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What influences public support for plastic waste control policies and green consumption? Evidence from a multilevel analysis of survey data from 27 European countries

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Abstract

Purpose: This study investigates the influence of individual- and country-level factors on citizen members' attitude and actions regarding plastic waste. At the individual level, it assesses the influence of the diversity of environmental news use from traditional media, online social networks, and other internet sources on the public's support for policy and green behaviors related to plastic waste.

Design/methodology/approach: We utilized secondary survey data collected from 27 European countries by Eurobarometer.

Results: The two-level analysis show that several individual factors including gender, age, political ideology, risk perception, and most importantly diversity of sources in *environmental news use*, from all three types of media sources, was positively associated with participants' policy support and green behaviors related to plastic waste. This research also found the influence of several country-level variables on green behaviors toward plastic waste.

Implications: When assessing support for plastic waste control, various factors at both levels (i.e., country and individual) need to be considered to mobilize the public.

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Findings suggest extending the theoretical model of social cognitive theory to include more country-level factors especially in cross-national comparison.

Originality/value: This study shed lights on understanding factors that could influence public policy support and green behaviors with regards to plastic waste.

Keywords: green consumption; media effects; multilevel analysis; news consumption; plastic waste; risk perception; social cognitive theory

The rapid increase of the world's population and acceleration of consumerism over the past century have posed numerous challenges to the environment (e.g., exhausting natural resources, escalating carbon dioxide emission) (Koh and Lee 2012). Of these challenges, plastic pollution has become one of the most pressing issues (Borrelle et al. 2020). According to the World Bank (2021), global plastic production had accumulated by more than 16,500% from 47 million tons in 1960 to a total of 7.82 billion tones in 2015, with about 60% of that plastic ending up in landfills or the natural environment (Ritchie and Roser 2018). Excessive use of plastic has threatened the planet, polluting the ocean as well as freshwater ecosystems globally, and killing various wildlife species (Latinopoulos et al. 2018). The United Nations' Environment Program (2018) has warned that if the current trend of plastic consumption and waste continues, by 2050 oceans could contain more plastics than fish.

Much scholarly attention has been given to find ways to raise awareness of plastic pollution and promote pro-environmental behaviors to reduce plastic waste (Soares et al. 2021). Academic studies have also tried to identify factors that influence pro-environmental behaviors such as participation in campaigns to advocate for changes related to eco-friendly consumption policies (Latinopoulos et al. 2018). So far, most studies have investigated individual factors (Eagle et al. 2016; Khan et al. 2019; Prakash and Pathak 2017) but a few have investigated public attitudes toward plastic waste and recycling behaviors cross-nationally (Davison et al. 2021; Harring et al. 2019; Wang 2017). Previous scholarship has pointed out the importance of information distribution in influencing public attitudes and behaviors (Bandura 1962, 1999). However, less is known about the link between diversity of environmental news and public opinion about plastic waste. The aim of the current research is to help fill this void.

Using survey data from 27 countries in Europe, the current study investigates individual and country-level factors that influence people's support for policies to control plastic waste and their green consumption behaviors. Importantly, this research sheds light on the influence of the diversity of environmental news sources on public members across the European continent. This study draws from the literature of social cognitive theory (Bandura 1963), social norms (Cialdini et al. 1990), and environmental risks (Bodemer and Gaissmaier 2015; Slovic 2000) to understand

factors that affect public members in a cross-national context. This study also makes practical contributions by providing insights about how to motivate people to take pro-environmental actions.

1 Literature review

1.1 Social cognitive theory

Social cognitive theory (SCT), which started as social learning theory, explains the influence of a person's social-environmental context and subsequent learning and behaviors (Bandura 1986). Learning, according to Bandura (1986), is not a one-way activity, but an active process of observation, practice, and adjustment. Introspection occurs when individuals recognize their own psychological processes, which undergirds the relationship between social-environmental factors and subsequent motivations and behaviors (Nabi and Prestin 2017). For SCT, learning is a dynamic process where an individual modifies their behavior based on the interplay of external forces and individual factors (Bandura 1965; Nabi and Prestin 2017).

