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Author(s)

Boermans, Diana D. ; Jagoda, Agnieszka ; Lemiski, David; Wegener, Jana ; Krzywonos, Malgorzata

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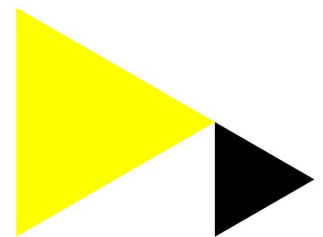
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Research article

Environmental awareness and sustainable behavior of respondents in Germany, the Netherlands and Poland: A qualitative focus group study

Diana D. Boermans^{a,*}, Agnieszka Jagoda^b, David Lemiski^a, Jana Wegener^c,
Malgorzata Krzywonos^d

^a Amsterdam University of Applied Science, Faculty of Technology, Wibautstraat 2-6, 1091 GC, Amsterdam, the Netherlands

^b Wroclaw University of Economics and Business, Faculty of Management, Department of Strategic Management and Logistics, ul. Kochanowskiego, 58-500, Jelenia Góra, Poland

^c Ruhr University Bochum, Center for Environmental Management, Resources and Energy (CURE), Overbergstraße 17, 44801 Bochum, Germany

^d Wroclaw University of Economics and Business, Faculty of Management, Department of Process Management, ul. Komandorska 118/120, 53-345, Wroclaw, Poland



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ABSTRACT

The diverse European landscape of climate consciousness is shaped by political values, financial constraints, and country-specific point of view. The aim of the study was to unravel age-specific ecological awareness, forms of engagement, and perceptions, contributing to a nuanced understanding of climate dynamics.

Selected regions: Germany (Rheinisches Revier), the Netherlands (Amsterdam Metropolitan Area), and Poland (Upper Silesia/Metropolis GZM) present different states regarding recycling/Circular Economy principles, and different environments.

The research design incorporates an inductive qualitative approach to investigate environmental awareness and attitudes toward ecologically friendly behaviors. Six FGIs (Focus Group Interviews) were conducted across three European regions, involving participants from diverse age groups (20–39 years and 40–60 years) in each region.

The study shows that ecological awareness varies between countries and generations, reflecting distinctive environmental strategies shaped by cultural and developmental factors. Participants in each region and age group exhibit diverse levels of engagement in sustainable activities, and highlight issues such as the need for tailored strategies, concerns related to eco-labelling, greenwashing, and inadequate waste treatment, as well as information gaps.

These variations in pro-environmental attitudes and behaviors across age groups and regions underscore the need for tailored strategies and regional policies. Transparency in waste management, eco-labelling, and sustainable transportation alternatives should be prioritized. Educational initiatives addressing information gaps, especially regarding lifestyle choices, are crucial. Collaboration and interdisciplinary approaches are essential for fostering positive change and a sustainable future across the European Union. Transparent communication, regulatory measures, and accessible eco-friendly options encourage widespread adoption of pro-environmental behaviors.

1. Introduction

Climate change, a global phenomenon accelerated by human activities, has given rise to numerous challenges, including rising temperatures, increasing sea levels, extreme weather events, and depletion of biodiversity. To effectively address and mitigate these impacts, a collective acknowledgment of responsibility is essential. Governments, corporations, and individuals all have crucial roles in taking action and

adjusting behaviors to confront the multifaceted challenges posed by climate change (Habets, 2023). The awareness of climate change began to gain momentum in the 1980s, culminating in the establishment of the 1992 Kyoto Protocol, a turning point that triggered increased awareness fueled by scientific reports in mainstream media (Lee et al., 2015). However, global awareness remains diverse, with national government responses varying based on political values, financial constraints, and country-specific psychological co-benefits. Recognizing and addressing

* Corresponding author.

E-mail address: d.d.dolat@hva.nl (D.D. Boermans).

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these disparities is crucial for bolstering climate change awareness and facilitating the effective implementation of coordinated environmental initiatives.

An increasing volume of recent publications have focused on the comprehensive evaluation of personal daily choices made by individuals and their impact on the environment (Driga and Drigas, 2019) (González-García et al., 2018) (Gaillac and Marbach, 2021) highlighting the pressing need for a profound shift in individual and societal values to combat climate change. Recommendations include embracing public transportation, reducing food waste, and adopting sustainable eating patterns such as reducing consumption of red meat. The aforementioned literature emphasizes the significant role of personal choices, particularly dietary decisions, in an individual's carbon footprint. Additionally, (Bailey et al., 2022) identify through systematic review the fast fashion industry as a major contributor to environmental degradation, emphasizing its impact on water consumption, energy use, and carbon footprint.

The behavioral patterns and attitudes of individuals concerning climate change and their potential impact on it emphasizing the urgency of addressing climate change at the individual level (Baiardi, 2023) as well as examining how cities involve non-public actors in their efforts to adapt to climate change (Hansen and Sato, 2016) has been researched. Distinct personal incentives seem to play an important role in shaping citizens' attitudes and behaviors regarding climate change (Patchen, 2006). It is being argued that individuals' environmentally relevant actions are primarily influenced by their emotions toward the environment. According to the same study many people lack a clear understanding of effective climate change solutions and the most impactful efforts they may take to reduce their environmental impact. Therefore, to facilitate assessing the impact of our everyday choices on the environment, online tools are being created. For example, a group of researchers developed two tools to quantify an individual's carbon footprint over a year with focus on the main emission sources: gas and electricity consumption, mobility, food, and waste. With these tools, people can identify which sectors have the greatest impact and are encouraged to adopt more sustainable behaviors to reduce their emissions (Senese et al., 2024).

Insights into national differences, individual predictors, and cross-national variations in climate change perceptions to investigate public perceptions of climate change across different European countries have been investigated using the European Social Survey (Poortinga et al., 2019). The study highlights both commonalities and variations in climate change perceptions across European countries, emphasizing the importance of considering socio-political and demographic factors in understanding these variations. The results suggest subtle regional differences in the impact of individual-level factors on climate change beliefs and concerns.

Other studies have focused specifically on individual countries, such as Poland (Ober and Karwot, 2022) exploring how a Polish consumers engage in pro-environmental behavior, and identifying motivating and limiting factors; and Australia (Lea and Worsley, 2008) emphasizing the impact of food production and distribution, and citizens personal everyday choices on the environment.

