

Article

Influencing Factors for Consumers' Intention to Reduce Plastic Packaging in Different Groups of Fast-Moving Consumer Goods in Germany

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Abstract: The greatly increased global use of plastic has serious negative environmental consequences. This study aims to analyse the influence of environmental attitudes, personal norms, social norms, and socioeconomic and demographic characteristics on consumers' intention to reduce plastic packaging in different groups of fast-moving consumer goods (FMCGs) in Germany. Data on plastic packaging use for food, clothing, cosmetics, cleaning goods, and furniture were collected from 299 German families in a four-stage survey. The findings show differing consumer intentions to reduce plastic packaging between food products and other FMCG. In particular, environmental attitudes can differentiate between consumer groups with high and low intentions to reduce plastic packaging in nearly all the product groups analysed, while social norms, gender and age only show statistically significant differences in some product groups. Personal norms did not contribute to group differentiation in any of the groups of FMCG analysed. The results are helpful for managers of FMCGs to develop more ecological packaging solutions in the future and for state authorities to derive political activities in this field.

Keywords: plastic packaging; fast-moving consumer goods; consumer attitudes; personal norms; social norms; gender; family size; educational level; age



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1. Introduction

According to [1], more than 59 million tonnes of plastic were produced in European countries in 2016 alone. Global plastic production has reached 348 million tonnes [2]. Geyer et al. [3] claim that the volume of plastic production increases by 8.4% annually. It is important to note that around half of all plastic products are disposable products that are discarded after use [4]. Borrelle et al. [5] claim that around 11% of the 2016 global plastic production found its way into freshwater environments, expected to rise to 53 million tonnes annually by 2030.

The increase in the production of plastics causes serious environmental impacts [6–8], considering that plastics and plastic waste have high chemical resistance, environmental resistance and durability, and will not decompose for decades. In particular, the estimated decomposition period of a polyethylene terephthalate (PET) bottle ranges from 27 to 93 years [9]. Prata et al. [10] believe that plastic pollution is considered a planetary threat and can cause disruption of the Earth's systemic processes, harming ecosystems or changing the physicochemical properties of the environment. The plastic pollution of land and aquatic environments is among the most critical worldwide environmental pollution and

toxicological problems [11,12]. A variety of toxicological hazards to lower and higher organisms are caused by plastics (micro-plastics) and their accompanying chemicals, which are persistent and pervasive pollutants [13–16]. Additionally, according to Ford et al. [17], plastic production will cause the emission of more than 56 billion tons of carbon dioxide equivalent into the atmosphere in the period from 2015 to 2050, which is about 13% of the total number of expected carbon dioxide emissions for this period across the globe. It is important to note that an increase in the concentration of carbon dioxide is one of the causes of global warming, the consequences of which are the intensification of dry seasons, sea level rise, changes in the geography of the Earth, an increase in the frequency of fires and increased desertification [18].

In Germany, regulations for packaging waste are set out in the German Packaging Act (Verpackungsgesetz). Currently, there are no special regulations for other plastic waste. Instead, disposal is governed by the general waste law requirements under the German Circular Economy Act (Kreislaufwirtschaftsgesetz) and in particular separate collection and observance of the waste hierarchy. The German Ordinance on Single-Use Plastics (Einwegkunststoffverbotsverordnung) has been adopted and entered into force on 3 July 2021. The Ordinance on Single-use Plastics implements the requirements of the Directive (EU) 2019/904 on the reduction of the impact of certain plastic products on the environment one-to-one [19]. In the future, certain single-use plastic products for which environmentally friendly alternatives already exist are to be banned. The ban affects products such as cotton swabs, disposable cutlery and plates, drinking straws, stirrers, cotton buds and balloon wands made of plastic. To-go food containers and beverage cups such as containers made of foamed expanded polystyrene (also known as Styrofoam) are also banned from the market. All products made from oxo-degradable plastic are also banned, which break down into micro-particles that are particularly difficult to dispose off, but do not degrade further [20]. Moreover, at the European Council of July 2020, the EU heads of state and government decided to introduce a tax on unrecycled plastic packaging waste from 2021. As a new source of own resources, the plastic tax should go to the EU budget, and the funds collected are to be used primarily to finance COVID-19 aid [19]. Despite the fact that the German government has not yet accepted this initiative, the plastic tax seems to be an important instrument in the global fight against plastic pollution.

One of the tools influencing manufacturers of packaging materials is also the assessment of consumer preferences for packaging. In recent years, some knowledge has been accumulated regarding consumer reactions to plastic packaging and reducing the use of plastic packaging. Walker et al. [21] found that most Canadian respondents (93.7%) are personally interested in reducing the consumption of disposable plastic packaging for food, but are less willing to pay for sustainable alternatives such as edible films, biodegradable materials, organic ecological textiles, recycled cardboard and paper, bioactive suspensions, nanopackaging, etc. [22]. At the same time, consumers from other high-income countries are willing to pay for more expensive sustainable packaging [23–25]. This indicates the absence of a unified consumer reaction to the rejection of the use of cheap plastic materials in food packaging.

Although the willingness to pay for eco-friendly packaging is usually high, there are gaps between attitude and behaviour, and a misunderstanding of eco-friendly packaging that can be a problem [26]. Misleading factors related to design in terms of colour or images [27] on packaging become barriers to understanding consumer behaviour. External factors also influence purchasing behaviour, but consumers are still critical of environmentally friendly options if they do not meet specific criteria [28]. However, the most important aspect in the eyes of consumers is the material from which the packaging is made, of which plastic is considered one of the most unstable [26]. This corresponds to the growing environmental problems that plastic production creates due to the growth rates of global production [6,8]. In addition to product characteristics and situational factors, consumers' psychographic characteristics often influence pro-environmental behaviour in general and the choice of packaging material for fast-moving consumer goods in particular. We analyse

the influence of environmental attitudes, personal norms, social norms, and some socio-economic factors on reducing the use of plastic packaging in different fast-moving consumer good product categories in Germany. The following research questions are studied in this context:

Are there differences in the willingness of consumers to reduce plastic packaging between different product categories of fast-moving consumer goods?

Which psychographic and socioeconomic factors influence consumers' willingness or behaviour to reduce plastic packaging in different product categories of fast-moving consumer goods?

Although the plastic packaging problem and its negative environmental impacts have been well-documented for years, the role of consumers in tackling this problem is not yet well-researched. While some studies have analysed consumers' views and estimates on food plastic packaging in recent years [29–31], other consumer goods categories have been less researched in this context. In this sense, the study contributes to this field of research by comparing consumers' willingness to reduce plastic packaging not only for food products but mainly for other categories of fast-moving consumer goods. Additionally, the influence of some psychographic and socioeconomic factors is analysed in this context, giving additional insights for scientific and practical purposes in this field of research.

