The Impact of Socio-Demographic Variables on Pro-Environmental Behaviour

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Abstract

There is growing evidence that human society has already entered the age of global environmental crises. As human behaviour is undoubtedly contributing to environmental problems, it is important to analyse pro-environmental behaviour. Socio-demographic variables are widely used to investigate individual behaviour; the aim of this study was to analyse how they influence pro-environmental behaviour in a Central and Eastern European country. An online survey was conducted among 442 participants aged 18+ in Hungary, and Spearman's rho, Mann-Whitney U test, Kruskal-Wallis test univariate ANOVA and regression analysis were used to analyse the relationship between socio-demographic variables and pro-environmental behaviour. The results show that age and the number of children a person has are positively associated with pro-environmental behaviour. In addition, women and members of civic organisations tend to have higher levels of pro-environmental behaviour. Using these significant socio-demographic variables in green segmentation and in developing complex models of pro-environmental behaviour is therefore recommended.

Keywords

socio-demographic variables, pro-environmental behaviour (PEB), Hungary, sustainability

1 Introduction

Human civilisation has entered the age of global environmental and social problems, and soon it will be too late to avoid the irreversible climate change (IPCC, 2023). Since the environmental issues are largely caused by humans (Dlamini et al., 2021), we need to change human behaviour to solve environmental and social problems.

The use of socio-demographic variables in the analysis of pro-environmental behaviour has a long history and it is still one of the most widely used methods (Ifegbesan et al., 2022). The golden age of the use of demographic factors in explaining pro-environmental behaviour dates back to the 1980s and 1990s (e.g., Jones and Dunlap, 1992; Van Liere and Dunlap, 1980). However, using socio-demographic variables to understand human behaviour related to the environment is still very popular (Sargisson et al., 2020). The most generally used socio-demographic variables are age, gender, education, political view, place of residence, and occupation. However, despite their widespread use, the research findings on the relationships between socio-demographic variables and pro-environmental behaviour are rather contradictory (Geerts et al., 2020; Nagy, 2006; Olli et al., 2001; Otto et al., 2016).

Over the past 30 years, Hungary has experienced significant economic growth. Nevertheless, environmentally friendly attitudes and behaviour are still far below the European average (Mikuła et al., 2021). However, environmental awareness is also growing among Eastern Europeans, even if they lag behind Western Europe (Dabija et al., 2018). Furthermore, in Hungary, little is known about how socio-demographics are associated with pro-environmental behaviour. This paper attempts to fill this research gap. Its main objectives are to investigate the relationship between socio-demographic variables and pro-environmental behaviour in Hungary, and to compare the novel findings with previous research results.

2 Literature review
2.1 Pro-environmental behaviour

Pro-environmental behaviour (PEB) is broadly defined to include behaviours that are minimally harmful to the

environment, or even beneficial to it (Steg and Vlek, 2009). In other words, PEB refers to behaviours that significantly influence environmental quality. Meffert and Kirchgeorg (1993) identified five main types of PEB:

1. reducing the consumption of traditional products,
2. shifting demand to purchasing environmentally friendly alternatives instead of traditional products,
3. consuming environmentally efficient products,
4. participation in recycling and separate/selective waste collection,
5. taking part in environmentally conscious complaints or protests.

PEB includes conservation, eco-conscious purchasing, waste reduction (e.g., recycling, composting), saving water and energy, donating to environmental causes, joining pro-environment organisations, protesting and volunteering (Yang and Wilson, 2023).

2.2 Age
Earlier research findings suggest that the youngsters are more environmentally conscious than the elders (Han et al., 2011; Jones and Dunlap, 1992; Straughan and Roberts, 1999). Barber (2010) found that younger people are more interested in environmental issues and have greater environmental awareness than the elders. According to Han et al. (2011), youngsters are more informed about environmental issues because of their online literacy and more effective information search on the internet.

However, several studies have come to the opposite conclusion, suggesting that as people age, their environmental awareness increases (Anderson and Krettenauer, 2021; Defrancesco et al., 2008; Dietz et al., 1998; Melo et al., 2018; Van Liere and Dunlap, 1980). In Portugal, older participants are reported having more pro-environmental behaviours (Soares et al., 2021). In the UK, younger people are more likely to be frequent single-use plastic bag buyers (Lavelle-Hill et al., 2020).