Numerous studies have examined consumer attitudes and behaviors for environmental reasons (Islam et al., 2021) (Khan et al., 2020) (Saari et al., 2021) revealing significant variability in people's awareness and attitudes toward climate change. However, there is a gap in the research regarding a comparative quantitative analysis of climate change awareness across different European countries and age groups, particularly using a more personal research method such as focus group interviews (FGIs). While all European Union (EU) member states adhere to common regulations aimed at climate change mitigation, the effectiveness of these regulations can vary significantly due to differences in national awareness levels, available resources, and infrastructural capacities. Investigating this variability is crucial for enabling policy-makers to tailor regulations more effectively, addressing the diverse

needs of Europeans across different cultural, historical, infrastructural, and financial contexts (Cerulli-Harms et al., 2018).

Those quantitative studies do not, however, allow for understanding of depth and context through detailed, subjective accounts. This is possible using qualitative research, in particular focus group interviews (FGI), which as a method provides valuable insights into people's views and actions through interviews and observation. FGI can provide input for developing new European regulations for sustainability. This method enhances our understanding of the differences between Europeans from various cultural and historical backgrounds regarding climate change, leading to a more nuanced and comprehensive perspective on the subject.

This study aims to investigate environmental awareness and attitudes toward eco-friendly behaviors across three European regions, focusing on awareness rather than detailed knowledge. We selected regions in Germany, the Netherlands, and Poland to represent varying stages of sustainable development and differing historical and infrastructural contexts (Wegener et al., 2023). The Rheinisches Revier, has a strong recycling heritage and leadership in environmental innovation. Amsterdam Metropolitan Area's aims for full circularity by 2050 and has well established recycling practices. In contrast, Upper Silesia faces significant economic and technological challenges, with lower public awareness of green initiatives due to its rapid industrial growth and post-communist industrial legacy. This diverse selection allows for a comprehensive understanding of how varying economic and historical contexts influence environmental awareness and behavior.

Conducting FGIs in these regions aimed to answer several research questions:

Research Question 1. Understanding Generational Differences:

How does awareness of ecological concerns differ between younger (20–39 years old) and older (40–60 years old) generations in the studied regions?

Research Question 2. Measuring Participants Engagement in Sustainable Activities in Everyday Life:

To what extent do citizens in different age groups and countries participate in sustainable activities and what forms of engagement in sustainable activities are prevalent in each context, and how do these vary by age and region?

Research Question 3. Identifying Pressing Ecological Issues:

What are the most pressing ecological issues perceived by individuals across the studied regions?

Research Question 4. – Identifying Major Concerns:

How do perceived ecological issues differ between countries, and what common environmental concerns exist?

Research Question 5. Detecting Information Gaps:

What are the most significant gaps in information regarding ecological concerns among individuals in these regions and how can targeted educational campaigns and resources be designed to bridge these information gaps effectively?

Given the profound influence of cultural, economic, and historical differences on environmental practices, this study aims to examine and compare these factors across regions from Germany, the Netherlands, and Poland. By investigating the disparities between age groups and countries, we aim to uncover unique insights into ecological concerns, forms of engagement, and perceptions. This comparative approach will contribute to a more nuanced and comprehensive understanding of climate change awareness and action in Europe, ultimately supporting more effective and inclusive environmental policies and practices.

2. Methods

2.1. Design

Qualitative research broadly refers to a category of research approaches that produce findings without reliance on quantitative measurement or statistical analysis (Corbin, 2015). This includes individual and focus group interviews, participant observation, ethnography, and several other approaches. Traditionally, qualitative methods have been used across a variety of disciplines to describe how things are, although it is still most common in social sciences research. Additionally, it stands out from other qualitative methods as it incorporates elements of other techniques (participant observation and individual interviews), while retaining its specificity and uniqueness (Wilkinson, 1998). This data collection technique consists of posing open-ended questions with inductive checking of answers. The literature emphasizes that the interpersonal and interactive nature of focus groups allows researchers to obtain information that could not be collected from a single respondent and that, due to the indicated interactivity, FGI respondents generate a wider range of views and ideas than could be captured through one-to-one methods (Kidd and Parshall, 2000). FGIs represent a qualitative research methodology that convenes a limited group of participants, typically ranging from six to ten individuals (Ciesielska and Jemielniak, 2017). The purpose of FGIs is to engage in focused discussions on predetermined topics, facilitated by a trained moderator who guides the conversation with the aim of extracting insights, opinions, and perceptions from the participants.

In our research we used an inductive qualitative design to investigate environmental awareness and attitudes toward ecologically friendly behaviors in everyday life among respondents with varying levels of familiarity with the subject, focusing on awareness rather than in-depth knowledge. Inductive reasoning is preferred when there is little knowledge in a given field, and the research process begins with observations and theories are proposed at the end.

The inductive qualitative research method allowed us to provide insights into people's views and actions by collecting information through interviews and observation.

While FGIs offer valuable qualitative insights, their appropriateness is contingent upon the nature of the study and the specific objectives at hand. In this study the FGI approach is appropriate as we were seeking to determine and understand the perceptions of ecological practices in each of the three regions and begin to understand similarities and differences between age groups and regions.

Careful consideration was given to the selection of participants for each FGI, with rigorous criteria employed to align their characteristics with the research objectives. The moderator's role is pivotal, involving skillful direction of the discussion to ensure equitable participation and adherence to the established research objectives. Open-ended and probing questions are strategically utilized to encourage participants to articulate their thoughts and share personal experiences.

The dynamics within the group setting are crucial in FGIs, providing an environment conducive to exploring diverse perspectives and dynamic reactions among participants. Engaging with each other facilitates the expression of emotions and allows the discourse to reveal unconscious content that the participants had not previously considered (sometimes it is useful for them to hear the opinions of others in a small group before forming their own thoughts and opinions). Through moderator-controlled discussion, participants were able to express their opinions, emotions, share their experiences and articulate attitudes toward environmental awareness among people of different ages and from the different EU countries, as well as their active participation in sustainable activities. Through these FGIs it was also possible to obtain in-depth information on sustainable activities and pressing environmental issues, and the differences in respondents' perceptions of them. The data generated from these interviews was inherently qualitative, and the subsequent analysis involved identifying patterns, themes, and insights

derived from the rich discussions.