2. Theoretical Framework: Attitudes and Behaviour

In the studies on consumer behaviour, it is argued that behaviour is mainly explained by attitudes. The attitude of consumers to products and their packaging is formed cognitively through beliefs and feelings of the product. One of the well-known social psychology theories that link behaviour and persuasion is Ajzen's Theory of Planned Behaviour (TPB) [32]. This theory is an offshoot of the Theory of Reasoned Action (TRA). TRA and TPB focus on theoretical constructs concerned with individual motivational factors as determinants of the likelihood of performing a specific behaviour. TRA and TPB both assume the best predictor of a behaviour is behavioural intention, which in turn is determined by attitude toward the behaviour and social normative perceptions regarding it [33].

TPB is an extension of the TRA and includes an additional construct: perceived control over performance of the behaviour. This theory states that consumer behaviour is directly influenced by behavioural intent. This intent can be predicted using three independent components: attitude to the target behaviour (benefits and consequences of the behaviour), perceived behavioural control (a person's perception of the ease or difficulty of performing this behaviour) and norms (subjective norms or perception of other people's opinions about the target behaviour) [30]. TPB is often used to study people's attitudes to environmental problems [30,34]. For example, So et al. [35] used the theory of planned behaviour to study the intentions of Hong Kong citizens to manage plastic waste. Studies have shown that situational factors directly and positively impacted the intention to manage plastic waste, but also indirectly influenced attitudes and perceived behavioural control concerning plastic waste.

TRA is mainly used to predict people's behaviour based on their pre-existing attitudes and behavioural intentions. Individuals' decisions to engage in specific behaviour are based on the results they expect to obtain from that behaviour [36,37]. Asnawi et al. [38] used TRA to analyse consumer reactions to government policies related to paid-for plastic bags in Indonesia. The study results showed that the chosen model is suitable for predicting consumers' intentions to support government policy regarding paid-for plastic bags. However, the authors found that consumers' knowledge of environmental issues and their religiosity were not directly related to their intentions to support the state policy against free plastic bags.

However, it is important to note that in most of the works in which TRA and TPB were used, only the attitude of consumers to the processing of plastic waste and the intention to purchase from several sustainable packaging options were analysed [39,40]. The attitude of consumers towards plastic packaging reduction remained a poorly lit area.

3. Literature Review: Plastic Packaging-Related Attitudes and Avoidance Behaviour

Plastic packaging is one of the most common types used with food, cosmetic products, personal care products, etc. A large body of literature has examined the links between consumers' attitudes and the use of plastic packaging to understand why consumers choose plastic-packaged products. Studies have consistently found that various individual psychological factors and attitudes influence plastic purchasing behaviour [41–43]. Consumers' behaviour towards plastic packaging use is very complex and therefore needs to be intensively studied from different angles.

This bundle of factors can lead to preferences for different packaging designs and materials and to different purchasing, use, and disposal behaviour [44–46].

3.1. Psychographic Variables Used in This Study

Psychographic variables are factors that can be used to segment target audiences into different groups or segments based on their internal traits [47]. These can include lifestyles, attitudes, personality traits, and values. Lifestyles can be associated with the consumers' patterns of behaviour. These can be further categorised into three sub-groups: activities, interests and opinions [48]. Activities can be defined as the nature of the consumers' work, hobbies and entertainment, the social events they attend, the type of vacations they go on, their club memberships, the sports they play, their shopping patterns, etc. Interests may be subdivided into the consumer's likes and dislikes regarding their families, homes, jobs, communities, forms of recreation, fashions, food and media, etc. The specific opinions that consumers hold tend to influence their buying decisions. These opinions can be based on themselves, social issues, politics, business, education, economics, culture, and the future, for example [49].

Attitudes tend to affect the consumer's perception of different commodities and brands of goods that might be used to satisfy their needs. Once the desire to purchase something arises, the next step that consumers need to take is to evaluate the need for it and then assess which brand they would opt for. The outcome of this decision is firmly based on attitudes. These will help evaluate the available alternatives when selecting a particular item [50].

In the framework of this study, the following psychographic variables were considered: environmental attitudes, personal norms, and social norms.

Social norms are rules or standards of behaviour that guide people's actions, help shape expectations about how others will act, and promote greater coordination in social life [51]. Social norms can be divided into descriptive norms (what other people do) and prescriptive ones (whether others approve or disapprove of the behaviour). Borg et al. [52] studied the impact of social norms on the problem of plastic waste. The authors found that descriptive norms are the strongest predictor of plastic avoidance, and most of the remaining variables regulate the relationship between norms and behaviour. The study results showed that it was possible to use the exchange of messages about social norms to bridge the gap between perception and action among consumers to solve the global plastic waste problem. This practice has already shown effectiveness in matters of global warming [53] and waste disposal [54].

Personal norms were chosen as the second psychographic parameter in this work. The main difference between personal and social norms is that social norms include reactions from other group members, while personal norms are based on rules and standards only on the part of the individual [55]. The importance of using personal norms in the study of environmental problems is considered in several works [56–59]. Wiefek et al. [60] found that personal norms and barriers significantly affect the reduction of plastic packaging consumption. Santos et al. [61] pointed out that personal norms are the strongest predictor of consumer intent when choosing eco-friendly packaging as an alternative to plastic packaging.

Environmental attitudes can be described as a set of moral, psychological, and social attitudes that arise in a person when interacting with the environment. Leonidou et al. [62]

and Trivedi et al. [63] emphasise that the attitude towards the environment can be divided into internal and external components. The internal attitude towards the environment is the attitude to the abuse of the environment by individual consumers, in which the main role in preserving the environment is played by a person. External attitude towards the environment is defined as an attitude towards the perceived need for social, political and legal changes to protect the environment. Understanding consumers' attitudes towards the environment can significantly influence the problem of reducing the use of plastic, in particular plastic packaging [64,65].

3.2. Environmental Attitudes

The attitude towards the environment is a critical psychographic factor in analysing the problem of plastic waste [43,66]. Modifying or preventing unnecessary plastic consumption is one example that depends on consumer decisions [2,67]. A study conducted in Canada showed that environmental pollution was one of the motivators for solving the problem of plastic waste [8]. Bisht and Janotra [68] found that environmental consciousness, health consciousness, the value of self-improvement and social pressure were important factors influencing the purchasing behaviour of "environmentally friendly" products through attitude and intention. Dilkes-Hoffman et al. [69] also studied the environmental attitude towards plastics in Australia. Eighty percent of respondents indicated a desire to reduce the use of plastics, which is associated with understanding the harmful effects of these materials on the environment. Filho et al. [70] observed that consumers increasingly considered the misuse and disposal of plastic packaging and bags as an environmental problem.

