1. Zero-waste activities pay off	(Khan *et al.*, 2019)
	Att_2. Zero-waste activities are good	
	Att_3. Zero-waste activities are useful	
	Att_4. Zero-waste activities are gratifying	
	Att_5. We must follow zero-waste principles	
	Att_6. Zero-waste activities make me feel a better person	
Subjective Norms	SbN_1. Most of my family would engage in zero-waste activities	(Khan *et al.*, 2019)
	SbN_2. Most of my friends would engage in zero-waste activities	
	SbN_3. Most of my family believe I should engage in zero-waste activities	
	SbN_4. Most of my friends believe I should engage in zero-waste activities	
	Sbn_5. Most of my friends and family would consider zero-waste activities as good	
Awareness of Conse-quences	Awarn_1. Zero-waste activities are the primary method for reducing environmental pollution	(Khan *et al.*, 2019)
	Awarn_2. Zero-waste activities create a better environment for posterity	
	Awarn_3. Zero-waste activities are the primary method for reducing landfills	
	Awarn_4. Zero-waste activities are the primary method for conserving natural re-sources	
	Awarn_5. Zero-waste activities save money	
Zero Waste-Behaviour Intention	Int_Cosm_1. I would like to buy cosmetics and personal care products in packaging limiting plastic use (such as compostable, returnable, and recyclable)	Original work
	Int_Cosm_2. I would like to buy solid cosmetics to limit the use of plastic (such as soap/shampoo bars or toothpaste tablets)	

Construct	Question	Reference
Zero Waste-Behaviour Intention	Int_Cosm_3. I would like to buy reusable products (electric shaver, diapers, personal care products)	Original work
	Int_Cosm_4. I would like to buy products made of biodegradable ingredients with no plastic	
Zero-Waste Behaviour (ZWB)	Beh_Cosm_1. I often buy cosmetics and personal care products in packaging limiting plastic use (such as compostable, returnable, and recyclable)	Original work
	Beh_Cosm_2. I often buy solid cosmetics to limit the use of plastic (such as soap/shampoo bars or toothpaste tablets)	
	Beh_Cosm_3. I often buy reusable products (electric shavers, diapers, personal care products)	
	Beh_Cosm_4. I often buy products made of biodegradable ingredients with no plastic	
Perceived Behavioural Control	Control_1. It is convenient to buy cosmetics and personal care products in packaging limiting plastic use (such as compostable, returnable, and recyclable)	Original work
	Control_2. It is convenient to buy solid cosmetics to limit the use of plastic (such as soap/shampoo bars or toothpaste tablets)	
	Control_3. It is convenient to buy reusable products (electric shaver, diapers, personal care products)	
	Control_4. It is convenient to buy products made of biodegradable ingredients with no plastic	

Source: own study.

Sample

We conducted the research in February and March 2022. We surveyed 344 participants. The survey questionnaire was prepared in electronic version and distributed using the snowball method. The sample size was estimated so that the maximum error does not exceed 5%. Table 2 summarizes the sample details.

Table 2. Profile of the sample of survey participants in Poland, n=344

Sex	Percentage	Age	Percentage	Residence	Percentage
Female	60%	20 years and less	22%	Village	19%
Male	40%	21-30 years	52%	Town	9%
–	–	31-40 years	6%	Small city	23%
–	–	41-50 years	13%	Large city	48%
–	–	Over 50 years	7%	–	–

Source: own study.

RESULTS AND DISCUSSION

Measurement Model-Based Assessment

Table 3 shows the results of the measurement model. It demonstrates that the constructs meet the posed criteria. This means that each construct contains variables for which factor loadings exceed 0.5. Cronbach's α and CR exceed 0.7 and the average variance extracted exceeds 0.5 for each construct. Some variables had to be excluded to obtain this model. The removed variables are not listed in the item column (Table 3).

We tested the discriminant validity of the measurement model as well. Tables 4 and 5 show the results of this analysis. Both the Fornell-Larcker and Heterotrait-Monotrait criteria indicated good discriminant validity of the measurement model.