2.2. Sample

Focus Group Interview research was conducted across three specific European regions: Rheinisches Revier in Germany, Greater Amsterdam in the Netherlands, and Upper Silesia in Poland. Six focus groups, consisting of participants from two age groups, were conducted to ensure a comprehensive understanding of attitudes across the different generations. The age brackets were 20–39 years (Younger Generation) and 40–60 years (Older Generation) (Table 1). The recruitment process was conducted by questionnaire which asked the potential participants to indicate their openness to the issues of ecology and recycling (these were important or very important issues for them). Each region hosted two focus groups, with participants carefully selected by a Polish survey company ("Korporacja Badawcza Pretendent") and coordinated by one of our partners, Wroclaw University of Economics and Business (WUEB). The research conducted in Germany and the Netherlands was commissioned by this company in collaboration with foreign entities. Focus groups were selected to closely match the regional population in terms of gender, education level, place of residence (50% city, 50% village), income, and employment status. However, accurately obtaining respondents for the last two categories proved challenging. All the interviews were performed in local national language by a survey company in the presence of one of the co-authors of this paper and were recorded for future reference.

2.3. Measures

Qualitative data was collected using semi-structured focus group interviews with open-ended questions, using online platforms, allowing for geographically diverse participation while ensuring the safety and convenience of the respondents. All interviews were conducted in the local language. During the interviews of up to 2 h, participants engaged in discussions facilitated by trained moderators, exploring their awareness of ecological and environmental concerns and recycling initiatives. The conversations started with questions regarding the participants' attitudes, beliefs, and perceptions regarding the environmental impact of their everyday choices and their willingness to engage in environmentally friendly efforts. The main questions asked by moderators were:

1. What do you understand about measures to improve the environment? How would you define it?
2. What is environmentally friendly behavior of yours? What do you do to be more environmentally friendly in everyday life?
3. What is environmentally conscious living these days?
4. Are there any practices that make it more difficult to be environmentally friendly, things that may annoy you?

The moderators have also prompted the conversation with some additional questions that varied between interviews, such as:

- "Do you compare what things are made of?"
- "What counterexamples come to mind? What is bad, what should be avoided?"
- "Does a certain behavior sometimes annoy you in this regard? What do you not accept?"

Table 1
Number of participants by region and age group.

	20–39	40–60
Germany	6	8
Netherlands	6	6
Poland	7	6

The FGIs were conducted during May and June 2023. The transcript only includes quotations, without indicating who said what; there are no references to the individuals.

3. Results

Respondents provided a wide range of responses. Transcripts of each session have been retained and quotations from individuals are provided in the following sections. As the recordings are voice only, we cannot attribute specific quotations to any individual. Samples of specific responses from each region and age group are provided in Tables 2–4.

3.1. Germany: younger generation

Note: Refer also to Table 2. The quotations in the table are not linked to specific interviews but are numbered sequentially according to their references in the text.

The respondents discussed a comprehensive list of pro-environmental actions. These actions included waste sorting and facilitating recycling processes (GY1), opting for cycling over driving (GY2), composting plant waste, nurturing gardens with flowers and nectar-producing plants beneficial to bees, cultivating personal herb and vegetable gardens, minimizing packaging during shopping (with a focus on reducing plastic and disposable materials), and supporting local businesses by purchasing regional products (GY3).

The study group also highlighted actions perceived as environmentally unacceptable, annoying, or harmful. These included excessive and unnecessary packaging (GY4), improper disposal of trash and waste in streets or in natural environments (GY5), and the prevalent trend of discarding entire products or significant parts after minimal use. Particularly concerning was the excessive shortening of product life cycles through a pattern of replacement rather than repair of both small, everyday items and larger appliances or vehicles. According to the focus group these are the practices that contribute significantly to environmental degradation.

3.2. Germany: older generation

Participants showcased a diverse array of pro-environmental initiatives ranging from energy-efficient home improvements (GO1, GO2), to conscious reductions in travel (GO3), avoidance of excessively packaged products (GO4), and boycott of specific brands (GO5). Noteworthy was the discerning approach toward purchases, with participants opting for ethically produced items and expressing reservations about products potentially sourced from exploitative labor and environmentally harmful practices (GO6).

Table 2
Quotations from FGIs conducted in Germany.

Germany	Younger (20–39 years)		Older (40–60 years)		Code	Citation
	Code	Citation	Code	Citation		
	GY1	Separating waste is very important.	GO1	We have recently installed triple glazed windows.	GO7	Taking things out of their natural packaging to put them into an artificial one is not okay.
	GY2	Many people go by car to buy small things, instead go by bike or walk.	GO2	We built a solar system on the roof two years ago.	GO8	Packaging is thrown into the forest or in the streets is something I get angry about.
	GY3	We like to shop regionally, like farmers markets.	GO3	Driving the car less, flying less.	GO9	The legislator should ban certain disposable products, like cutlery.
	GY4	What bothers me extremely is the absolute immense plastic waste that is being produced for things such as a banana or an orange that have a natural skin by themselves.	GO4	As little waste as possible in packaging.	GO10	The problem is that the environmentally friendly products are often the more expensive ones.
			GO5	As a matter of principle, we don't buy any products from Nestlé.	GO11	Something with an organic label that can also be faked.
	GY5	It happens so often that there is some kind of trash lying in the street, the trash cans are not being used at all.	GO6	They exploit the environment, take water from poorer countries. I don't always have to choose the cheapest when I know people are being exploited.	GO12	You can hardly find any products that are exclusively "Made in Germany", when you order things, most of it says, "Made in China". Clothes, odds and ends it adds up to long distance transport and packaging.

These challenges and concerns in the pursuit of environmentally conscious living mentioned by the older generation in Germany included the extent of excessive packaging (GO7), inadequate disposal of waste in public spaces (GO8), the abundance of single-use products (GO9), and the perception of eco-friendly items being financially inaccessible (GO10). Additionally, there was a tangible skepticism among German participants, especially older individuals, regarding the credibility of recycling practices and the authenticity of products labelled as “organic” or “BIO” (GO11). A significant concern revolved around lengthy supply chains, aggravating environmental burdens due to transportation and excessive packaging (GO12).

Notably, the research identified subtle differences in pro-environmental attitudes between age groups. While both older and younger generations exhibited environmentally conscious behaviors, the older generation demonstrated a heightened focus on proper disposal methods for old appliances, emphasizing the necessity for transparent and substantiated data from recycling companies. Older respondents, while appreciating the value of recycling, expressed a need for tangible benefits derived from the process, underscoring the importance of concrete outcomes in recycling initiatives.

3.3. The Netherlands: younger generation

Note: Refer also to Table 3. The quotations in the table are not linked to specific interviews but are numbered sequentially according to their references in the text.