It is important to note that despite consumers' understanding of the relationship between the problem of plastic pollution and the environment, some consumers from industrialised nations such as Germany perceive their plastic pollution to be well under control through disposal, with pollution mostly occurring at other locations. This attitude is in line with the finding that outsourcing pollution to other locations leads to the emotional detachment from the negative environmental impact [71]. Understanding the importance of preserving the environment and similar ethical beliefs are not just prevalent in Western countries. These concepts can be observed globally [29,72]. Overall, a thrifty attitude towards the environment is commonly found to be the most important factor for plastic avoidance [66].

It was also observed that many consumers appear to lack knowledge of the environmental impacts of some packaging alternatives [27,73]. Even well-informed consumers frequently show a disconnection between their attitudes and their actions, with purchasing decisions that contradict their expressed intentions and behaviour [74].

This study proposes that environmental attitudes influence the consumer's intention to reduce the consumption of plastic packaging and proposes the following hypothesis:

Hypothesis 1 (H1). *People who score higher in terms of pro-environmental attitudes will show greater willingness to reduce consumption of plastic packaging.*

3.3. Personal Norms

Often people underestimate the influence of personal norms as a psychographic factor when considering environmental problems, particularly plastic waste [75]. Kim and Seock [42] found close relationships between personal norms and behaviour aimed at protecting the environment.

The Norm Activation Model (NAM) Schwartz [76] describes personal norms or moral norms as self-expectations, punishments, and duties that are anchored in internalised values. It is possible to determine with great accuracy a person's preferences on several issues by knowing their personal norms. For example, people with strong personal norms buy eco-friendly plastic because they feel ethically obligated to do so. Hwang et al. [77] stated that moral duty had positive and substantial effects on purchase intentions of eco-friendly plastic packaging and products manufactured with recycled materials. The

findings of Karandikar et al. [78], who relate personality traits and personal norms to decision-making in moral dilemma situations, explain why some people prefer convenience over personal norms in choosing to buy more plastic packaging than necessary.

In this study, we hypothesise that a high personal norm correlates with reduced plastic-packaged product consumption. Several studies indicate that TPB is criticised for the dominance of cognitive variables [79,80]. Considering that personal norms have an emotional nature, using this parameter in the study is important. For example, the work of Morren and Grinstein [81] shows that adding personal norms to the TPB model and subjective norms moderately improves the understanding of cross-cultural differences in behaviour towards the environment.

Hypothesis 2 (H2). *Personal norms have a positive impact on reducing the consumption of plastic-packaged products.*

3.4. Social Norms

One of the most controversial constructions in TPB is the influence of social norms. In their meta-analysis, Heidbreder et al. [2] found that social norms were a weak predictor in a wide range of actions aimed at protecting the environment. However, in other studies [42,82], the authors confirmed the importance of the social norm in studying environmental problems.

There is a widespread belief that people's intentions and behaviours are highly influenced by their social surroundings [83,84]. People are significantly influenced by normative forces and the social circumstances of their daily life. For example, the degree to which an individual believes that a specific conduct contributes to the environment or global warming is likely to be connected to the perception that other individuals they regard as significant also hold this opinion. Consequently, social norms have been acknowledged as a vital component of motivation and behaviour, as well as a critical aspect in behavioural impact and change. Nonetheless, the idea of social norms is currently underutilised in the environmental field [85].

Social norms directly impact purchasing behaviour and personal norms moderate the association between social norms and purchasing eco-friendly clothing, for example [86]. The findings revealed that social norms are highly linked to purchasing behaviour, while personal norms considerably regulate the association between social norms and shopping behaviour. The study by (Ajzen [32] and Ye and Yao [41] showed that social norms influence behaviour, not just directly but also indirectly through personal standards of eco-friendly conduct. Social norms influence individuals' pro-environmental behaviour directly and indirectly by creating a strong personal duty to buy eco-friendly clothing. In other words, personal norms are a process variable that relates societal standards to eco-friendly clothing purchase behaviour. As a result, societal standards must be internalised for people to buy eco-friendly clothing.

Even though modern consumers tend to have control over their purchasing behaviour, their personal conceptions of ethical and moral behaviour are influenced by social norms and examples of social behaviour [71]. For example, in the context of single-use plastic consumption, peer pressure has been shown to be a relevant factor [87]. Other studies showed that the effect of subjective norms on plastic buying behaviour is ambiguous [2,72]. Taking all these insights together, this study hypothesises that social norms positively influence consumers' intentions to reduce the consumption of plastic packaging products.

Hypothesis 3 (H3). *Social norms positively impact reducing the consumption of plastic-packaged products.*

3.5. Sociodemographics

A range of sociodemographic factors may play a role in decisions on purchasing plastic. For example, more highly educated people frequently avoid purchasing plastics [88,89]. This may be associated with this group's higher relevance of environmental attitudes [2]. Many studies have found that women are also less likely to buy plastic bags or packaging [2], demonstrating the role gender plays in shaping environmentally friendly consumption decisions [52]. Age is also quite a conflicting factor, with some studies pointing to older people willing to reduce plastic consumption [29], whereas others found younger people to be more committed to environmentally friendly purchasing decisions [2,66]. In Lithuania, young people also prefer to use their own shopping bags when shopping more than consumers aged over 60 years old [90]. In Canada, the green attitude is observed by more highly educated shoppers, who tend to follow waste-prevention initiatives and cut out alternative packaging suppliers [21]. Consumers with the lowest levels of education are more concerned with the content of the product than with its packaging, and they are more price-oriented than concerned with the packaging. It has been discovered that consumers with greater levels of education give more importance to packaging and are more environmentally conscious [91]. There is another factor for consumers' intention to reduce plastic associated with less visible plastic hazard—the threat to human health from toxic chemicals found in most plastic products, including children's toys, food packaging, kitchen products, clothing, electronics and many other daily consumer products [92]. Therefore, it is logical to assume that the size of the family has an influence on consumers' intention to reduce plastic packaging in the household. Thus, regarding family size in particular families with children should have a higher tendency to reduce plastic consumption.

Based on the previous studies, the following hypothesis can be formulated.