Table 3. Statistical measures used to evaluate the reliability and convergent validity of the measurement model applied in the research process

Variables	Item	Loadings	Cronbach's alpha	CR	AVE
Attitudes	Att_1	0.658	0.870	0.902	0.607
	Att_2	0.789			
	Att_3	0.849			
	Att_4	0.814			
	Att_5	0.777			
	Att_6	0.776			
Awareness of Consequences	Awarn_1	0.836	0.901	0.931	0.771
	Awarn_2	0.875			
	Awarn_3	0.917			
	Awarn_4	0.883			
ZW Cosm Behaviour	Beh_Cosm_1	0.802	0.723	0.829	0.550
	Beh_Cosm_2	0.710			
	Beh_Cosm_3	0.644			
	Beh_Cosm_4	0.798			
Perceived Behavioural Control	Control_1	0.833	0.790	0.864	0.612
	Control_2	0.801			
	Control_3	0.751			
	Control_4	0.746			
ZW Cosm Behaviour Intention	Int_Cosm_1	0.790	0.770	0.853	0.593
	Int_Cosm_2	0.712			
	Int_Cosm_3	0.737			
	Int_Cosm_4	0.836			
Subjective Norms	SbN_1	0.783	0.824	0.876	0.585
	SbN_2	0.758			
	SbN_3	0.777			
	SbN_4	0.791			
	SbN_5	0.713			

Source: own study.

Table 4. Fornell-Larcker criterion used to evaluate the discriminant validity of the measurement model applied in the research process

Variables	Attitudes	Awareness of Consequences	ZW Cosm Behaviour	ZW Cosm Intention	Perceived Behavioural Control	Subjective Norms
Attitudes	0.779	–	–	–	–	–
Awareness of Consequences	0.663	0.878	–	–	–	–
ZW Cosm Behaviour	0.322	0.315	0.741	–	–	–
ZW Cosm Intention	0.557	0.454	0.519	0.770	–	–
Perceived Behavioural Control	0.276	0.221	0.548	0.378	0.784	–
Subjective Norms	0.553	0.399	0.331	0.331	0.253	0.765

Source: own study.

Structural Model-Based Assessment

Figure 3 presents the structural model. The constructed structural model accounted for 41.1% (R^2 = 0.414) of the variability of the zero-waste behaviour construct for cosmetics and personal care products. The predictive power of the model was Q^2 = 0.220. The model's significance was confirmed by SRMR = 0.078, which was lower than the assumed cut-off value of 0.09.

Table 5. Heterotrait-Monotrait criterion used to evaluate the discriminant validity of the measurement model applied in the research process

Variables	Attitudes	Awareness of Consequences	ZW Cosm Behaviour	ZW Cosm Intention	Perceived Behavioural Control
Awareness of Consequences	0.743	–	–	–	–
ZW Cosm Behaviour	0.405	0.386	–	–	–
ZW Cosm Intention	0.666	0.529	0.702	–	–
Perceived Behavioural Control	0.329	0.258	0.722	0.488	–
Subjective Norms	0.642	0.451	0.430	0.401	0.309

Source: own study.

Table 6 shows which hypotheses were confirmed under the present research model. Therefore, the significant predictors of zero-waste behaviour regarding cosmetics and personal care products were intentions of the behaviour (p-value < 0.001) and perceived behavioural control over this behaviour (p-value < 0.001). In this way, we confirmed hypotheses H5 and H6. Factors connected with the awareness of consequences and subjective norms turned out to be insignificant predictors of zero-waste behaviour intentions regarding cosmetics and personal care products. Therefore, hypotheses H2 and H3 have not been proven true. Attitudes towards ZWB (p-value < 0.001) and perceived behavioural control (p-value < 0.001) turned out to be significant predictors of zero-waste behaviour regarding cosmetics and personal care products, which confirmed hypotheses H1 and H4.