Participants demonstrated a commendable commitment to pro-environmental actions, highlighting a broad spectrum of behaviors. These actions include waste segregation and recycling (NY1), avoidance of plastic bags (NY2), preference for second-hand items (NY3), reduction in air travel in favor of public transportation (NY4), limiting meat consumption (NY5), support for circular shops (NY6), mindful clothing purchases emphasizing quality over quantity (NY7), and energy conservation (NY8), and even consciously choosing to not have children (NY9). Their initiatives highlight a conscious effort to minimize their ecological footprint and contribute to environmental preservation. Responders identified several practices considered unacceptable or environmentally harmful. These included products unnecessarily packaged in plastic, reliance on air or car travel (NY10), online shopping habits (NY11), and the purchase of disposable items (NY12). Such practices were recognized as detrimental to the environment, reflecting the participants' discerning awareness of the ecological impact of various activities.

A noteworthy aspect of the respondents' pro-environmental behaviors is the influence of external regulations, particularly evident in waste segregation practices in regions such as Amsterdam. This emphasizes the

Table 3
Quotations from FGIs conducted in the Netherlands.

The Netherlands	Younger (20–39 years)				Older (40–60 years)	
	Code	Citation	Code	Citation	Code	Citation
	NY1	I recycle everything that is possible, glass, paper, plastic, organic, etc.	NY8	Energy consumption is important to me – in winter, I don't heat above 18.5 °C and wear a thick sweater instead.	NO1	I try using as little plastic as possible.
	NY2	A lot of things that are packaged in plastic – that is not environmentally friendly.	NY9	I purposely don't have children, which is environmentally friendly.	NO2	I always try to leave nothing behind when I go to the beach or park and clean up a bit.
	NY3	I always try to buy second-hand when possible.	NY10	For me, the biggest challenge is to fly less, but there are few alternatives. I find it a big problem.	NO3	A lot of initiatives with deposits, etc., which I am happy about.
	NY4	Travelling by public transport and flying less.	NY11	Ordering online instead of buying in the store.	NO4	I don't have a car, so I get around by bike and train. I drive electric myself; I always drive environmentally consciously – electric, of course.
	NY5	I eat less meat.	NY12	Buying disposable items, such as cutlery or stuff from Action [A retail store].	NO5	I buy more expensive shoes made from materials that are better for the environment.
	NY6	I try to buy circular products.	NY13	Waste processing works very well in Amsterdam, so even from the general bin, a lot is separated. The system is better than if we did it ourselves, it works well.	NO6	I don't replace electronic items quickly just to buy new trendy gadgets.
	NY7	I try to buy less, and when I do buy, I pay attention to quality.			NO7	At Schiphol, I recently saw all four bins emptied into one container, what a fake show. Then you start to question why people are being lied to.
					NO8	I find local buying from neighbors less sustainable because people go there by car alone, then a supermarket on a larger scale is more sustainable.

impact of local policies and regulations in shaping individuals' ecological behaviors, underscoring the significance of regional initiatives in fostering environmentally friendly practices (NY13).

3.4. The Netherlands: older generation

Participants demonstrated a keen commitment to pro-environmental actions, indicating a heightened awareness of ecological issues. Their initiatives included reducing plastic usage (NO1), actively cleaning up loose plastic waste to prevent environmental harm (NO2), returning deposit bottles to stores to promote recycling (NO3), embracing eco-friendly transportation modes like bicycles and public transit, engaging in waste segregation practices (NO4), and making conscious choices to buy products crafted from durable materials (NO5) and not giving into latest electronic trends every few years (NO6). Respondents also voiced concerns about the effectiveness of recycling initiatives, especially when all waste is eventually directed to the same bin (NO7). This frustration underscores the need for more transparent waste management systems, ensuring that recycling efforts yield tangible environmental benefits. Additionally, the lack of options for purchasing local products without relying on cars emerged as a significant concern (NO8). This highlights the necessity for accessible, sustainable transportation alternatives and localized purchasing opportunities to reduce carbon emissions associated with transportation.

Both the younger and older generations in the Netherlands demonstrated a commitment to pro-environmental actions, but they emphasize different aspects of sustainable living. The younger generation focuses on conscious consumer choices and reducing ecological footprints, while the older generation places a strong emphasis on waste management and eco-friendly transportation. Both generations share concerns about the environment but manifest them in distinct ways, reflecting their generational perspectives and priorities.

3.5. Poland younger generation

Note: Refer also to Table 4. The quotations in the table are not linked to specific interviews but are numbered sequentially according to their references in the text.

The younger generation expressed a deep skepticism towards the effectiveness of ecological campaigns, perceiving them as mere marketing tactics rather than genuine environmental initiatives (PY1). Their

limited awareness about ecological practices, especially concerning dietary choices (PY2), poses a significant challenge. Despite a desire to be environmentally conscious, they find the process too complex and daunting (PY3). Their concerns also highlight the predominant lack of reliable information and the difficulty in finding credible information sources (PY4).

Furthermore, the younger generation engages in pro-environmental actions that align with their limited understanding. They focus on reducing food waste (PY5) and exploring second-hand clothing options (PY6). Their approach to electronic devices reflects an understanding of investing in quality for durability, showcasing a practical perspective (PY7).

3.6. Poland older generation

Conversely, the older generation exhibited a more proactive approach than the younger generation in Poland, actively participating in environmental initiatives such as waste segregation (PO1), reducing plastic use through personal actions like carrying reusable bags (PO2, PO3), and picking up litter (PO4). They displayed a commendable awareness of local initiatives, like subsidies to replace coal-based heating systems (PO5), and exhibit a willingness to adapt their behaviors accordingly.

Their concerns, however, revolved around the lack of clear guidelines, especially regarding eco-labels on clothing (PO6), indicating a need for more transparent communication from manufacturers. Their proactive measures, such as turning off unused appliances and responsibly disposing of old equipment (PO7), underscore a practical understanding of energy conservation.

While the younger generation expressed skepticism and faced challenges in understanding and implementing sustainable practices, the older generation adopted a more proactive and informed approach to environmental initiatives (Table 4). Both groups have their unique perspectives and areas of concern, highlighting the importance of tailored strategies to engage different generations in sustainable behaviors.

Table 4
Quotations from FGIs conducted in Poland.