In Hungary, Hofmeister-Tóth et al. (2013) found that young people (15-29 years) performed the fewest pro-environmental actions, while middle-aged people (40–49 years) performed the most, with the difference being significant only between these two age groups. In contrast, Szarka et al. (2014), who studied the food consumption behaviour of the 50+ generation, found the elders are not particularly interested in sustainability in general. A similar conclusion was reached by Sudbury Riley et al. (2014), who found that there

exists an environmentally conscious segment in the older age group, but there are even more groups that are not environmentally conscious at all. According to Patel et al. (2017), in India middle-aged consumers (36–50) are more pro-environmental conscious than younger and older consumers.

Furthermore, there is some research which found no significant relationship between age and environmental awareness (Amoah and Addoah, 2021; Finger and Lehmann, 2012; Piskóti and Nagy, 1998; Yang and Wilson, 2023; Yiridoe et al., 2010).

2.3 Gender
The relationship between gender and pro-environmental behaviour is also ambiguous. Many studies support that females are greener than males. Women tend to be more sensitive to environmental problems (Hofmeister Tóth et al., 2011) and tend to behave in a more environmentally friendly way than men (Hofmeister-Tóth et al., 2013; Li et al., 2022). In Spain, Sánchez et al. (2016) found that female gender influences pro-environmental purchase behaviour positively. Females are more emotionally connected to nature and have higher level of PEB in comparison to males (Anderson and Krettenauer, 2021).

Females tend to be more environmentally conscious because of their more altruistic (Dietz et al., 2002) and cooperative (Irwin et al., 2015) behaviour. In general, women are more adaptive (flexible) than men and have a higher degree of normative control and are therefore more inclined to do more for the environment. Females engage in PEB in the public sphere due to social expectations (Trelohan, 2022). In Portugal, Soares et al. (2021) found that women are much less likely than men to pollute the environment with plastic. They are more supportive of plastic ban policies, more positive towards reducing plastics, and have stronger intention to reuse and recycle (Li et al., 2022). The environmentally conscious behaviour of females has also been confirmed by several other studies (Dietz et al., 2002; Ifegbesan et al., 2022; Oztekin et al., 2017; Piskóti and Nagy, 1998; Straughan and Roberts, 1999).

However, there are studies that have come to the opposite conclusion (Balderjahn, 1988; Laroche et al., 2001). In Ghana, Amoah and Addoah (2021) found males to be more associated with good environmental practices.

Other studies found no significant relationship between gender and environmental behaviour (Conradie et al., 2013; Dietz et al., 1998, 2002; Martins Gonçalves and Viegas, 2015; Melo et al, 2018; Van Liere and

Dunlap, 1980; Xiao and McCright, 2014). Recently, Yang and Wilson (2023) found no robust gender differences in environmental behaviours of men and women.

2.4 Income

The relationship between income and PEB is also unclear. The wealthier are more sensitive to environmental problems (Hofmeister Tóth et al., 2011), and are more likely to engage in good environmental practices (Amoah and Addoah, 2021). Higher income makes the purchase of more expensive environmentally friendly or fair-trade products easier (Gatersleben et al., 2012), but higher income also tends to be associated with higher environmental emissions due to more intensive car use (Bruderer Enzler and Diekmann, 2015). Several studies have shown that higher income leads to higher environmental impact (Ala-Mantila et al., 2014; Baiocchi et al., 2010; Diekmann and Jann, 2000; Kerkhof et al., 2009; Wilson et al., 2013). Melo et al (2018) found that higher household income tends to be associated with lower scores of the PEB index. Recently, Yang and Wilson (2023) detected a significant negative total effect of personal income on personal PEB.

However, Piskóti and Nagy (1998) found no significant relationship at all between income and environmental awareness in Hungary.

2.5 Education

Higher level of education is generally associated with more environmentally conscious behaviour (Bruderer Enzler and Diekmann, 2015; Hofmeister Tóth et al., 2011; Patel et al, 2017; Straughan and Roberts, 1999), which could be explained by the time spent in school. The more time we spend in school, the more information about environmental issues we can obtain by studying sustainability-related topics. Meyer (2015) found that as people become more educated, they become more sensitive to issues of social well-being and thus more environmentally aware. In Hungary, according to Hofmeister-Tóth et al. (2013), the tendency toward PEB increases with people being more educated. Melo et al. (2018) found positive relationship between educational attainment and PEB. Recently, Suárez-Perales et al. (2021) found that environmental education positively but indirectly influences PEB of university students. Yang and Wilson (2023) found that higher level of education is associated with stronger personal and public PEB. However, several studies have not found a significant relationship between the level of education and PEB (Finger and Lehmann, 2012; Piskóti and Nagy, 1998; Yiridoe et al., 2010).