Hypothesis 4 (H4). *The willingness of people to reduce plastic consumption depends on sociodemographic status:*

Hypothesis 4.1 (H4.1). *Gender—women are more motivated to reduce plastic, which is used in households for packaging cleaning detergents, care and decorative cosmetics, foods, etc.*

Hypothesis 4.2 (H4.2). *Age—young people are more interested in preserving the environment than the older generation, and thus are more engaged in reducing plastic packaging.*

Hypothesis 4.3 (H4.3). *Education level—people with higher education are more picky about the use of plastic packaging.*

Hypothesis 4.4 (H4.4). *Family size—families with children tend to reduce the use of plastic.*

3.6. Plastic Packaging Avoidance across Product Groups, Care and Decorative Cosmetics Packaging Avoidance across Product Groups

Plastics are associated with food packaging and convenience among consumers. Plastic packaging is mainly used in the food industry and for other fast-moving consumer goods. Plastic packaging represents the largest commercial use of plastics, accounting for almost half of all plastic waste produced worldwide, approx. 85 million tonnes [93,94]. Similarly, Dilkes-Hoffman et al. [69] observed that consumers usually identify plastics with food packaging and convenience, but are aware of plastic's negative environmental implications. According to Swedish customer opinions, paper-based packaging is ecologically beneficial, but plastic and metal are not. No less than 86% of respondents said they would pay more for ecologically friendly food packaging. The majority of Swedish consumers are aware of their weaknesses in appraising the environmental status of food packaging, emphasising the need for advice. Despite many consumers recognising that plastic waste is an environmental concern and seeking to minimise their personal plastic packaging consumption, reduction does appear to be difficult [69].

Consumers are primarily concerned with packaging's end-of-life characteristics, although cultures differ in balancing the relative importance of recycling, reusability, and biodegradability. According to Boesen et al. [95], plastic is viewed as the least ecologically beneficial packaging material for liquid foodstuffs, and consumers judge this mostly on imagined recycling possibilities. When analysing bio-based plastic packaging, customers prioritise features connected to the end-of-life stage, such as recyclability and biodegradability, while focusing less on manufacturing, transportation, and retailing [73].

Numerous studies have shown consumers' interest in avoiding the use of plastic packaging in many sectors of industry, such as the food industry [96], cleaning products [97], and the cosmetic industry [98]. Cavaliere et al. [96] argue that plastic avoidance is driven mostly by environmental and health concerns about plastics. Furthermore, subjective awareness and the value placed on parties' commitment to addressing the plastic issue only indirectly impact consumer behaviour in terms of plastic avoidance. Cinelli et al. [98] found that even cosmetic packaging is seeking sustainable solutions, with research concentrating on adapting bio-based and biodegradable polymers to suit the demanding standards for cosmetic preservation while retaining sustainability and biodegradability. Several bio-based and biodegradable polymers are available, including poly (lactic acid), polyhydroxyalkanoates, polysaccharides, and others, and some first solutions for both rigid and flexible packaging are now on the market. However, some variables, such as travel [8], furniture [99], and textiles [100], may influence packaging-avoidance behaviour. Rhein and Schmid [8] found that people were more likely to recycle if the recycling sites are nearby and they did not have to travel a great deal. Migliaccio et al. [99] found that there were also multiple issues with the selection of packaging and trash disposal for ecological demands. Environmental trademarks and branding are not often deployed in Italian businesses. Wiederhold and Martinez [100] found that price, availability, knowledge, transparency, image, and purchasing habits are all impediments to sustainable fashion consumption. To summarise, the following hypothesis can be formulated based on the outcome of all these studies, and a pattern can be observed where the reduction in plastic packaging varies among the different product categories.

Hypothesis 5 (H5). *Consumers' interest in reducing plastic packaging varies among the different product categories of consumer goods.*

4. Methodology

4.1. Data Collection

The study participants were found through an online survey. In order to obtain as many participants as possible, many channels (e.g., email lists, social media, press releases) were used to contact potential respondents. The target audience for this survey was over 18 and currently living in Germany. They also had to be responsible for purchasing groceries for the household. In the online survey's cover letter, potential participants were informed that the study consisted of four parts and that €50 would be paid if all four parts were successfully completed. Before the questionnaire was sent out, various pretests were carried out. A total of 453 people followed the call via social media and mailing lists and participated in the first online survey. However, for budgetary reasons, a selection had to be made among the interested participants of the first online survey. Accordingly, 350 people were selected based on the criteria size of residence and waste collection system (e.g., buy-back centre, "yellow bag"; recycling point). Since different waste collection systems exist in different German regions, it was essential to have enough participants in the various systems (Part 1 of this study). In the second part (Part 2), light packaging was collected for 14 days, and a diary was kept for specific product packaging (Part 3). The study was completed with a second online survey (Part 4). The data in this publication are from this second online survey (Part 4). Of the 350 people selected, 299 ultimately participated in the final online survey. In the second online survey, in addition to sociodemographic data (age, gender, education level, and family size), we also asked about environmental

attitudes, personal norms and social norms. These were queried with different statements: social norms were measured by three statements used in [42], rated from 1 (strongly agree) to 7 (strongly disagree). The statements on personal norms were also adapted from [42]. Again, a seven-point scale was offered for a response. The same scale was used when asking about environmental attitudes. The questions on these attitudes were based on the questions from Haws et al. [101]. For our study, a seven-point Likert Scale was chosen for evaluating the different items, since it provided more varied options [102].

4.2. Data Analysis

In this study, we conducted a confirmatory factor analysis (CFA) [101]. This technique has been used quite often in social and behavioural sciences. One of the biggest advantages of CFA is that it can bridge the gap between theory and observation. Furthermore, it can give crucial information regarding the fit of data to the assigned model and the results point toward likely modifications that can be analysed next. Lastly, it is beneficial to confirm or reject the theory-derived model. Hence, CFA has been used as a part of our analysis to specify the variables that are not clearly dedicated to an analysed factor and to confirm or reject the theory-derived model.

Besides this, we used a binomial logistic regression. With the help of binary logistic regression, one can predict the relationship between the independent variables (nominal, ordinal or metric scale level) and the dependent variables (nominal scale level). Binary logistic regression is used to model nominal outcome variables, in which the log odds of the outcomes are modelled as a linear combination of the predictor variables.