SCT provides a comprehensive theoretical model for understanding human cognition, including attitudinal and behavioral effects, in the context of social learning (Nabi and Prestin 2017). Because of its broad applicability, SCT has been used across domains in behavioral research, including neuroscience (Fuhrmann et al. 2014; Reardon 2014), criminology (Burgess and Akers 1966; Pfohl 2009), developmental psychology (Miller 2016), and media violence (Anderson and Bushman 2001). Within the context of environmental issues, psychologists have pointed out the relevance of SCT for understanding pro-environmental attitudes and behaviors (Sawitri et al. 2015). Environmental psychologists as well as marketing and media scholars have adapted the theory to understand how to intervene and promote human behaviors that are less harmful to the environment (Phipps et al. 2013; Sawitri et al. 2015).

1.2 Pro-environmental behaviors

Pro-environmental behavior consists of several forms of actions to mitigate or reduce harmful ecological impacts, for instance, through environmental activism, non-activist behavior in the public-sphere, private environmentalism, and organizational environmental behaviors. Organizational behavior is one of the core themes of ecological modernization academia, which consists of environmental management and policies; while private/personal environmental behaviors reflect the

everyday practice of environmental protection performed by individuals of the private sphere (Stern 1999). The private sphere's pro-environmental behavior can be seen through recycling, energy conservation, litter control, consumer choices, modes of travel, home design decisions, green consumption, and planting trees. The public sphere of pro-environmental behavior includes participation in environmentally friendly demonstrations, membership in environmental protection groups, petition-signing, or financial support for environmental activities (Balzekiene and Telesiene 2012).

1.3 SCT and media effects

In applying SCT to mass media effects, exposure to abstract or symbolic information is foundational for learning, and exposure to mediated information is increasingly necessary for audiences to make sense of the world (Bandura 2001; Lingwood 1971). Put simply, media can facilitate the delivery of information, which aids observational learning, enhances self-efficacy, and motivates relevant attitudes and behaviors (Nabi and Prestin 2017).

Bandura (2003) contended that the media exert influence on psycho-social changes through dual pathways. One pathway is through direct influence on behaviors through informing, enabling, motivating, and guiding individuals to act, and the other is by influencing audience members who can subsequently serve as influencers linked to social networks and communities where interpersonal discussions and negotiations occur. Studies have shown that both traditional and digital media can also influence pro-environmental behaviors, or actions that mitigate negative or harmful ecological impacts (Adams and Gynnild 2013; Chung et al. 2020; Han and Xu 2020). Traditional mass media effects have predicted pro-environmentalism attitudes, green purchasing, and civic engagement behaviors (Ho et al. 2014). For example, researchers examined exposure to 11- to 12-min pro-environmental messages, which were either modeled or discussed, on two home renovation shows on the HGTV network, and compared them to control messages with neutral scenes derived from the same programs (Rhodes et al. 2016). Findings showed that the programs' messages reinforced pro-environmental attitudes through increased attitude accessibility, meaning that the shows were effective in persuading participants who already held congruent attitudes, rather than attitudes that were against environmental preservation. Attitude accessibility fully mediated the relationship between the programs' messages and intentions to perform the pro-environmental behaviors.

Other studies have found that media exposure containing environmental messages can elevate levels of concern for the environment while increasing personal

responsibility to the environment; with personal responsibility mediating the relationship between concern and pro-environmental behavior (Liu and Li 2021). The same study revealed that exposure to social networking sites also increased levels of personal responsibility, however, they also diminished levels of concern for the environment, suggesting possible differential effects between traditional and social media sources. Findings from other research have shown public affair news on television and natural documentary films can predict pro-environmental behavior (Holbert et al. 2003); and print and online newspapers can predict environmental information-seeking behavior (Zhao et al. 2011). Media exposure has also shown significant relationships with different aspects of environmental cognition, regardless of environmental value, attitude, and intention mechanism (Lee 2011). These findings lay the groundwork for further investigation into whether the diversity of environmental news sources would exert any influence on people's pro-environmental behaviors, under the SCT framework.