2.6 Place of residence

Earlier research found differences in environmental awareness between people living in rural and urban areas; however, research findings are contradictory. Dunlap et al. (2000) found that urban populations are more environmentally aware. A plausible explanation for this is that people living in cities are more sensitive to the harmful effects of pollution (e.g., smog, lack of green spaces, etc.) because they are directly exposed to it (Shen et al., 2011). When urban populations become more environmentally conscious, they can immediately experience the positive effects of their greener behaviour (Groenewegen et al., 2006). In China, people living in large cities are more environmentally conscious than those living in smaller cities (Chen et al., 2011). Recently, it is reported that urban residents have significantly higher levels of PEB compared to rural people in Canada (Anderson and Krettenauer, 2021). An opposite conclusion was reached by Hinds and Sparks (2008), who found that students living in rural England had more positive attitudes towards the natural environment than those living in cities. Other studies have also confirmed the positive environmental attitudes of rural people (Collado et al., 2015; Huddart-Kennedy et al., 2009). However, some researchers have found no significant relationship between place of residence and environmental awareness (Olli et al., 2001; Piskóti and Nagy, 1998; Yang and Wilson, 2023).

2.7 Occupation

In addition to the difference between white-collar and blue-collar occupations, a distinction between occupations in extractive and non-extractive industries can also be observed in the literature (Kowalewski, 1994). The environmental impact of extractive occupations (e.g., mining, logging, etc.) is very high, and therefore people working in such occupations are not inherently environmentally conscious. Other research has found that people in intellectual occupations are more environmentally conscious (Olli et al., 2001). According to Ogunbode and Arnold (2012), white-collar workers are better informed about environmental issues and are most inclined to consider environmental aspects in their political decisions and consumption. An earlier study in Hungary (Piskóti and Nagy, 1998) found a non-significant relationship between occupation and PEB.

2.8 Other socio-demographic variables

Marital status is also an ambiguous predictor of PEB. Some researchers have found that married people tend to behave in a more environmentally friendly way (Patel

et al., 2017), whereas Chen et al. (2011) found that singles are more environmentally conscious. Further studies found a non-significant relationship between marital status and PEB (Diamantopoulos et al., 2003; Klöckner, 2013; Piskóti and Nagy, 1998).

A study for the UK (Longhi, 2013) found that singles and childless couples are more environmentally conscious than couples with children. It suggests it is more difficult to live eco-consciously when there is a child in the family. In contrast, Bell and Braun (2010) argue that the birth of a child activates maternal instincts in women that are partly responsible for the development of environmentally conscious behaviour. According to Melo et al. (2018), the presence of a young children positively affects PEB. In Hungary, Piskóti and Nagy (1998) found no links between the number of children and PEB.

Membership in civic organisations has a positive influence on environmental behaviour (Torgler et al., 2011). People who volunteer frequently feel more personally connected to the place and the environment, and believe that their efforts contribute to solving environmental problems and enjoy being part of this (Dresner et al., 2015). Earlier research in Hungary found no relationship between membership in a civic organisation and the level of environmental awareness (Piskóti and Nagy, 1998).

3 Research methodology and sample

To achieve the research objective, i.e., to measure the impact of socio-demographic variables on PEB, first a pro-environmental behaviour scale was developed, then the influence of demographic variables on PEB was analysed. The PEB scale was used to measure pro-environmental behaviour. It is an updated, partly modified version of the General Ecological Behaviour (GEB) scale, which was originally developed by Kaiser et al. (1999). The PEB scale does not include social desirability variables as Kaiser (1998) found that social responsibility has little influence on PEB. Additional four GEB scale items were omitted because they were outdated and not relevant. However, 11 new items were added, so the PEB scale now contains 37 items related to environmentally conscious behaviour (Table A1 in the Appendix). Respondents were asked to indicate on a dichotomous scale whether a statement about a specific environmentally conscious behaviour (item) was more typical (yes) or less typical (no) for them.