Table 6. Results of hypothesis testing in the structural model applied in the research process

Variables	β	Standard Deviation	t	p-value	f^2	Verification of the hypothesis
H1. Attitudes -> ZW Cosm Intention	0.405	0.088	4.580	0.000	0.119	positive
H2. Awareness of Consequences -> ZW Cosm Intention	0.136	0.096	1.417	0.157	0.016	negative
H3. Subjective Norms -> ZW Cosm Intention	-0.008	0.064	0.118	0.906	0.000	negative
H4. Perceived Behavioural Control -> ZW Cosm Intention	0.238	0.053	4.460	0.000	0.082	positive
H5. Perceived Behavioural Control -> ZW Cosm Behaviour	0.410	0.049	8.325	0.000	0.246	positive
H6. ZW Cosm Intention -> ZW Cosm Behaviour	0.364	0.050	7.231	0.000	0.194	positive

Note: statistically significant values are in red.
Source: own study.

Discussion

The results confirming the significance of attitudes and perceived behavioural control were consistent with other studies (Askadilla & Krisjanti, 2017; Chin *et al.*, 2018; Fatoki, 2020; Hsu *et al.*, 2017; Yeon Kim & Chung, 2011). Both attitudes and perceived behavioural control affected purchase intentions positively. Research by Firek and Dziadkowiec (2020) offers an interesting comment on attitudes (Firek & Dziadkowiec, 2020). Of course, knowledge of a product shapes attitudes with rational arguments for positive and negative dispositions towards it. Still, Firek and Dziadkowiec (2020) indicate that the low level of knowledge about green cosmetics in Poland is the main reason why people tend not to buy them. Moreover, according to Firek and Dziadkowiec (2020), green cosmetics are available mainly online. Their availability in brick-and-mortar chemists is believed to be low. This means the perceived behavioural control concerning access to green cosmetics among Polish consumers is low. Therefore, in light of the model proposed here, low perceived behavioural control will be detrimental to the purchase of green cosmetics. However, we hope that global trends such as increasing concern for the environment, development of ecological certifications, the influence of social media and global pro-ecological initiatives, and increased awareness of health and safety will contribute to improving the knowledge and availability of ecological cosmetics in Poland.