1.4 Diversity of environmental news sources

Rapid developments of different digital platforms have changed how audiences across the world consume news. Besides traditional news outlets (i.e., newspapers, TV channels, radio shows, etc.), news now reaches audiences via multiple new platforms. Of those platforms, online social networks, which have seen increasing penetrations, have gradually become regular news sources for many internet users (Park et al. 2021). For example, results from a 2018 survey reveal that in six out of the eight Western European countries surveyed, more than 50% said they ever got news from social media. Also, in the same survey, younger adults are more likely to seek news from social media sources, which indicates how important the role of these new platforms in the news media landscape (Pew Research Center 2018).

Apart from all the hypes about surging accessibility for news users, concerns regarding how disruptive online social networks and other online sources can be to the whole information environment and to news consumption abound. The rampant spread of hate speech, misinformation, and other types of harmful content on social media and online platforms have raised concerns among tech companies, academics, and policymakers (DePaula et al. 2018). Scholars have also attributed the decline in news consumption to the proliferation of social media and online platforms (Poindexter 2012). Others have, however, argued that multi-platform use could lead to exposure to diverse news sources (Guo and Chen 2022). Ha et al. (2018) theorized the use of diverse news platforms, including it in their conceptual model, which indicates that using a variety of platforms for news represent some level of news engagement.

The current study focuses on the diversity of environmental news sources from traditional media, online social networks, and the use of non-social network online environmental news as factors that may influence policy support for waste management and green consumption practices. Specifically, plastic waste management includes plastic waste generating and recycling, and the policy environment in which these behaviors take place. Green consumption (i.e., purchase of green foods, clothing, green living and travelling) is a shift from traditional ways of purchasing and consuming material to a more “ecological model” that “seeks to minimize the negative impacts of individual behaviors on the ecological environment while meeting human needs” (Wang et al. 2021: 1).

Previous research has found evidence of diversity of news sources on civic participation. For example, Diehl et al. (2018, 2019) found that multi-platform use for news is positively associated with alternative modes of political participation (i.e., online political engagement, joining protests, lifestyle politics, and offline political groups/associations). More recently, findings of a study by Waeterloos et al. (2021) revealed that multi-platform news use influences people’s SNS participation and volunteering. The aforementioned review provides the rationale for an assumption that the diversity of platform use for environmental news may affect respondents’ policy support and green consumption. Thus, this study hypothesizes that:

H1: Greater diversity of environmental information sources from traditional media will be positively associated with policy support related to plastic waste management (H1a) and green consumption (H1b).

H2: Greater diversity of environmental information sources from online social network will be positively associated with policy support related to plastic waste management (H2a) and green consumption (H2b).

H3: The use of environmental information sources from non-social network online media will be positively associated with policy support related to plastic waste management (H3a) and green consumption (H3b).

1.5 Injunctive norms

The concept of social norms overlaps with SCT, as people tend to use norms or social rules as guideposts for self-regulating their goals and behaviors. Social norms, including descriptive norms and injunctive norms, have been examined in behavioral research for decades (Cialdini et al. 1990). Injunctive norms refer to the “perception of what most people approve or disapprove” (or the norms of “ought”) (p. 203). Injunctive norms usually apply to whether the activity will be approved by a

social group and, therefore, carries social consequences (Han and Cheng 2020). Social norms have been used in research on behavioral changes in public health, especially the excessive uses of alcohol (DeJong et al. 2009), and risky driving behavior (Harith and Mahmud 2020).