On the PEB scale, each behaviour item is assigned a behavioural difficulty, which expresses the size of the uncontrollable constraint. The more difficult it is to implement an environmentally friendly behaviour, the greater the individual uncontrollable constraint is assumed to be for that behaviour. The behavioural difficulty is calculated by dividing the number of respondents who do not behave in an environmentally conscious way (e.g., does not participate in selective waste collection) regarding the specific behaviour (e.g., waste collection) by the total number of respondents. The overall tendency of a person to be green is calculated by dividing the number of behaviour items in which the person behaves in a pro-environmental way by the total number of behaviour items. Since this method considers both the tendency of a person to behave pro-environmentally in general terms and the behavioural difficulties, it is possible that people behave in a somewhat inconsistent way. For instance, an individual who generally exhibits high levels of environmental consciousness may prefer taking baths over showers, demonstrating a lack of environmental consciousness in this particular behaviour. Conversely, an individual who is generally not environmentally conscious may still engage in a specific PEB with high behavioural difficulty, such as avoiding car usage due to financial constraints.

To collect data, an online survey was conducted in 2022 in Hungary. A total of 451 respondents aged 18 years and above were included in the sample. Responses were collected using convenience sampling. The only eligibility condition for participation in the survey was that respondents had to be at least 18 years old. Participation was voluntary and completely anonymous. The online survey (Google Forms) was primarily distributed through social media platforms (Facebook and LinkedIn).

Based on the size of the sample and that of the population of 8,608,859 people aged 18 and above in Hungary, the confidence interval of the sample at the 95% confidence level is 4.52%. After data-cleaning, the sample was weighted by gender to ensure representativeness, resulting in a gender distribution of 49.4% males and 50.6% females, which aligns with the distribution of the target population. The mean age of the respondents is 28.6 years. A large proportion of the sample is made up of people with tertiary education (55.0%), but the percentage of people with secondary education is also high (41.7%) while those with primary education account for only 3.3%. The sample includes a significant proportion of urban residents (64.1%), compared to only 35.9% of those living in rural territories. The sample therefore mainly reflects the views of young urban residents with tertiary education.

Data analysis was conducted using SPSS 28 and JASP, following the necessary data cleaning, as well as the exclusion of incomplete questionnaires.

4 Results and discussion

For each respondent, a weighted sum of 37 Pro-Environmental Behaviour (PEB) items, adjusted for behavioural difficulties, was calculated. This sum was then transformed into the PEB scale (Eq. (1)), which ranges from 0 to 1, by dividing the weighted sum by the total sum of behavioural difficulties:

$$\text{PEB} = \frac{\sum_{i=1}^{37}\left(D_i \sum_{j=1}^{N} X_{ij}\right)}{\sum_{i=1}^{37} D_i}, \tag{1}$$

where:
- PEB: Pro-Environmental Behaviour scale;
- N: Total number of respondents;
- X_{ij}: Value given by the j-th person for the i-th behaviour (1 if the individual behaves pro-environmentally, 0 if not);
- D_i: Behavioural difficulty of an item (Eq. (2)).

and:

$$D_i = \frac{A_i}{N}, \tag{2}$$

where:
- A_i: Number of respondents who answered "no" to the i-th action;
- N: Total number of respondents.

Behavioural difficulty of an item was defined as the number of respondents who answered "no" to that specific behaviour, i.e., the non-environmentally conscious individuals regarding the specific behaviour, divided by the total number of respondents.

A score of 0 on the PEB scale indicates the absence of any environmentally friendly behaviour, while a score of 1 denotes complete pro-environmental consciousness across all 37 PEB items. Therefore, higher scores on PEB scale indicates higher level of pro-environmental consciousness.

To estimate reliability of the PEB, Cronbach's α, McDonald's ω and Guttman's λ_2 were computed. Cronbach's α uses inter-item correlations while McDonald's ω is based on a factor analysis result. Guttman's λ_2 is less commonly used in practice compared to α and ω; however, it provides additional insight into the reliability of scales.

Table 1 shows that reliability estimates for McDonald's ω, Cronbach's α, and Guttman's λ_2 are similar, ranging from 0.756 to 0.767. This consistency across different reliability coefficients indicates that the PEB scale reliably measures a construct with acceptable internal consistency. The substantial overlap in the confidence intervals for each statistic further corroborates the robustness of these reliability estimates. Overall, the PEB scale demonstrates good internal consistency, providing confidence in the reliability of the scores derived from it.