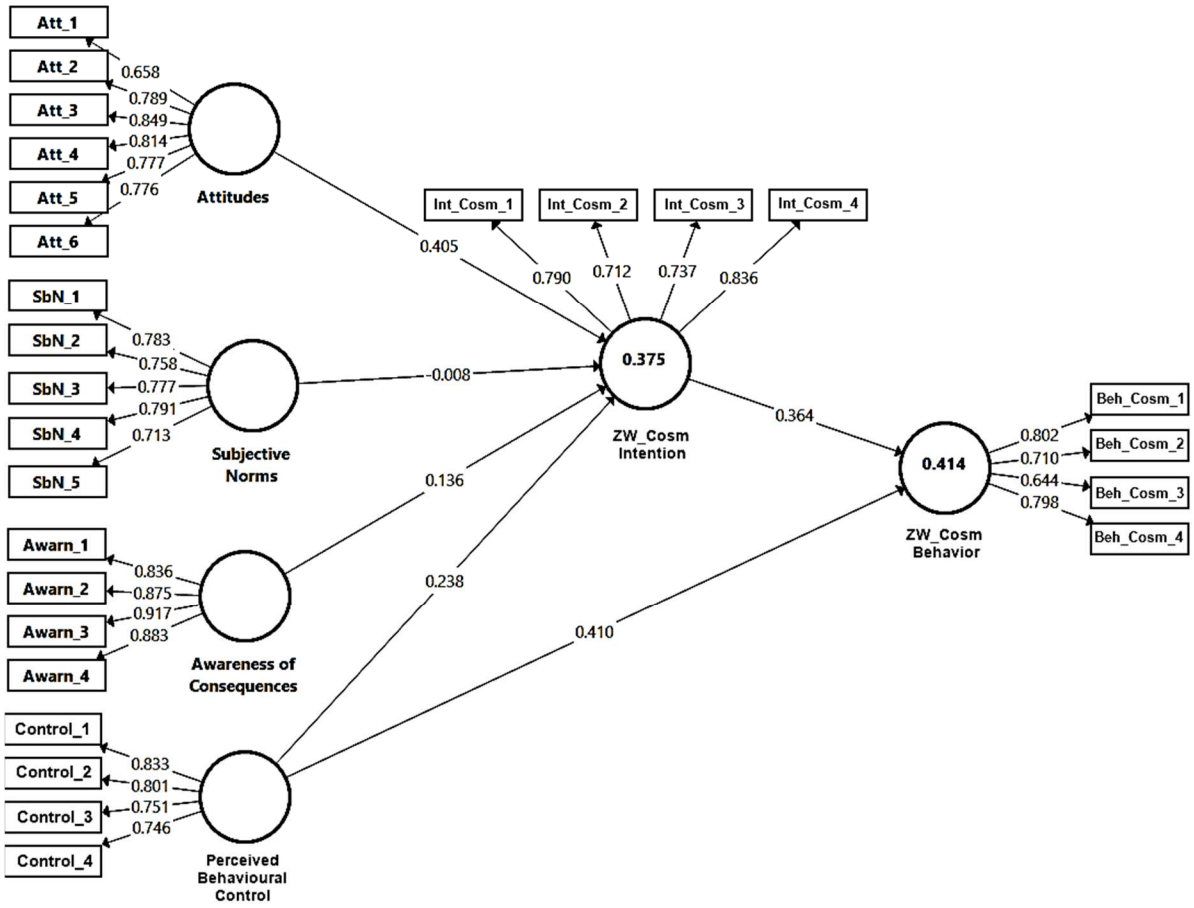

Figure 3. Structural model of the factors determining zero waste behaviour among Polish consumers of cosmetics and care products

Source: own elaboration.

The most surprising result was that subjective norms were not confirmed as a significant factor. In research by Askadilla and Krisjanti (2017), Chin *et al.* (2018), Hsu *et al.* (2017), Yeon Kim and Chung (2011), this factor is identified as a significant determinant of behavioural intentions. We argue that as social beings, humans consider the opinions of their closest circles when making decisions. However, subjective norms turned out to be insignificantly affecting intentions to purchase green cosmetics in the present study. Nevertheless, other authors also presented similar results. Suphasomboon and Vassanadumrongdee (2022) used the perceived value theory and established that social value does not affect the intention to purchase sustainable cosmetics. Similarly, a ranked list of motivators to purchase green cosmetics proposed by Firek and Dziadkowiec (2020) puts opinions and recommendations of friends among the least significant factors (seventh out of ten).

Fatoki (2020) identified the insignificance of subjective norms in the framework of TPB. This may be because Fatoki conducted the study among communities with no significant traditions of environmental awareness and no strong regard for environmental values. They were dominated by other values. Firek and Dziadkowiec (2020) provide more details by placing green cosmetics' ingredients and health impact as the primary purchase motivators in their ranking list. In light of the above, the insignificance of the subjective norm factor observed in our model is easier to understand. It also demonstrates that the green cosmetics market in Poland is at an initial stage of growth. The public pressure towards environmentally-friendly behaviour can be expected to increase as environmental trends grow more popular. Subjective norms may then become more relevant. We also assume that the increase in marketing and educational activities of organic cosmetics producers will have a positive impact on the significance of subjective norms.

Another factor found to be insignificant in the present study is the awareness of the consequences of zero-waste behaviour. It is absent in the original theory of planned behaviour. Perhaps, it is one of the reasons why it has no significant impact on zero-waste behaviour intentions towards green cosmetics. However, it seems more probable that the factor is connected with poor environmental awareness. Especially considering that ecological awareness was in the sixth position out of ten in the ranking list of motivators to purchase green cosmetics proposed by Firek and Dziadkowiec (2020). The situation is even more complicated as regulations concerning extended producer responsibility are yet to be implemented in Poland even though they are anticipated. Therefore, consumers expect manufacturers to first take responsibility for environmental issues, and only then can the zero-waste effort reach its full potential.

CONCLUSIONS

General Summary of Results

In search of the answer to the research question, we verified six hypotheses and confirmed four of them. The research question looked for factors affecting zero-waste behaviour regarding cosmetics in Poland. We indicated zero-waste behaviour intentions and perceived behavioural control as potential factors. We confirmed both hypotheses. As behaviour intentions are a complex construct determined by multiple factors according to TPB, we proposed further potential predictors during the study. The indicated factors were related to attitudes towards zero waste, factors referred to as the awareness of consequences of zero-waste activities, factors referred to as subjective norms and factors related to perceived behavioural control. Attitudes and perceived behavioural control turned out to be significant, while awareness of consequences and subjective norms were insignificant for zero-waste behaviour intentions regarding cosmetics in Poland.