More recently, social norms have been used to understand pro-environmental behaviors in different countries. Researchers in China, for example, used surveys to examine the effects of norm perceptions on pro-environmental behaviors stimulated through mass media, including traditional media and social media outlets (Han and Cheng 2020). Han and Cheng (2020) posited that mass media exert influence on pro-environmental behaviors such as recycling and discussing environmental issues with relatives and friends by affecting their perceptions of risk, or assessments of harmful impacts to the environment. Findings confirmed that traditional and social media exposure and norm perceptions affected pro-environmental behaviors. However, differences emerged between types of media, with traditional media negatively moderating the relationship between injunctive norm perception and pro-environmental behaviors, and social media positively moderating the relationship between subjective norm perception and pro-environmental behaviors.

In short, when social norms align with an individual's self-assessment about their ability to take an action, they can serve as powerful sources of influence and play an important role in human decision-making and behaviors (Thøgersen and Grønhoj 2010; van der Linden 2013). This study hypothesizes that:

H4: Stronger injunctive norms will predict policy support related to plastic waste management (H4a) and green consumption (H4b).

1.6 Environmental issues and risk perception

Plastic pollution started more than 70 years ago with the invention of the first plastics, or manufactured items including packaging and products that contain a high molecular weight of organic polymers. While durable for use during their service life, plastics are highly resistant to degradation lasting anywhere from a few hundred to 1,000 years, littered and buried in land, and carried to marine environments where they can aggregate and disperse in oceans and seas. Discarded plastics and fragments can clog drains and worsen flooding, degrade air quality from open dumps, contaminate water sources, and be ingested by an estimated 660 different organisms which causes major damage to them (Lebreton and Andrady 2019). In 2016, approximately 330–393 million metric tons of plastic were produced globally, which also required fossil fuel extraction for production and associated carbon emissions during the process. Yet country-level recycling rates are low,

including recycling in the United States where only 9.4% of discarded plastics are recycled (Lebreton and Andrady 2019).

In 2017, 87% of European respondents to the Eurobarometer Survey expressed concern about the impacts of plastic products on the environment, although responses were only measured through a single item (Dilkes-Hoffman et al. 2019). In Australia, researchers conducted a nationally representative survey to understand public attitudes toward plastics as an environmental issue (Dilkes-Hoffman et al. 2019). Findings showed that despite most respondents viewing plastics as serious environmental threats and wanting to reduce their own plastic use, consider alternatives, and support measures to reduce plastic waste, these attitudes were not significantly related to pro-environmental actions.

Scholars have recently examined how plastics, and more specifically microplastics, have transformed from issues into risks through a comparison of peer-reviewed scientific publications, and online news articles from media outlets with broad readerships in the United States and United Kingdom (Völker et al. 2019). For that study, risk was conceptualized as toxicological exposure and hazards from microplastic waste. Findings showed that many of the scientific articles referred to risks as hypothetical and uncertain, yet existing and requiring additional research for a more complete understanding. Compared to the scientific publications, the online news articles framed risks associated with the presence of microplastics in a more definitive way as harmful to humans and animals, and highly probable without referencing the scientific knowledge gap about the probability of harm (Völker et al. 2019).

Others have approached the question of risk perceptions related to plastic pollution using inductive qualitative methods to understand broader context behind consumer awareness of single-use plastic packaging, i.e., beyond environmental concerns and willingness to purchase substitutes (Rhein and Schmid 2020). Interviews conducted with 124 participants, who were also German consumers, revealed a broad recognition of single-use plastic packaging as prevalent and as waste and pollution (i.e., threatening oceans). Participants attributed responsibility for plastic waste problems to continents such as Africa and Asia, yet reported that their home continent (Europe) and country (Germany) were not similar violators. These results suggest potential differences in how citizens of different countries perceive themselves and their home country in relation to other countries in addressing the issue of plastic waste.

H5: Respondents' greater risk perception of plastic waste will predict their support for policies on plastic waste management (H5a) and green consumption (H5b).

1.7 Attitude toward environmental protection

Extant studies have considered social psychological factors such as environmental knowledge, environmental attitudes, and attitudes toward environmental behaviors with different pro-environmental behaviors (Aral and López-Sintas 2020). Aral and López-Sintas (2020) analyzed data from the 2017 Eurobarometer and found that behaviors such as eco-friendly purchasing, public transportation use, and reduced resource consumption were predicted with the greatest variance through multilevel regression models containing the aforementioned-social psychological variables. Analyses showed that different combinations of variables were significantly associated with each behavior.