The analysis revealed a mean PEB score of 0.47 in Hungary, indicating a generally low level of pro-environmental behaviour among the Hungarian population. This finding aligns with the results of Mikuła et al. (2021), who ranked Hungary 15th out of 27 EU countries in terms of PEB levels, further corroborating the observed low pro-environmental behaviour in the country. To assess the normality of the continuous variables, the Kolmogorov-Smirnov test was conducted. The test results ($p < 0.001$) indicated that each variable, including age, income, number of children, and PEB, followed a non-normal distribution. Consequently, Spearman's correlation was employed to identify significant relationships between PEB and the continuous socio-demographic variables. The Spearman's rho values indicate that both age and number of children are weak but significant predictors of PEB (Table 2).

Age ($\rho = 0.231$) emerges as a slightly stronger predictor than the number of children ($\rho = 0.205$), suggesting a modest increase in environmental consciousness with advancing age. This finding is consistent with previous research demonstrating a positive relationship between age and PEB (Anderson and Krettenauer, 2021; Defrancesco et al., 2008; Dietz et al., 1998; Melo et al., 2018; Van Liere and Dunlap, 1980).

Table 1 Scale reliability statistics

Estimate	McDonald's ω	Cronbach's α	Guttman's λ_2
Point estimate	0.758	0.756	0.767
95% CI lower bound	0.726	0.723	0.736
95% CI upper bound	0.790	0.787	0.795

Table 2 Correlation table

			Age	Income	No. of children	PEB
Spearman's rho	PEB	Correla-tion coeffi-cient	0.231**	0.018	0.205**	1.000
		Sig. (2-tailed)	<0.001	0.732	<0.001	.

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

The number of children in the family is also slightly but positively associated with PEB. This result corroborates the findings of Bell and Braun (2010), who asserted that the birth of a child positively impacts PEB by activating parental instincts.

To analyse the effect of categorical socio-demographic variables on PEB, the Kolmogorov-Smirnov test was employed to determine the normality of the category distributions (Table 3). Based on the number of categories, the Mann-Whitney U test was used for dichotomous variables with two categories, while the Kruskal-Wallis test was applied to variables with three categories. The Mann-Whitney U test was performed using nonparametric analysis of two independent samples, whereas the Kruskal-Wallis test was conducted as a 1-way ANOVA (k samples). The significance levels presented in Table 3 indicate whether the null hypothesis, which posits that the distribution of PEB is identical across categories, should be accepted or rejected.

Acceptance of the null hypothesis indicates that this specific variable has no significant effect on PEB. Consequently, place of residence, education, occupation, and relationship status are socio-demographic variables that do not significantly influence environmentally conscious behaviour. In contrast, gender and civic organisation membership are identified as significant predictors of PEB. This implies that there is a notable difference in pro-environmental behaviour between males and females, as well as between members and non-members of civic organisations. Members of non-governmental, non-profit organisations exhibit higher levels of pro-environmental behaviour ($M = 0.4828$) compared to non-members ($M = 0.4266$). This finding aligns with previous research that has established a positive relationship between civic organisation membership and PEB (Dresner et al., 2015; Torgler et al., 2011).

The research findings show that women behave in a more environmentally friendly way ($M = 0.4760$) than males ($M = 0.4125$). This result matches and confirms those observed in earlier studies supporting the idea that females are more environmentally conscious than males (Dietz et al., 2002; Ifegbesan et al., 2022; Oztekin et al., 2017; Piskóti and Nagy, 1998; Straughan and Roberts, 1999).

Four socio-demographic variables that significantly influence pro-environmental behaviour were identified: age, the number of children, gender and membership in civic organisations.