In our questionnaire, the respondents were asked directly about their level of consideration for avoiding plastic packaging across different product categories. For the logistic regression model, the original seven-point-scale was recorded as a dummy variable with the denomination “strong” (originally codes: very strong (1) and strong (2)) and “weak” (original codes: not so strong (3) partly (4), little (5), very little (6), not at all (7)). The denomination “strong” was given the value of one, and the denomination “not strong” the value of zero. This variable was entered into the regression as a dummy-coded dependent parameter. Via the binomial regression analysis, it was explored whether the factors “environmental attitude”, “personal norms” and “social norms” have an impact on plastic packaging avoidance. Besides that, other independent variables such as “age”, “sex”, “education level”, and “size of family” were used to explain the probability of belonging to one of the two dependent groups (“strong”; “not strong”). Consequently, data were modelled using the following expression:

$$\begin{aligned} \text{logit ("strongly" avoid plastic packaging)} &= \mathbf{x}^0\beta = \text{environmental attitude} * \beta_1 \\ &+ \text{personal norms} * \beta_2 \\ &+ \text{social norms} * \beta_3 \\ &+ \text{female} * \beta_4 \\ &+ \text{elderly age group} * \beta_5 \\ &+ \text{higher education} * \beta_6 \\ &+ \text{family size} * \beta_7 \\ &+ \text{constant} \end{aligned} \quad (1)$$

The software application “R” [103] and the logit package [104] were used in this study to estimate the specified model.

4.3. Sample

Compared to the average in Germany, women are noticeably overrepresented in the sample of this study (Table 1). However, this also reflects the fact that in most households, housework and shopping for fast-moving consumer goods (FMCG) are still done by women [105]. Furthermore, younger and better-educated participants are also overrepresented in the sample. This might be because younger people are more interested in issues related to environmental protection. The rather complex structure and procedure

of the survey's data collection might also have favoured the participation of more highly educated people.

Table 1. Sociodemographic structure of the sample.

Characteristics	Sample (<i>n</i> = 299)	Germany
	%	%
Gender Male	25.4	48.8
Female	74.6	51.2
<i>Age groups I</i>		
18–29 years	43.8	16.6
30–44 years	42.9	22.3
45–59 years	10.0	27.5
>60 years	3.3	33.6
<i>Age groups II (for logistic regression)</i>		
18–35 years	75.6	-
>35 years (elderly age group)	24.4	-
<i>Family size</i>		
1	22.7	42.3
2	37.1	33.2
3	16.7	11.9
4	16.5	9.1
5 and more	7.0	3.5
<i>Number of children in family</i>		
No children	77.3	66.0
1 child	9.7	16.2
2 children	9.7	10.6
3 children	2.6	6.3
4 children	0.7	0.9
<i>Education I</i>		
No indication about school grade	0.3	-
No school grade	1.7	1.0
Still in school	0.7	-
Lower secondary school diploma (Hauptschule)	0.3	-
Secondary school level I (mittlere Reife)	7.4	37.6
Polytechnic secondary school (polytechnische Oberschule)	1.0	-
Final secondary school (Abitur)	88.6	31.5
<i>Education II (for logistic regression) no grade, lower or secondary education</i>	11.4	-
higher education *	88.6	16.7

* Considering with diplomas of universities and equivalent institutions according to German Education System.

5. Results

5.1. General Plastic Packaging Avoidance Behaviour and Comparison across Product Categories

In a first step, we analysed participants' general motivation to reduce plastic waste in their family. For this purpose, we used the question "How strongly do you consider reducing plastic packaging in your daily life?", which is also the dependent variable for the binomial logistic regression analysis. Many respondents indicated a "very strong" and "strong" motivation to reduce plastic packaging. Both top scores accounted for more than 60% of all answers (Figure 1). This illustrates the importance of reducing plastic packaging in consumers' minds.

A comparison of the motivation to plastic packaging reduction across product categories revealed a slightly more detailed picture (Table 2). We asked the respondents the following question: "To what extent do you pay attention within the specified areas, to reduce or avoid plastic packaging?". To this end, the original seven-point-scale was recoded and aggregated to a two-point-scale with the denominations "strong" (original codes: very strong (1) and strong (2)) and "weak" (original codes: slightly strong (3), partly (4), less (5),

very little (6), not at all (7)). The findings demonstrate that for foods, a high proportion (75.3%) of the respondents revealed a self-reported favourably strong intention to reduce plastic packaging. Textiles followed far behind (top scores strong = 52.8%) in the second position and cosmetics (40.1%) and furniture (40.1%) as joint third places. The lowest intention of the respondents to reduce plastic packaging was for cleaning products (top scores strong = 27.8%). In analogy to the descriptive findings, a χ^2 -test revealed significant differences across the seven analysed product categories ($\chi^2 = 170.95, df = 6, p < 0.01$). A mosaic plot (Figure 2) was created to analyse the differences across product categories in detail. Blue indicates that the observed value is higher than the expected value if the data were random. Red shows that the observed value is lower than the expected value if the data were random. In the category of foods and textiles, the frequency of the answer option “strong” was significantly above the average, whereas in the cleaning category the “weak” option was greatly overrepresented.

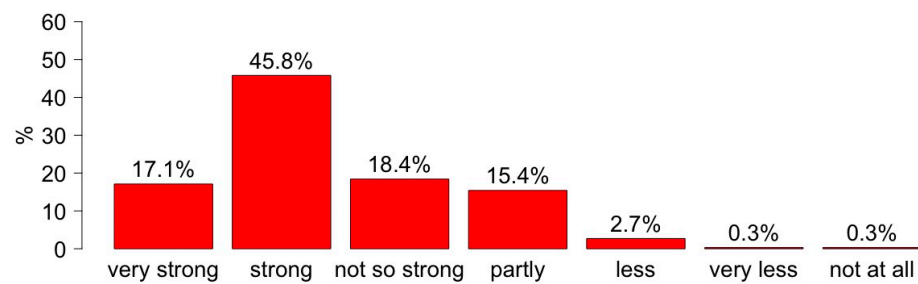


Figure 1. Distribution of answers to the question: “How strongly do you consider reducing plastic packaging in your daily life?”.

Table 2. Intention of users to reduce plastic packaging across various categories based on a two-point-scale.

	Strong Intention (%)	Weak Intention (%)
Food	75.3	24.7
Textiles	52.8	47.2
Cosmetics	40.1	59.9
Washing	39.5	60.5
Furniture	40.1	59.9
Cleaning	27.8	72.2
Travel	37.1	62.9

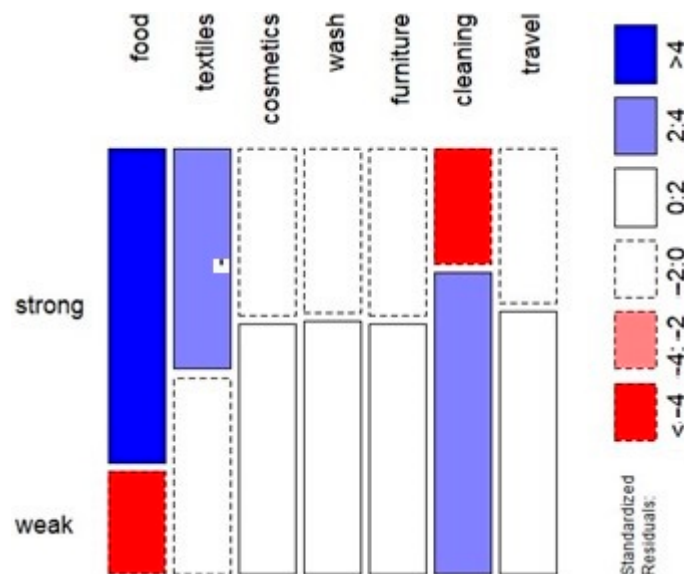


Figure 2. Mosaic plot of standardised Pearson residuals.