With one exception, environmental attitudes and attitudes toward environmental behaviors were positively related to eco-friendly packaging, public transportation use, and reduced resource consumption (Aral and López-Sintas 2020). Environmental attitudes did not significantly predict public transportation use; however, they did predict eco-friendly packaging and reduced resource consumption. Environmental knowledge was found to be a stronger predictor of public transportation use compared to either environmental attitude or attitude toward environmental behaviors, and a slightly stronger predictor of eco-friendly purchasing and reduced resource consumption (within at least one of two regression models) (Aral and López-Sintas 2020). Importantly, items in the corresponding knowledge scale represented media and information sources, as opposed to perceived or actual environmental knowledge, and were represented by frequency counts of newspapers, books, magazines, television, radio, film, events, cultural institutions, social media and the internet, family and friends listed as information sources (Aral and López-Sintas 2020).

H6: Respondents' attitude toward environmental protection will predict their support for policies on plastic waste management (H6a) and green consumption (H6b).

1.8 Policy support and green consumption

Previous research has attempted to identify factors predicting green consumption. Policy support refers to the acceptance or support for government or organizational policies that help protect the environment (Inoue and Alfaro-Barrantes 2015). Green consumption is broadly about individual actions that are oriented toward sustainable environment (Peattie 2010). Green consumption can involve behaviors such as recycling, reusing products, or using public transportation among others. According to Inoue and Alfaro-Barrantes (2015), both policy support and green consumption

are two types of pro-environmental behaviors. While it is more common for research in this area to examine the influence of respondents' attitude, norms, risk perception, information use and others on green consumption (Smith and Kingston 2021; Yang et al. 2015; Yoon et al. 2021), less has been done to explore the linkage between respondents' support for environment-related policies and green consumption, especially with regards to plastic waste management (Larson et al. 2015; Yuriev et al. 2018). Thus, this study asks:

H7: Respondents' plastic waste management policy support will predict their green consumption practices.

1.9 Multilevel analysis

Researchers have started to consider the simultaneous influences of micro-level factors, including individual-level social psychological and demographic variables, and macro-level factors, comprising measures such as national adult literacy rates, affluence (Gross Domestic Product), and waste and recycling rates, to offer additional explanatory power to understand environmental behaviors and differences between and within countries (Aral and López-Sintas 2020; Pisano and Lubell 2016). Additionally, several country-level variables have been used in multilevel analyses of pro-environmental behaviors to illuminate broader situational factors at work, including Gross Domestic Product (GDP) as an indicator of affluence; post-materialistic values such as quality of life and self-expression; education development, which includes national adult literacy and enrollment ratios; and perceived environmental degradation (Pisano and Lubell 2016). Pisano and Lubell (2016) analyzed these variables along with items from the Environmental Health component of the Environmental Performance Index (EPI), which represented areas such as environmental effects of disease, and water and air quality for human health (Pisano and Lubell 2016). Recycling rate is an indicator of how much recycling is adopted in each of the countries, which contributes overall to understanding the prevalence of this activity at the national level. While EPI and recycling rate represent the broader context of a nation with regards to environmental performance, green consumption in this study is a behavioral variable at the individual level, which may vary differently across the nation's population. A country could be ranked high in the EPI index or have high recycling rate, but a respondent from that country may not practice green consumption. Together, these country-level variables were hypothesized to be positively related to the same public and private pro-environmental behaviors at a national level. Findings confirmed that countries that were wealthier and that showed higher postmaterialist values (e.g., materialism

and self-expression) showed greater involvement in environmental protection, compared to countries with low GDP and postmaterialist values. These results were similar to findings from other multilevel analyses (Pirani and Secondi 2011).