A univariate ANOVA model was developed using the significant socio-demographic variables, with PEB as the dependent variable and gender, age, civic organisation membership, and the number of children as predictors (Table 4). The R-squared value of 0.173 indicates weak predictive strength, suggesting that *socio-demographic variables alone are insufficient predictors of PEB*. To more accurately explain pro-environmental behaviour, it is necessary to incorporate additional psychological variables, such as attitude, normative control, and perceived behavioural control. It aligns with the results of

Table 3 Summary table of the test results (categorical variables)

	Kolmogorov-Smirnov Sig.	Test	Sig	Null hypothesis
Gender				
Male	0.200	Mann-Whitney	<0.001	Rejected
Female	<0.001			
Civic organ.				
Non-member	0.020	Mann-Whitney	<0.001	Rejected
Member	0.001			
Residence				
Urban	0.004	Kruskal-Wallis	0.412	Accepted
Suburban	0.140			
Rural	<0.001			
Education				
Primary	0.016	Kruskal-Wallis	0.247	Accepted
Secondary	0.002			
Tertiary	0.029			
Occupation				
Blue-collar	0.016	Mann-Whitney	0.276	Accepted
White-collar	<0.001			
Relationship				
Single	0.007	Mann-Whitney	0.134	Accepted
In relationship	0.087			

Table 4 Summary table of the test results (categorical variables)

	Type III SS	df	Mean square	F	Sig.
Corrected model	1.466a	5	0.293	15.778	<0.001
Intercept	6.531	1	6.531	351.367	<0.001
Age	0.254	1	0.254	13.665	<0.001
Children	0.002	1	0.002	0.124	0.725
Gender	0.544	1	0.544	29.256	<0.001
Civic org.	0.197	1	0.197	10.595	0.001
Gender * civic org.	0.224	1	0.224	12.073	<0.001
Error	6.989	376	0.019		
Total	83.329	382			
Corrected total	8.456	381			

R-squared = 0.173 (Adjusted R-squared = 0.162) Dependent variable: PEB

Kemi and Zilahy (2024), who identified personal and psychological factors as key drivers of green and sustainable textile consumption. Their bibliometric study, which analysed 104 articles indexed in the Web of Science database and published between 2011 and 2021, highlighted attitude, subjective norm, perceived behavioural control, past experiences, fashion sensitivity, emotional value, perceived consumer effectiveness, and faith as significant influences on sustainable consumption patterns. Further studies also underscore the importance of incorporating additional variables beyond demographic factors. For instance, information campaigns that aim to strengthen the cognitive component of attitude, such as providing information on saving opportunities, can play a significant role in moderating occupants' behaviour to reduce high space heating expenditures in panel apartment blocks (Janky and Kocsis, 2022).

In the univariate ANOVA model, gender emerges as the most influential predictor of PEB. Table 4 demonstrates that while age and civic organisation membership are also significant predictors, their effects on PEB are relatively weak. The findings suggest that older women who participate in civic organisations are likely to exhibit higher levels of pro-environmental behaviour.

To reconfirm the results of the ANOVA, a regression analysis was conducted using the same set of variables. In the regression model, the independent variables included the number of children, gender (gender_dummy), civil status (civil_dummy), and age, while PEB was defined as the dependent variable. Table 5 demonstrates that the R-squared value is merely 0.129, suggesting that only a small proportion of the variance in the dependent variable is explained by the independent variables in the regression model. Consequently, it is recommended to incorporate additional independent variables into the model.

Within this model, age emerges as the most influential predictor of PEB, followed closely by gender, which has a slightly weaker effect on pro-environmental behaviour (Table 6). Membership in civic organisations is the weakest significant predictor, whereas the number of children shows no significant impact on PEB.

5 Conclusions, implications, limitations and future research directions

From a theoretical perspective, this paper contributes to the understanding of individual pro-environmental behaviour. Socio-demographic variables are often used in behavioural studies, but for a long time there is no consensus on their influence on PEB (Diamantopoulos et al., 2003). This study adds to the knowledge on sustainable behaviour by identifying four statistically significant demographic predictors of PEB: age, gender, number of children and membership of a civic organisation.

This research finding closely aligns with the results reported by Witek and Kuźniar (2021), who, through a survey of 650 Polish consumers, examined the role of sociodemographic factors in explaining consumers' green purchase behaviour. Their study revealed that variations in gender, age, education level, personal financial situation, and the number of children in the family significantly affect both awareness and purchasing behaviour related to green products.