The results related to environmental attitudes, personal norms and social norms are shown in Figure 3. They are mostly positive regarding the items of the analysed scales, i.e., the participants predominantly either totally agreed, agreed or slightly agreed to the individual statements. Only for two statements related to personal norms (see the first two statements in Figure 3) can a somewhat higher degree of disagreement be observed.

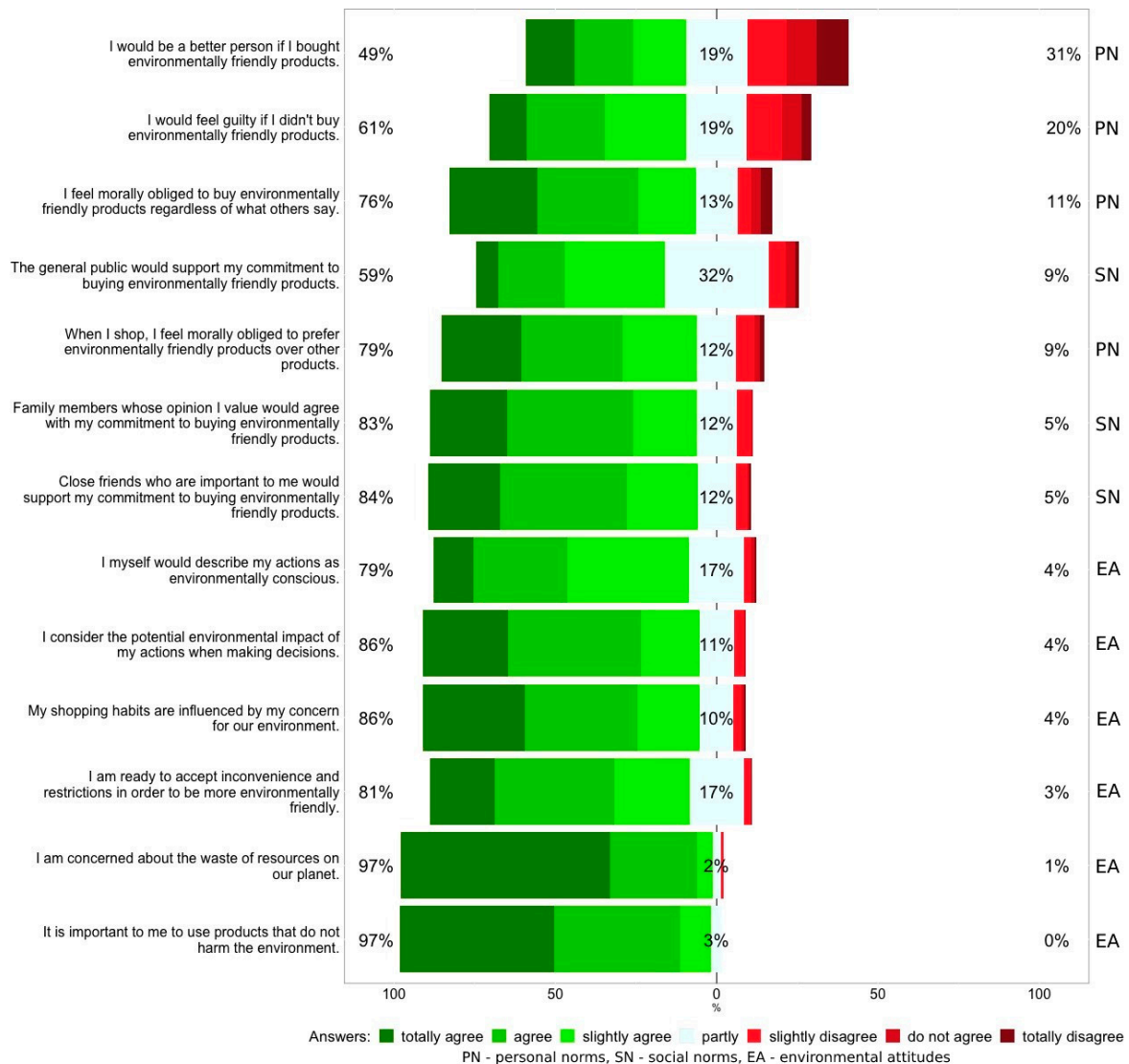


Figure 3. Pictographic representation of the response distribution to the statements of environmental attitudes, social and personal norms.

In a further step, we performed a factor analysis to reduce the complexity of the analysed data. An initial step in any factor analysis is to check the factorability of the data. For this purpose, we applied the Kaiser–Meyer–Olkin factor adequacy and received a good value of 0.89. Because the main purpose of the factor analysis was data reduction, a confirmatory factor analysis was carried out with the aim of deriving factor scores for the subsequent logistic regression analysis (Table 3). A parallel analysis suggested a three-factor solution. The found factor loadings using the oblim-algorithm were satisfactory for the three-factor solution and fitted well to the three item-batteries of the chosen scales (Table 4). The factor solution accounted for 58% of the variation. The fit indices found (CFI = 0.939, TLI = 0.923, p -value RMSEA < 0.05) were all satisfied. In addition, Cronbach's alpha for the three factors was calculated and demonstrated to all have a good reliability (Environmental attitudes $\alpha = 0.87$, social norm $\alpha = 0.76$, personal norms $\alpha = 0.84$).

Table 3. Factor loadings and communalities (h2) for the statements of the survey.