In one multilevel analysis, Pisano and Lubell (2016) examined data from the 2010 Environmental Module of the International Social Survey Program (ISSP), comprising responses from 38,000 participants in 30 countries on six continents. Individual-level variables included demographics, environmental risk perception, self-perception of knowledge, efficacy, and willingness to make personal sacrifice. All individual-level variables were hypothesized to hold positive relationships with individual-level private and public environmental behaviors (Pisano and Lubell 2016). Behaviors included private pro-environmental activities such as recycling and conserving water, and public actions such as signing a petition supporting the environment and donating money to an environmental group. Findings showed that all four constructs related to environmental attitudes predicted private and public environmental behaviors.

In the Aral and López-Sintas (2020) study, country-level variance was also found to affect each pro-environmental behavior and European countries were clustered into two groups according to mean values of their respective citizen respondents' reported behaviors. Differences between countries were attributed to political governmental, and economic policies, macroeconomic conditions, along with cultural, and institutional factors. However, the researchers did not include further analysis of such country-level variables and called for more multilevel research to integrate such factors and explain similarities between nations, especially since countries can greatly influence individual and collective actions (Aral and López-Sintas 2020). This study includes GDP per capita, the previously mentioned Environmental Performance Index, and recycling rate (See Table 1 for more details) as country-level variables to understand their potential effects on pro-environmental behaviors. We examine the following research question:

RQ1: Of the three country-level factors including GDP per capita, Environmental Performance Index, and recycling rate, which factor predicts respondents' policy support and green consumption?

Ecological approaches, which account for different contextual factors, to understanding individual behaviors have been increasingly utilized as they have proven to provide more nuanced interpretations of factors at multiple levels (Moran et al. 2016). In multilevel modeling, individual or lower-level variables are considered as nested within a broader context, in which those variables are assessed. Besides nested effects, using multilevel modeling also allows for examining cross-level effects, which explain the interactions between factors at different levels

Table 1: Country-level variables.

Country	GDP per capita (US\$)	Environmental performance index	Recycling rate
<i>Austria</i>	37,800	78.97	65.5
<i>Belgium</i>	35,510	77.38	85.3
<i>Bulgaria</i>	8,700	67.85	57.9
<i>Croatia</i>	12,040	65.45	58.4
<i>Cyprus</i>	24,120	72.60	70.2
<i>Czech Republic</i>	17,990	67.68	69.6
<i>Denmark</i>	48,530	81.6	67.7
<i>Estonia</i>	15,070	64.31	60.4
<i>France</i>	32,890	83.95	65.7
<i>Finland</i>	36,800	78.64	70.2
<i>Germany</i>	35,720	78.37	68.5
<i>Greece</i>	17,400	73.60	68.6
<i>Hungary</i>	12,680	65.01	46.1
<i>Ireland</i>	57,780	78.77	63.9
<i>Italy</i>	27,040	76.96	68.3
<i>Latvia</i>	12,180	66.12	55.8
<i>Lithuania</i>	13,390	69.33	60.7
<i>Luxembourg</i>	83,470	79.12	70.9
<i>Malta</i>	21,690	80.90	35.6
<i>Poland</i>	12,420	64.11	58.7
<i>Portugal</i>	18,190	71.91	57.6
<i>Slovakia</i>	15,490	70.60	66.6
<i>Slovenia</i>	6,550	67.57	60.4
<i>Spain</i>	24,910	78.39	68.8
<i>Sweden</i>	43,760	80.51	70.1
<i>The Netherlands</i>	41,450	75.46	78.1
<i>United Kingdom</i>	32,640	79.89	62.1
<i>Mean (SD)</i>	26,922 (15,589)	73.8 (6.13)	64.52 (8.5)

(Slater et al. 2006). In this study, we are also interested in investigating whether the country-level variables would co-vary with the three environmental news variables in similar way. In other words, whether the influence of environmental news on individuals’ policy support and green consumption would be moderated by the country-level factors. Thus, this study asks:

RQ2: Of the three country-level factors including GDP per capita, Environmental Performance Index, and recycling rate, which ones interact with individual-level variables on diversity of environmental news sources in predicting Europeans’ support for policies on waste management and green consumption.