Theoretical and Practical Implications

The results significantly contribute to the state of the art of research on the impact of zero waste on the implementation of the circular economy. Note particularly that the survey was conducted in Poland, where such environmentally-involved movements as zero waste are budding and just catching the eyes of consumers and manufacturers. Although the problem has grown in popularity in the literature, it has yet to gain footing in Eastern-European countries. In light of the above, the model based on the theory of planned behaviour identified attitudes and perceived behavioural control as significant factors affecting zero-waste intentions and behaviour.

We expanded the TPB model for the current analysis to identify factors affecting zero-waste intentions and behaviour regarding cosmetics and personal care products with an additional construct awareness of consequences. Even though this factor turned out to be insignificant (hypothesis falsified) in the study among Polish consumers, it can potentially be significant in the case of other European populations with longer environmental traditions and greater awareness. The proposed new construct in the TPB model can be useful for juxtaposing other European countries, where the circular economy model is more popular. Being aware of the consequences of zero waste behaviour is linked to preventing the negative effects of excessive consumerism and the associated health, environmental and economic benefits.

Moreover, the analyses investigated the significance of subjective norms, which was assigned various, also opposite, significance levels across other studies in the literature (Askadilla & Krisjanti, 2017; Chin *et al.*, 2018; Hsu *et al.*, 2017; Suphasomboon & Vassanadumrongdee, 2022; Yeon Kim & Chung, 2011). The insignificance of subjective norms in the present study could be attributed to the fact that the Polish cosmetics industry just started its green cosmetics journey.

The study is also a practical contribution to manufacturers and sellers of green cosmetics and personal care products in Poland. It is recommended that the entrepreneur makes sure to give the consumer a sense of greater control over ZWB regarding cosmetics and personal care products when introducing such innovations. It is advisable to improve the availability of green products so that they can be purchased in brick-and-mortar stores as well as online. As the present research shows, per-

ceived behavioural control does affect purchase intentions and the purchase itself. Another recommendation is to intensify the effort to build environmentally friendly attitudes, including the promotion of the zero-waste concept. The significant role of attitudes demonstrated in our model affects intentions to purchase green cosmetics, which, in turn, affects purchase directly. We suggest that the educational and marketing activities of ecological cosmetics producers take advantage of the strong tradition of herbalism and natural cosmetics among older generations in Poland. In our opinion, younger generations will expect education and marketing activities in social media and the involvement of influencers. However, we emphasize that all marketing activities should be combined with the anti-plastic revolution in packaging, so as not to lose credibility for sustainable development.

Limitations of the Study and Further Research

The primary limitation of the deliberations and analyses presented here is their spatial extent limited to Polish consumers. In particular, Poland's cultural and economic differences should be emphasized, which may significantly impact consumer behaviour. Nevertheless, the conclusions and recommendations can still be employed in other European countries, especially those with still developing environmental awareness of consumers and manufacturers.

Moreover, the research did not analyse the impact of demographic factors (age, sex) on zero-waste intentions and behaviour. It might be particularly interesting to investigate determinants of zero waste across generations to make comparisons with the period before Poland's economic transformation. Therefore, future research will be international and will include analyses of intergenerational differences. Moreover, considering the ubiquity of the Internet and social media communication, it may be a substantial future research direction to investigate the role of social media in shaping consumer awareness regarding purchasing green products and zero-waste behaviour.

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Acknowledgements and Financial Disclosure

This paper was published as part of statutory research at the Silesian University of Technology, Faculty of Organization and Management, grant numbers: BK-274/ROZ1/2023 (13/010/BK_23/0072), BK-264/ROZ1/2024 (13/010/BK_24/0081).

Conflict of Interest

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Ministry of Education and Science
Republic of Poland

The journal is co-financed in the years 2022-2024 by the Ministry of Education and Science of the Republic of Poland in the framework of the ministerial programme "Development of Scientific Journals" (RCN) on the basis of contract no. RCN/SP/0251/2021/1 concluded on 13 October 2022 and being in force until 13 October 2024.