Statements	Factors			h2
	Environmental Attitudes	Social Norms	Personal Norms	
It is important to me to use products that do not harm the environment.	0.72	0.02	0.02	0.55
I consider the potential environmental impact of my actions when making decisions.	0.79	0.03	0.01	0.66
My shopping habits are influenced by my concern for our environment.	0.75	−0.03	0.20	0.74
I am concerned about the waste of resources on our planet.	0.46	0.05	0.09	0.29
I would describe my actions as environmentally conscious.	0.63	0.10	0.02	0.48
I am ready to accept inconvenience and restrictions to be more environmentally friendly.	0.71	0.05	−0.01	0.53
Family members whose opinion I value would agree with my commitment to buying environmentally friendly products.	0.21	0.68	−0.13	0.58
Close friends who are important to me would support my commitment to buying environmentally friendly products.	−0.01	0.84	0.02	0.71
The general public would support my commitment to buying environmentally friendly products.	−0.17	0.61	0.21	0.38
When I shop, I feel morally obliged to prefer environmentally friendly products over other products.	0.32	0.04	0.63	0.75
I would feel guilty if I didn't buy environmentally friendly products.	0.05	0.03	0.86	0.80
I feel morally obliged to buy environmentally friendly products regardless of what others say.	0.16	0.01	0.75	0.73
I would be a better person if I bought environmentally friendly products.	−0.28	−0.01	0.65	0.30

Table 4. Distribution of variances across the three factors.

	Environmental Attitudes	Personal Norms	Social Norms
Proportion Variance	0.26	0.19	0.13
Cumulative Variance	0.26	0.45	0.58
Proportion Explained Variance	0.45	0.33	0.22
Cumulative Proportion Variance	0.45	0.78	1.00

5.2. Logistic Regression Findings for Groups with Differing Motivations to Reduce Plastic Packaging Use

As mentioned in the methodology section, the seven-point-scale measuring the motivation to reduce plastic packaging was reduced to a dummy variable for the logistic regression analysis. Thus, for each product category, there is a segment of respondents that “strongly” considers the reduction of plastic packaging (coded with 1) and one segment that only “weakly” takes this topic into account (coded with zero for the regression analysis).

The logistic regression estimates show that environmental attitudes are an important factor for separating consumers with a high intention to reduce plastic packaging waste from those with a lower intention, with high statistical significance ($p < 0.01$) for all considered product categories except textiles ($p < 0.1$) (Table 5). The logistic regression coefficients, as mentioned in Table 5, suggest that environmental attitudes have the highest effect on the dependent variable compared to the other independent variables. The positive regression coefficient of environmental attitudes for all product categories suggests that participants with higher environmental attitudes show a higher intention to reduce plastic waste in all the product categories analysed than those with a lower environmental attitude.

Related to personal norms, no statistically significant influence on the intention to reduce plastic packaging could be found among our survey participants. This is true for every product category analysed in the study. For the scale of social norms, a statistically significant influence was observed in the categories of textiles, furniture and travel, which also have the highest and positive regression coefficients for this factor. It means that

decisions made by consumers to reduce plastic packaging in these fields are highly affected by the people around them (for instance, family members, friends and social peers).

Table 5. Regression coefficients β and their standard error values (s.e.) estimated in logistic regression analysis.

	Dependent Variable:							
	Overall (1) β (s.e.)	Food (2) β (s.e.)	Textile (3) β (s.e.)	Cosmetics (4) β (s.e.)	Washing (5) β (s.e.)	Cleaning (6) β (s.e.)	Furniture (7) β (s.e.)	Travel (8) β (s.e.)
Environmental attitudes	1.005 *** (0.196)	1.106 *** (0.206)	0.253 (0.161)	1.152 *** (0.209)	0.928 *** (0.193)	1.047 *** (0.220)	0.295 * (0.170)	0.610 *** (0.185)
Personal norms	0.201 (0.171)	−0.005 (0.184)	0.250 (0.156)	0.026 (0.173)	−0.085 (0.167)	−0.096 (0.184)	0.018 (0.164)	−0.065 (0.165)
Social norms	0.304 * (0.156)	−0.030 (0.171)	0.254 * (0.137)	0.030 (0.154)	−0.056 (0.147)	−0.239 (0.160)	0.363 ** (0.151)	0.450 *** (0.157)
Female	0.169 (0.319)	−0.158 (0.356)	0.353 (0.286)	0.524 (0.322)	0.690 ** (0.316)	0.802 ** (0.367)	0.839 *** (0.316)	−0.354 (0.303)
Older age group	0.066 (0.345)	−0.457 (0.358)	0.356 (0.303)	−0.118 (0.333)	0.087 (0.315)	0.330 (0.337)	0.720 ** (0.307)	0.336 (0.311)
High education	−0.347 (0.477)	−0.723 (0.555)	0.367 (0.395)	−0.272 (0.433)	0.437 (0.422)	0.411 (0.456)	0.015 (0.402)	−0.373 (0.408)
Family size	0.063 (0.117)	0.064 (0.126)	0.015 (0.102)	0.050 (0.114)	0.012 (0.108)	0.022 (0.118)	0.037 (0.106)	0.077 (0.109)
Constant	0.670 (0.586)	2.078 *** (0.696)	−0.593 (0.507)	−0.804 (0.555)	−1.478 *** (0.550)	−2.262 *** (0.621)	−1.360 ** (0.535)	−0.311 (0.520)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

The sociodemographic variables shown in Table 5 indicate a very mixed picture regarding their influence on consumers' motivation to reduce plastic packaging. However, female respondents were shown to have a statistically significant positive motivation for plastic packaging reduction in the categories of washing, cleaning and furniture, while the influence of gender was not statistically significant in the other categories (Table 5). Another statistically significant influence—age—could be only observed in the furniture category, while education and family size did not show any significant influence in any of the analysed categories (Table 5).

6. Discussion

This study aimed at analysing the influence of environmental attitudes, personal norms, and social norms, as well as such sociodemographic factors as gender, age, education level, and family size on reducing plastic packaging consumption across different product groups, as a case study for German conditions. For this study, a seven-point Likert scale was chosen to categorise the responses of the correspondents, since it has been successfully used in several previous studies and has proven to acquire an accurate description of the participants' responses. The limitation of this scale is the avoidance of extreme and average values in correspondents' responses. This fact indicates that the data obtained must be statistically processed to identify this type of error on the experimental results. A confirmatory factor analysis was conducted to establish relationships between the different factors. Finally, several binomial logistic regression models were estimated to find the significance of the analysed factors to answer the hypotheses suggested in Section 2.

More than 60% of respondents note a “strong” or “very strong” willingness to reduce the use of plastic packaging. This result is in line with the results of other studies that show the extent of consumer interest in reducing the use of plastic containers [21,106]. The results are also close to a study conducted in Germany to check consumer attitudes towards plastic waste [4,107]. Another study [108] indicated that 86% of Swedish consumers were prepared

to pay more for ecologically friendly food packaging, and in their opinion, paper-based packaging is ecologically better than plastic or metal packaging. Another study [109] showed that most (93.7%) of the Canadian consumers were personally motivated to reduce their consumption of single-use plastic food packaging.