2 Method

2.1 Sample and measures

This research uses Eurobarometer 92.4, a secondary dataset, collected in December 2019 from 27 European countries. Eurobarometer surveys began in 1974 and have been designed to poll public opinion from the continent regularly on numerous issues. Eurobarometer uses multiple methods including face-to-face, telephone, or online to collect data. The surveys rely on randomly selected samples of at least 1,000 persons or 500 persons for countries or territories with a population below 1 million. Besides being randomly selected, the samples are also weighted to ensure demographic and geographical representativeness (European Union 2021). The sample used in this study included responses from 27,498 Europeans, who were 15 years or older at the time of data collection. On average, nearly 1,000 people were selected from each of the countries, using a two-stage random sampling procedure. First, addresses were stratified according to demographic distribution of the population in each country and resident types (e.g., urban, metropolitan, rural). Then they were assigned into different clusters. Systematic sampling with a random starting point was adopted to select eligible households within the clusters. In several countries (e.g., Britain), the sampling procedure was based on respondents' electoral registers (Gesis 2012).

Two types of variables representing two levels of analysis including individual and country were used in this study. Individual-level variables included demographics (e.g., gender, age, political ideology, and social class, which is a proxy for income as the data were collected from different countries with different levels of economic development), environmental news source, attitude toward environmental issues, injunctive norm, risk perception, plastic waste policy support, and green consumption. Country-level variables consisted of several variables representing the broad socioeconomic and "ecological" environment. They included GDP per capita, recycling rate, and Environmental Performance Index.

2.2 Individual-level variables

Demographics: *Gender* is a binary variable with two options of man (45.9%) and woman (54.1%). *Age* is an open-ended question ($M = 51.8$; $SD = 18.1$). *Political ideology* was measured with a 10-point scale in which 1 = left and 10 = right ($M = 5.26$; $SD = 2.1$). *Social class* had five brackets (e.g., The working class; The lower middle class; The middle class; The upper middle class, and the higher class) and an option for others.

Diversity of environmental news sources was measured by asking respondents to indicate the sources of their environmental news including both traditional (e.g., national newspapers, regional or local newspapers, magazines, television news, radio, film, and documentaries on television, etc.) and online (e.g., online social networks, the Internet). An additive scale was computed from the answers to traditional news sources to create the *traditional environmental news sources* ($M = 1.69$; $SD = 0.86$). Digital news sources were further split into two categories including environmental news from *online social networks* (i.e., Facebook, Twitter, YouTube, WhatsApp, Messenger, TikTok, Instagram, LinkedIn, Reddit, Snapchat, Pinterest, Tumblr, and other) and environmental news from other *internet sources* (i.e., weblogs, blogs, forum, etc.). Eurobarometer measured *environmental news from online social networks* with a series of binary questions, which allowed for creating an additive variable ($M = 0.75$; $SD = 1.19$). *Environmental news from other internet sources*, however, was one binary question.

Attitude toward environmental protection was a single question asking respondents whether protecting the environment is not at all important (1), not very important, fairly important, or very important (4) to them personally ($M = 3.46$; $SD = 0.63$).

Injunctive norm or what ought to be done by various actors to protect the environment, was a composite variable, combined from five items asking whether the respondent believed if “big companies and industry,” their “city, town, or village,” their “government,” “the European Union,” and “citizen themselves” were doing too much (3), about the right amount (2), or not enough (1) to protect the environment (Cronbach Alpha = 0.82; $M = 1.31$; $SD = 0.39$).

Risk perception was combined from four four-point scale items asking respondents whether they were worried about the “environmental impact of everyday products made of plastics,” “environmental impact of microplastics,” “the impacts of chemicals present in everyday products” on their health, and “the impact of chemicals present in everyday products” on the environment (Cronbach Alpha = 0.85; $M = 3.36$; $SD = 0.60$).