Poland	Younger (20–39 years)		Older (40–60 years)	
	Code	Citation	Code	Citation
	PY1	Ecological issues are a great magnet for attracting customers; putting green labels on products is often used for purposes far removed from their original intent. Ecology has become a way to attract customers.	PO1	I started my ecological journey at home by sorting waste, first inside the house and then into the containers outside. It's very important that some products can be reused.
	PY2	I'm not sure if this is eco-friendly because I've heard different opinions, but I heard that eating meat often is destructive due to the entire meat production and farming process.	PO2	I buy loose fruits instead of putting them in bags.
	PY3	We still don't even know how to sort waste correctly, for example, that wet paper can't go with regular paper. It's too difficult and complicated even for people who want to do it. It's not easy.	PO3	I use reusable shopping bags. I always carry one with me, and the one I have has lasted a good two years.
	PY4	It's not easy because there's a lot of disinformation.	PO4	If I'm walking down the street, I pick up litter that I see lying around.
	PY5	In the store, I pick single bananas because no one else wants to buy them and they rot, or wrinkled peppers and I buy products that have a best-before date of today or tomorrow.	PO5	In our city, there is a program to replace heating sources. Many private homes still have coal stoves.
	PY6	I try to limit buying new items in stores and always buy second-hand, for example, on Vinted.	PO6	Eco-friendly clothing has emerged, though I'm not sure how it works.
	PY7	When buying electronics, I try to buy good quality so they last longer" and "I choose home appliances with the best energy rating.	PO7	When I buy appliances like a washing machine or refrigerator, which consume energy, it's worth choosing the most energy-efficient ones, turning them off when not in use.

4. Discussion of the results

4.1. Ecological awareness across countries and generations (RQ1)

The awareness of ecological concerns varies between countries and generations. Each country presented distinctive environmental strategies, potentially reflective of the developmental stage of their respective countries. For instance, in Germany, different age groups display distinct environmental priorities, with the younger generation emphasizing actions like waste sorting and reducing plastic use, while the older generation focuses on energy-efficient home improvements and ethical purchasing. The older German group's commitment to boycotting environmentally detrimental brands highlights the significant influence of consumer choices on environmental awareness. In Poland and the Netherlands, older respondents prioritize responsible waste management, aligning with a shared commitment to address ecological concerns. Conversely, the younger generation in Poland directs its attention towards waste limitation, indicating a unique emphasis on reducing overall waste generation. In the Netherlands, the younger generation introduces a novel perspective by emphasizing population control as part of their approach to environmental responsibility, showcasing

diverse attitudes towards ecological awareness across generations. Notably, older German and both Dutch generations highlighted the importance of reducing car transportation, advocating for the use of public transport or bicycles; however, this view was conspicuously absent in the responses from both the Polish younger and older generations. This underscores either a restricted understanding or a dismissive attitude regarding the environmental impact of transportation. Alternatively, it may reflect differences in sustainable transportation practices and infrastructure development across the countries under study (Szczuraszek and Chmielewski, 2018).

The pronounced emphasis on waste separation among older respondents in Poland and the Netherlands suggests a shared commitment to responsible waste management. Conversely, the younger Polish group's focus on waste limitation underscores a generational shift in environmental priorities, potentially indicative of evolving attitudes towards resource conservation. In Germany, a consistent concern for limiting plastic waste was observed across both age groups, reflecting a pervasive awareness of the detrimental environmental impact associated with single-use plastics.

The distinctive environmental strategies presented by each group may reflect the varying developmental stages of their respective nations. For example, older Polish respondents discussed transitioning from coal furnaces to gas alternatives, addressing a specific aspect of energy consumption prevalent in their region. In contrast, older Germans focused on house insulation as a means to curtail energy use, showcasing a nuanced approach shaped by regional priorities and available resources. Poland's unique position in the energy transformation is a known problem, especially in the context of coal energy culture (Mrozowska et al., 2021). Historically, Poland faced high energy intensity, carbon dependence, environmental degradation, and an outdated electricity infrastructure. Public opinion on abandoning coal is influenced by political and ideological factors and the rhetoric surrounding coal as a national treasure continues from the Communist era. There is a political divide, with right-wing parties supporting coal, while left and liberal groups favor an energy transition and environmental concerns. Despite conflicts, there is consensus on supporting measures for clean energy production in coal-dependent regions (Żuk and Szulecki, 2020).

In the Dutch focus groups, environmental awareness was evident to be deeply ingrained in the culture and policies. The country has a strong commitment to sustainability, with a robust recycling infrastructure, extensive use of renewable energy sources, and a high level of public engagement in environmental issues (KPMG, 2023). Dutch citizens are known for their eco-conscious lifestyles, including cycling and the promotion of green urban planning.

The German groups also exhibit a notable level of ecological awareness. The country is renowned for its strict environmental regulations, investment in clean energy technologies, and a well-developed, cheap public transportation system (Fokuhl, 2023). German citizens often prioritize sustainable practices in their daily lives, and there is a strong emphasis on eco-friendly initiatives across various sectors (OECD, 2023).

Conversely, Poland appears to be facing more challenges in terms of ecological awareness. While there are growing pockets of environmental activism and initiatives (OECD, 2015), the country has been criticized for its heavy reliance on coal for energy production and slower adoption of renewable energy sources (Mrozowska et al., 2021) (Żuk and Szulecki, 2020). Environmental concerns have sometimes taken a backseat to economic priorities in Poland, leading to air and water pollution issues (Poland - Country Commercial Guide, 2024) (Traczyk and Gruszecka-Kosowska, 2020). Raising ecological awareness should be a priority in all countries, but especially in Poland, where much work remains to be done.

Overall, the variations observed in the awareness of ecological concerns among different age groups in Germany, the Netherlands, and Poland highlight the influence of cultural and generational factors on

environmental priorities and underscore the need for tailored strategies to address these varied perspectives.

4.2. Measuring participants engagement in sustainable activities in everyday life (RQ2)

Citizens' engagement in sustainable activities varies significantly across age groups and countries. In Poland, younger individuals tend to be skeptical of ecological campaigns, indicating lower participation levels in sustainable activities within this demographic. Conversely, the older generation in Poland actively engages in waste segregation and plastic reduction, showing higher levels of commitment to environmental sustainability. In the Netherlands and Germany, both younger and older generations exhibit strong participation in sustainable activities. There is a unified and widespread engagement in these countries, with both age groups actively involved in pro-environmental actions. This contrasts with the distinct difference in engagement levels between age groups in Poland.

In Poland, the younger generation's engagement in sustainable activities is limited due to skepticism towards ecological campaigns. In contrast, the older generation in Poland actively participates in waste segregation and plastic reduction. In the Netherlands, both younger and older generations emphasize waste segregation and support eco-friendly transportation methods. In Germany, there is a shared concern across age groups about excessive packaging and improper waste disposal, leading to common environmental awareness and active engagement in these issues. This indicates that in the Netherlands and Germany, sustainable activities such as waste segregation, eco-friendly transportation, and reducing packaging waste are prevalent across all age groups, unlike in Poland, where significant age-related differences exist.