However, the research findings also suggest that demographic variables alone have limited power in predicting environmentally conscious behaviour. Therefore, it is necessary to incorporate additional factors, such as

Table 5 Model summary

Model	R	R square	Adjusted R square	Std. error of the estimate	Change statistics				
					R square change	F change	df1	df2	Sig. F change
1	0.359	0.129	0.121	0.14010	0.129	16.280	4	441	<0.001

a. Predictors: (Constant), number of children, gender_dummy, civic org._dummy, age

Table 6 Coefficients

Model		Unstandardised coefficients		Standardised coefficients		
		B	Std. error	Beta	t	Sig.
1	(Constant)	0.315	0.020		16.049	<0.001
	gender_dummy	0.063	0.013	0.211	4.745	<0.001
	civic org._dummy	0.049	0.014	0.152	3.394	<0.001
	age	0.002	0.001	0.245	3.944	<0.001
	number of children	−0.003	0.008	−0.023	−0.376	0.707

Dependent Variable: PEB

psychological variables, into a comprehensive model of pro-environmental behaviour (PEB). This conclusion is consistent with the results of Gifford and Nilsson (2014), who examined various determinants of pro-environmental behaviour and found that demographic variables alone are insufficient predictors.

Furthermore, the study contributes to the understanding of environmentally conscious behaviour in the context of a Central and Eastern European country. Overall, the current research findings add to a growing body of literature on sustainability and individual behaviour.

In terms of managerial implications, the findings of this study can be successfully used to segment consumers based on their pro-environmental behaviour and develop a strategy to reach them. The research findings suggest that older women who are active members of civil society organisations tend to be the most environmentally friendly and are therefore the best target group for companies selling environmentally friendly (green) products and services. From the governmental perspective, they are the most receptive to sustainability-related social campaigns or actions, even as volunteers. This research also suggests

that younger men without children who do not participate in civic organisations are at the other extreme. They are the least interested in the environment and sustainability. Environmental awareness-raising campaigns should focus on and target this group.

As far as the limitations of the study concerned, the lack of a fully representative sample reflecting the characteristics of the entire population aged 18+ in Hungary is a serious limitation of the study and the generalisation of the survey results. The current findings are mostly related to young, urban residents with tertiary education. A repeated survey using a representative sample is advisable to reconfirm research findings.

Another limitation of the research is that the results are only valid for Hungary. For this reason, it would be beneficial to extend the research to all EU countries in the future to make the results comparable and to take into account country-specific factors (e.g., different cultures). In this future research, the complex model of PEB should be developed using the significant socio-demographic variables identified in this study, combined with other psychological variables such as attitudes, values and environmental concern.

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Appendix A

Table A1 PEB scale items

PEB item	Source
1. I don't wash anything until I can wash a full load.	1
2. If I replace a household appliance, I always buy a more energy-efficient version.	2
3. I'd rather take a shower than a bath.	1
4. I'm not replacing anything just because it's out of fashion.	2
5. I throw used batteries in the dustbin.	1
6. I collect paper selectively.	1
7. After meals, I pour the leftovers down the toilet.	1
8. I collect empty bottles selectively.	1
9. I warned someone (s)he did not behave pro-environmentally.	2
10. I enjoy eating a lot of meat.	1
11. I travel by plane at least once or twice a year.	2
12. I throw unused medicines in the trash.	1
13. My room is always warm in winter as I hate being cold.	2
14. I buy many products made from recycled materials.	1
15. I prefer paper bags to plastics.	1

Notes: 1: Kaiser et al. (1999); 2: Newly added by the author

Table A1 PEB scale items (continued)

PEB item	Source
16. I use air freshener in the bathroom.	1
17. I wash even the dirtiest clothes without pre-washing.	1
18. I usually use public transport instead of a car.	1
19. I air the rooms many times in winter to keep the air fresh.	1
20. I usually buy local products and food.	2
21. I use an oven-cleaning spray to clean the oven.	1
22. If a shop gives me a plastic bag, I always accept it.	1
23. If use insecticide to kill insects.	1
24. I do not buy products tested on animals.	2
25. Much less waste generated in my household than a year ago.	2
26. I often buy environmentally friendly products, organic foods.	2
27. I don't usually use a car in the city.	1
28. I often talk to my friends about environmental problems.	1
29. I do not buy from firms that don't care about the environment.	2
30. I drink canned drinks.	1
31. I usually buy drinks in returnable bottles.	1
32. I do not use washing powders.	2
33. I never drive faster than 100 km/h on the motorway.	1
34. I sometimes support environmental organisations financially.	1
35. I clean the toilet with chemicals.	1
36. When I wash, I also use rinse aid.	1
37. I am a member of an environmental group.	1

Notes: 1: Kaiser et al. (1999); 2: Newly added by the author