Reliability and validity tests were conducted for the three measurement scales. It was shown that environmental attitude significantly impacts the reduction of plastic packaging in all analysed product groups as hypothesised in this study (Hypothesis 1). This may be related to respondents' awareness of the increase in plastic waste and its negative impact on the environment and their high environmental awareness. The data obtained are consistent with the results of other researchers, such as Escario et al. [65] and Popovic et al. [40].

In this study, it was found that personal norms show some tendencies to influence the motivation of consumers to reduce plastic packaging. However, this influence is not significant for any of the analysed product categories and does not differ statistically significantly among the product groups studied ($p > 0.01$) (Hypothesis 2). The results obtained are consistent with the results of other scientists [56,57]. Wiefek et al. [60] observed that personal norms significantly affect consumers' attitudes to plastic packaging for household needs. Santos et al. [61] found that personal norms are the strongest predictor of consumer intention when choosing eco-friendly packaging, which is an alternative to plastic packaging.

Studies of Heywood [58] and Khan et al. [59] from different periods showed that social norms have an ambiguous effect on consumers' motivation to avoid plastic packaging. The study on hand found that social norms had a statistically significant impact on the motivation of consumers to reduce plastic packaging only in areas of textiles, travel and transport ($p < 0.1$). In other areas, social norms did not have any significant impact on the respondents' motivation (Hypothesis 3). Studies conducted in other countries also indicate the ambiguous influence of social norms in the study of the plastic waste problem. Researchers from Finland [110] found that social norms do not significantly impact behaviour when dealing with plastic packaging. A study conducted in China showed that attitudes towards the environment, social norms and environmental behaviour in the past show a less direct relationship with people's intentions to avoid buying disposable plastic packaging [111]. On the other hand, Australian scientists [52] have found that descriptive norms are the strongest predictor of plastic avoidance, and most of the remaining variables regulate the relationship between norms and behaviour. The results of this study showed that it is possible to use the exchange of messages about social norms to bridge the gap between perception and action among consumers to solve the global plastic waste problem. This practice has already shown effectiveness in matters of global warming [53] and waste disposal [54].

The analysis of Table 5 showed that there are gender differences in the motivation of consumers to avoid plastic packaging in the field of washing, cleaning, and furniture compared to other groups ($p < 0.05$). This result may be because women use products of these consumer product groups more than men, which is observed not only in our study [30]. It is important to note that the age group of the respondents only has a statistically significant difference in the level of motivation of consumers to avoid plastic packaging in the field of furniture ($p < 0.05$). Theoretically, higher education and family size should positively affect the motivation of consumers to avoid plastic packaging. However, there were no statistical differences between the product groups analysed. Thus, the study's results only partly confirmed the influence of gender, age, level of education, and family size on reduced consumption of products packaged in plastic (Hypothesis 4).

The results of this study confirm the hypothesis that there are significant differences in the reduction of plastic consumption by categories of different consumer goods/services (Hypothesis 5). If we consider the full sample (Table 5, Constant group), we find that consumers' motivation to reduce the consumption of food products in plastic packaging is statistically significantly different from all the other consumer goods packed in plastic ($p < 0.01$). The data obtained may become the basis for understanding the behaviour and

motivation of consumers in relation to the plastic waste problem, particularly disposable plastic packaging.

One of the key limitations is the sample structure. The sample consists mostly of young and educated people. The people making up the sample are very keen to reduce the environmental impacts of plastic waste and hence it is not a representative sample for Germany based on the demographics, but also concerning environmental attitudes. This may probably lead to biased and more favourable results. In this context, the social desirable answers of respondents cannot be excluded.

7. Managerial Applications

In this study, we observed that consumers' motivation to reduce plastic packaging in food products is significantly different between the analysed categories of FMCG. Thus, the findings of this study may be of value for managing the (plastic) packaging of FMCG to find more environmental solutions in this field in the future. Additionally, the study may also provide new insights to improve governments', policymakers' and other academics' understanding of citizens' behavioural intentions, allowing for the development of effective campaigns or initiatives to be taken in the field analysed.

8. Conclusions

The increase in the global production and use of plastic is causing serious global environmental pollution. There is ample research on strategies for collecting, recycling and disposing of plastic waste, but very little research on consumer behaviour towards plastic waste and consumption. This study aimed to analyse the influence of environmental attitudes, personal norms, and social norms, as well as sociodemographic factors such as gender, age, education level, and family size in reducing plastic packaging consumption across different product groups, as a case study for German consumers. The results obtained from regression analysis showed that more than 60% of respondents were interested in avoiding plastic food packaging and reducing plastic consumption. A comparison of the motivation to plastic packaging reduction across product categories showed that for foods, a high proportion (75.3%) of the respondents revealed a self-reported favourably strong intention to reduce plastic packaging. Textiles followed far behind (top scores strong = 52.8%) in second position and cosmetics (40.1%) and furniture (40.1%) as joint third places. The lowest intention of the respondents to reduce plastic packaging was for cleaning products (top scores strong = 27.8%). The logistic regression estimates show that environmental attitudes are an important factor for separating consumers with a high intention to reduce plastic packaging waste from those with a lower intention, with high statistical significance ($p < 0.01$) for all considered product categories except textiles. Personal norms have potential to influence the motivation of consumers to abandon plastic packaging, but this influence does not significantly statistically differ between the product groups studied. It is important to note that social norms have an ambiguous effect on consumer motivation to reduce plastic packaging between different product groups. We did find a fuzzy influence of sociodemographic parameters (gender, age, level of education, family size) on reducing the consumption of products in plastic packaging. One important conclusion of the study is the confirmation of the hypothesis that there are significant differences in the reduction of plastic consumption by categories of different FMCG. The study results are pertinent to Germany. Hence, transferring the results to other industrialized countries with high-income consumers might be possible. However, the results should be handled carefully if other socioeconomic, social or environmental conditions are important in other countries. Cross-cultural and international studies could give more insight in this area of research in the future.

Limitations of the Study and Further Research

The results of this study are based on the response of volunteer respondents in the online questionnaire. In this regard, we used a convenience sample for our study and

there is no way of knowing how representative such a convenience sample is. As with any work based on survey results, our work has limitations related to the uneven distribution of respondents by social groups relative to the average distribution of social groups in Germany. One of the key limitations is the sample structure. The sample consists mostly of young and educated people. The people making up the sample are very keen to reduce the environmental impacts of plastic waste and hence it is not a representative sample for Germany based on the demographics but also concerning environmental attitudes. This may probably lead to biased and more favourable results. In this context, the socially desirable answers of respondents cannot be excluded. Thus, for further research on this topic, it is recommended that researchers use probability sampling techniques, which are much more likely to be representative of the larger population.

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