4.3. Pressing ecological issues identified in interviews (RQ3)

One of the most common concerns, raised by the majority of respondent groups, except the young Dutch, was greenwashing and the inadequate treatment of municipal waste. The older German group also emphasized the economic challenge of environmentally friendly choices being often more expensive. Governmental intervention such as a CO₂ tax could solve those issues and make the pro-ecological choices not only more affordable but also easier to understand. Furthermore, the younger German respondents expressed discontent with goods being designed for replacement without affordable repair options. This concern suggests a growing awareness of the environmental impact of planned obsolescence and calls for a reevaluation of product design and manufacturing practices, highlighting an urgent need for regulations, such as Right to Repair (European Commission, 2023a) and Green Claim Directive (European Commission, 2023b) to be imposed on the producers immediately.

Younger Dutch respondents voiced concerns regarding the need to alter comfortable lifestyles, particularly in the context of air travel reduction, indicating the challenges associated with transitioning to more sustainable living. Many agree that changes in lifestyle are necessary to combat climate change, but they are often hesitant to make significant sacrifices. People may believe that they can reduce consumption without impacting their standard of living (Patchen, 2006). These concerns reflect the tension between individual choices and the broader societal shifts required for meaningful environmental impact. Similarly, the younger Polish generation voiced frustration over the paradox of personal environmental restrictions in contrast to the seemingly unchecked behaviors of the affluent, with one participant stating, "I cannot use a plastic straw, but rich people fly daily in their private jets", highlighting the contrast between personal environmental restrictions and the carefree lifestyle of the wealthy. Another concern raised by a Dutch respondent was of the limitations of a small country's impact on global issues; this underscores the importance of international cooperation and shared responsibility. This type of concern is not

isolated. The ethical debate surrounding individual responsibility for reducing carbon footprints in the context of climate change as well as the argument of individual contributions being too small to significantly impact the global environment has been investigated. The ethical research emphasizes the interconnection of global actions in the context of climate change and highlights that small individual actions collectively contribute to significant harm due to the conditions of globalization and interconnectedness (Fraginière, 2016).

The unique environmental strategies adopted by each group reflect the diverse developmental stages of their respective nations. Differences in perceptions of pressing ecological issues underscore the necessity for tailored approaches to address specific environmental challenges in each country and among different age groups. However, it also reveals that many challenges are common among respondents, suggesting that a significant portion could be alleviated through appropriate regulations and the imposition of pricing measures.

4.4. Major concerns mentioned by interviewees (RQ4)

The identified significant gaps in information regarding ecological concerns among individuals in specific age groups and countries are as follows:

- In Germany, older individuals express skepticism about recycling practices and question the authenticity of "organic" products. This skepticism emphasizes the need for clearer communication and education regarding recycling processes and product labelling.
- In the Netherlands, concerns are raised about the absence of clear guidelines on eco-labels, highlighting the necessity for standardized and transparent information on eco-labelling to guide environmentally conscious consumer choices.
- In Poland, the younger generation lacks awareness about waste sorting, underscoring the necessity for enhanced education and awareness programs to bridge this informational gap.
- Across the groups, there are shared apprehensions about greenwashing and inadequate waste treatment. This underscores a broader need for transparent and reliable information in environmental initiatives to foster trust and ensure the effectiveness of sustainability practices.

Addressing these informational gaps is essential for promoting informed decision-making and active participation in sustainable practices among individuals in the specified age groups and countries.

4.5. Summary of the key insights from the interviews

Across Germany, the Netherlands, and Poland, there are notable differences in ecological concerns by age group (Table 5).

Germany shows a strong emphasis on waste segregation and energy use, with a particular concern about product obsolescence and greenwashing affecting consumer behavior.

The Netherlands focuses on recycling, sustainable transportation, and waste cleanup, with specific concerns related to lifestyle changes and waste management practices.

Poland highlights issues with food waste, socio-economic disparities in ecological responsibility, and greenwashing, with a focus on practical waste management and the transition from coal to other energy sources.

These differences reflect varying regional priorities and challenges in addressing environmental sustainability.

5. Identifying of information gaps in interviewees' responses (RQ5)

The focus groups addressed numerous valid environmental concerns (Table 5), such as:

Table 5
Summary of FGI findings per country and age group.

Country	Age Group	Most Commonly Mentioned	Commonly Mentioned	Unique	Biggest Concern
Germany	20–39 years	● Waste segregation	● Less plastic packaging	● Reusing	● Products are designed to break or be replaced as a whole and not repaired
	40–60 years	● Limiting energy use: less driving, flying, renewable energy, etc.	● Less plastic packaging	● Insulation for less energy usage	● Environmental friendly is more expensive while should be cheaper
The Netherlands	20–39 years	● Recycling what is possible	● Greenwashing	● Boycotting some brands	● Need to change lifestyle, e.g., flying less
	40–60 years	● Cleaning up waste from surroundings	● Transport: biking, walking, train, instead of a car	● No children	
Poland	20–39 years	● Limiting food waste	● Transportation: less driving and if so, electric	● Buying good quality clothes, more sustainable	● Separated waste not treated correctly by companies (mixed together)
	40–60 years	● Waste collection and correct disposal	● Buying good quality goods, for longer use	● Hypocrite – little man does the job, wealthy people do not and cause more pollution	● Greenwashing, ecology for sale but now verified
			● Less plastic	● Coal furnaces being replaced by other energy sources, mainly gas	● Lack of reliable and simple information

- reducing consumption – decreasing the physical intake of goods and services, including adapting to smaller living spaces;
- limiting packaging usage – promoting the reuse of packaging materials and generating less waste;
- adopting renewable energy – incorporating technologies such as solar panels and heat pumps into energy sources; and
- many others as mentioned previously.

However, a significant information gap regarding the everyday behaviors and choices that can have the most impact on the environment as described in literature (Patchen, 2006) (Fragnière, 2016) (Koide et al., 2021) could be observed. While respondents did mention some relevant aspects, there were crucial actions with potentially huge environmental impact that were overlooked. Following are examples of aspects that were either not mentioned by a specific group or country, or inadequately understood by the respondents, such as transportation choices, dietary choices, or fashion choices. By highlighting these overlooked yet impactful actions, it becomes clear that there is a need for better education and awareness on the environmental benefits of these everyday behaviors.

5.1. Transportation choices – with a primary focus on reducing car usage and minimizing air travel

While respondents from the Netherlands and Germany deliberated extensively on this topic, it is surprising that neither group in Poland even mentioned this crucial aspect.

The growing global population, coupled with rapid urbanization, has led to an unprecedented surge in transportation activities. Transportation is a vital component of modern society, facilitating mobility, trade, and economic growth. However, the predominant reliance on fossil fuels, inefficient transportation systems, and lack of consideration for environmental consequences have led to the escalation of greenhouse gas emissions. The lack of consideration for alternative modes of transport, such as cycling or walking, exacerbates the problem.

Surprisingly, data from ourworldindata.org (Wei et al., 2007) reveals that in 2019, the number of air travel trips per capita for the Netherlands, Germany, and Poland were 1.7, 1.35, and 0.53, respectively. Similarly, according to statistical information from Odyssee-Mure (2023) Polish citizens covered by car 7784 km per capita in 2019, while these figures were 10152 km, and 13152 km for Dutch and German citizens, respectively. Although the Polish respondents did not explicitly emphasize transportation as a significant factor in pro-environmental practices, their overall travel frequency is noteworthy. Specifically, by plane they travelled three times less frequently than Dutch respondents and by car two times shorter distance than Germans. These numbers are evidently influenced by economic status, income distribution among citizens, and respective petrol prices in those countries (Nikolov, 2022). This fact strongly emphasizes that imposing a (relatively) higher price on a product has a more substantial impact on human pro-environmental behavior than awareness and self-control. This finding serves, therefore, as another rationale supporting the idea that policy adjustments such as increase of excise duty on energy under the European Energy Taxation Directive (“Restructuring the Community framework for the taxation of energy products and electricity,” 2003) which has, surprisingly, not changed since 2003, prompting changes in pricing which are the most effective tools for promoting pro-environmental behaviors.

5.2. Dietary choices – especially limiting meat and dairy consumption

Our research clearly indicates a significant lack of public awareness of dietary choices impact on the environment, especially in Germany, where not a single participant from both the younger and older generations mentioned dietary choices as environmentally important. This awareness gap is also prevalent among older generations in all countries

studied. The issue was only brought up by the younger Dutch generation, and one individual from the younger Polish generation touched on the subject, however, expressing doubts and admitting uncertainty about its environmental significance.

Meat production and consumption are integral aspects of global food systems, catering to the nutritional needs of billions of people. However, the environmental repercussions of these practices remain largely underestimated (Clark et al., 2019). Meat production, particularly livestock farming, contributes significantly to greenhouse gas emissions (Gaillac and Marbach, 2021) (Fan et al., 2022). Human activities utilize over 50% of the planet's available freshwater runoff, and agriculture alone accounts for about 70% of this consumption. Livestock plays a substantial role in agricultural water use, contributing to 38% of global crop water consumption (Kim et al., 2020). In fact, approximately 10–12% of global greenhouse gas (GHG) emissions, measured in carbon dioxide equivalents (CO₂eq), are attributed to agriculture. Agriculture is a significant anthropogenic source of atmospheric methane (CH₄). Additionally, carbon dioxide (CO₂) emissions arise from farming activities involving the use of fossil fuels. Consequently, GHG emissions from the agricultural sector play a substantial role in global warming, contributing to serious environmental challenges (Arunrat et al., 2022).

Despite these facts, public awareness remains limited, hindering informed decision-making: respondents from all demographic groups have asserted that their grocery shopping practices exert a notable influence on the environment, nonetheless, reduction of meat consumption was not seen as one of the major factors. The great lack of understanding the influence of meat production and consumption (Ritchie, 2020) on the environment poses a significant challenge to sustainable development. While the younger generation exhibits a slightly higher level of awareness, a substantial gap in understanding persists. Addressing this gap necessitates concerted efforts in education, outreach, and policy formulation. By empowering the public, especially the youth, with accurate information, we can foster a global consciousness that drives responsible choices, paving the way towards a more sustainable future.

5.3. Fast fashion trends

The conducted surveys also indicated a conspicuous lack of awareness among participants about the environmental implications of their fashion choices. This aspect was only mentioned by one participant from the younger Polish generation and one from the older Dutch generation.

Fast fashion, characterized by rapid production cycles and low-cost, disposable clothing, has witnessed a meteoric rise, transforming the global fashion industry (Bhardwaj and Fairhurst, 2010). The expansion of fast fashion in recent decades has led to a surge in textile waste, carbon emissions, and resource depletion (Niinimäki et al., 2020). The fashion industry has been designated by the United Nations as the second most environmentally harmful sector. It contributes to 8% of total carbon emissions and 20% of global wastewater. Remarkably, the fashion industry alone surpasses the combined carbon emissions from international flights and shipping. Additionally, it consumes approximately ninety-three billion cubic meters of water each year. Fast fashion, characterized by rapid production, cheap labor, high volumes, and low-cost materials, is the second most polluting industry globally. The production of waste, particularly wastewater and textile waste from the fast fashion industry, contributes significantly to environmental degradation, including air and water quality reduction. The clothing and textile sectors, notorious for their impact, outsource about ninety percent of global clothing production to low-to middle-income countries, where cheaply produced, low-quality items are sold at low prices (Bailey et al., 2022). The current business model in the fashion sector, characterized by high production and sales, fast manufacturing, low product quality, and short product life cycles, results in unsustainable consumption, substantial waste, and environmental impacts.

To address these issues, a shift in production processes and

consumption attitudes is necessary. Key strategies for creating a sustainable fashion paradigm include limiting growth, reducing waste, and promoting a circular economy (Sahimaa et al., 2023). Moreover, educating consumers about the negative impact of fast fashion on climate change and the environment, promoting and supporting sustainable clothing brands and products, and implementing policies that encourage more sustainable production and consumption practices are essential steps to address this issue (Anisah et al., 2024).

Despite the mounting evidence highlighting these issues, there exists a profound lack of willingness among consumers to mitigate the environmental consequences despite the significant information gap, especially among the young generation (Teerawattananon et al., 2021). This lack of willingness to alter consumption patterns hinders the transition towards sustainable fashion alternatives. One option to combat this problem would be introducing a serious Extended Producer Responsibility (EPR) code making fashion brands responsible for the entire lifecycle of their products, including recycling and disposal which in turn would encourage more sustainable design and production practices as proposed by the European Commission (European Commission, 2023c).

6. Recommendation

Sustainable Development Goal 12 (SDG12), one of the seventeen goals established by the United Nations as part of the 2030 Agenda for Sustainable Development, focuses on “Responsible Consumption and Production” explicitly outlines the objective of ensuring that, by 2030, people worldwide possess pertinent information and awareness for fostering sustainable development and adopting lifestyles in harmony with nature. Regrettably, the current situation indicates a significant deficiency in meeting this goal (United Nations, 2015).

Another goal of SG12, which aims to rationalize inefficient fossil-fuel subsidies, has unfortunately not yet made significant progress. Many countries have struggled to take concrete actions, despite the clear recognition of the need to remove market distortions caused by these subsidies and to reflect their environmental impacts. The persistence of harmful subsidies continues to encourage wasteful consumption of fossil fuels, exacerbating environmental issues such as climate change and air pollution. The challenge lies in finding a balance that addresses these environmental concerns while also safeguarding the development needs of developing countries and protecting vulnerable communities from adverse impacts. As of now, the international community has not been successful in effectively phasing out these subsidies and achieving this crucial goal.

Raising public awareness about the environmental consequences of their daily choices is crucial, as we see many information gaps across the countries as well as generations studied in this work. Research shows that individuals who are more aware of the environmental impact of their lifestyle are more willing to reduce it, even if it means paying more for certain products (Schleich and Alsheimer, 2024). Educational initiatives, government policies promoting sustainable lifestyle and improving community engagement can, therefore, instigate behavioral change. In essence, it should not only highlight the magnitude of consequences but also empower individuals and institutions with tangible steps and a holistic understanding of the issue through a collaborative and interdisciplinary approach (Perga et al., 2023).

Our research reveals that, alongside the need to tackle information gaps, the primary determinant shaping our daily decisions is, predictably, the affordability of environmentally friendly options. Individuals across all demographics have underscored the financial and cognitive challenges associated with prioritizing eco-conscious choices in their everyday lives. Governments are expected to allocate subsidies towards sustainable alternatives, thus making them more accessible, while also curbing greenwashing and furnishing consumers with transparent information regarding the environmental impact of various products. Taking immediate action is crucial for enhancing environmental

awareness and fostering positive change, particularly in transportation, where strategies involve redirecting fossil fuel subsidies, investing in accessible public transit, implementing carbon pricing mechanisms, supporting local goods, and reducing air travel. Additionally, addressing the lack of information about the environmental impact of meat production requires promoting meat alternatives through informative campaigns, educational programs, diverse food options, subsidies, incentives, and initiatives in schools and hospitals, along with clear product labelling. The multifaceted approach to fast fashion's environmental impact and consumer reluctance involves education, advocacy, policy interventions, industry accountability, and promoting circular economy models. To combat widespread greenwashing, governments must promote reliable information through public certification programs, mandate transparency in reporting environmental practices, allocate resources for consumer education, enforce stricter regulations, impose fines, and require businesses to undergo regular environmental audits.

7. Limitations of the study and opportunities for further research

The use of focus group interviews as a qualitative research method presents several inherent limitations that are important to acknowledge when interpreting the results of this study. While focus groups offer valuable insights into consumer attitudes and behaviors, several factors constrained the breadth and applicability of our findings (Rabiee, 2004).

Sample Size and Representation: The study involved a small sample, with up to eight participants per focus group, which may not capture the full range of consumer behaviors across different countries or demographics. Additionally, participants were chosen for their interest in ecology and recycling, introducing selection bias and limiting the generalizability of the findings.

Cultural and Regional Differences: Interviews were conducted in native languages and then translated into English, potentially losing nuances in consumer behavior and attitudes.

Group Dynamics: Focus group dynamics can be affected by dominant personalities, which may overshadow quieter participants. Additionally, participants might give socially desirable responses rather than their true feelings.

Age-Based Grouping: Grouping participants by age may overlook significant differences within age groups, potentially missing inter-generational influences on consumer behavior.

Data Collection and Interpretation: The qualitative nature of focus group data means analysis is subjective, leading to potential biases. The structured format and time constraints might limit exploration of complex behaviors, affecting the depth of understanding.

Analytical Approach: We used descriptive qualitative analysis instead of thematic or content analysis due to the interviews being in native languages. Translating statements could introduce errors, so a simpler analysis approach was chosen to avoid translation issues.

Temporal Relevance: The study provides a snapshot of consumer behaviors and attitudes at a specific time, which may not reflect evolving trends or long-term changes.

Logistical Challenges: Consistency in focus group moderation across regions is challenging, which may impact data comparability and introduce inconsistencies.

Despite these limitations, the focus group method provided valuable insights into consumer environmental awareness and sustainable behavior. The results, including identified information gaps, offer a solid foundation for designing subsequent quantitative research.

8. Conclusion

This study provides valuable insights into the complexities of pro-environmental behaviors, shedding light on both positive actions and concerning trends among respondents. By understanding the factors that

influence these behaviors and perceptions, policymakers and environmental advocates can develop targeted strategies to encourage sustainable practices. Moreover, the findings emphasize the need for comprehensive awareness initiatives, ensuring that individuals are well-informed about a broader range of pro-environmental actions, leading to a more environmentally conscious society.

This study illuminates the disparities in ecological awareness and actions within different age groups, and more so between countries. While the younger generation displays a willingness to contribute, they are hindered by a lack of accessible information and understanding. In contrast, the older generation, while actively engaging in pro-environmental activities, faces challenges related to ambiguous eco-labels and a need for more widespread information dissemination.

Drawing comprehensive conclusions for an entire country based on our limited interview groups is not feasible. Nonetheless, our findings suggest a notable disparity in ecological awareness among Germany, the Netherlands, and Poland, with the Netherlands demonstrating a leading position in environmental consciousness, while Poland appears to lag behind Germany and the Netherlands.

Understanding these varied perspectives is crucial for developing targeted educational programs and communication strategies. Bridging the information gaps and fostering a shared understanding of environmental issues could lead to a more unified, effective, and impactful approach to ecological conservation in Poland.

Moreover, the research highlights the necessity for transparent communication, regulatory measures, and accessible eco-friendly options to encourage widespread adoption of pro-environmental actions. By understanding these complexities and tailoring interventions accordingly, policymakers and advocates can foster a more environmentally conscious society, bridging generational gaps and promoting sustainable living for all.

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CRediT authorship contribution statement

Diana D. Boermans: Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization. **Agnieszka Jagoda:** Writing – review & editing, Writing – original draft, Validation, Methodology. **David Lemiski:** Writing – review & editing, Project administration. **Jana Wegener:** Writing – review & editing, Supervision, Project administration, Conceptualization. **Malgorzata Krzywonos:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Conceptualization.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used Chat GPT to grammar check and re-write some sentences. After using this tool/service, the author(s) reviewed and edited the content as needed and take (s) full responsibility for the content of the publication.

Declaration of competing interest

There is no conflict of interest.

Data availability

Data will be made available on request.

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