Two dependent variables were *policy support* for plastic waste management and *green consumption*. *Policy support* was combined from averaging four items asking respondents for their views on how important each of the four potential policy scenarios was in reducing plastic waste and littering. The items included (1) Local authorities should provide more and better collection facilities for plastic waste; (2) People should be educated on how to reduce their plastic waste; (3) Industry and retailers should make an effort to reduce plastic packaging, and (4) Products should be designed in a way that facilitates the recycling of plastic. Test results indicated the items were highly consistent (Cronbach Alpha = 0.77; $M = 3.56$; $SD = 0.49$).

Green consumption ($M = 2.17$; $SD = 1.51$) was an additive variable combined from responses to a multiple-choice question on whether participants, “in the past six months” had “avoided buying over-packaged products”; “avoided single-use plastic goods other than plastic bags (e.g., plastic cutlery, cups, plates, etc.) or bought reusable plastic products”; “separated most of” their “waste for recycling”; “bought products marked with an environmental label”; “joined a demonstration, attended a workshop, taken part in an activity (e.g., a collective beach or park clean up)”; “bought second-hand products (e.g., clothes or electronics) instead of new ones,” and; “repaired a product instead of replacing it.”

2.3 Country-level variables

Country-level variables were downloaded from various databases including the World Bank (e.g., GDP per capita), European Union, and Yale University that have been monitoring different aspects of the socioeconomic and environmental contexts in many countries. Most country-level variables were collected/gathered in 2020. However, in case the 2020 data were not available in an index, the data for the closest year was used. For example, the latest available data on recycling in Europe was in 2018. All three country-level variables were standardized. Country-level variables were standardized before being included in the analysis.

GDP per capita ($M = 26,922$; $SD = 15,589$) was downloaded from the World Bank's (2021) website. *GDP per capita* has often been used as an indicator of countries' levels of economic development, which is an important factor in shaping citizens' value systems and behaviors.

Environmental Performance Index ($M = 73.8$; $SD = 6.13$) was composed from 32 indicators (e.g., $PM_{2.5}$ exposure; sanitation, marine protection, etc.) to rank 180 countries on environmental health and ecosystem vitality. The initiative, managed by Yale University, offers data and fact-based analysis to demonstrate how countries around the world are addressing environmental challenges (Wendling et al. 2018). Of the countries in the sample, France (83.95) was ranked as the highest, and Poland was the lowest (64.11) in how well they performed on various environmental aspects.

Recycling rate ($M = 64.52$; $SD = 8.50$) was made available through EuroStat, which provides multiple types of data on different aspects of waste management by member states of the European Union. The latest data available through the institution was in 2018. The rate indicates the percentage of packaging waste being recycled in each of the European countries (Eurostat 2021). Of the countries in the sample, Malta had the lowest percentage of packaging waste being recycled (35.6%), while Belgium had the highest percentage (85.3%) (See Table 1).

2.4 Analysis strategy

Multilevel regression modeling using Stata was adopted to test the hypotheses. As common in multilevel modeling, several steps were taken to detect multicollinearity and to test whether there were cluster effects that could be attributed to the country level variables. Specifically, to detect multicollinearity Pearson's correlation tests were conducted. Results indicated no correlation coefficient between the variables was higher than 0.8 (Vatcheva et al. 2016). In addition, regression test results showed no variance inflation factor (VIF) value higher than 2.5 and no tolerance level for each of the predictors below 0.2 in both models, demonstrating low risks for multicollinearity (Johnston et al. 2018).

The first model, which did not include any of the independent variables, was used to assess whether there were cluster effects, likelihood-ratio (LR) tests and residual intraclass correlations for the two dependent variables *policy support* and *green consumption*. Results of LR tests showed statistically significant variability in both *policy support* ($\chi^2 = 1,364.65$, $p < 0.001$) and *green consumption* ($\chi^2 = 2,975$, $p < 0.001$) beyond the residual level. Residual intraclass correlation coefficients also demonstrated some clustering effects in *policy support* (ICC = 0.059 with a 95% confidence interval from 0.032 to 0.091, $p < 0.05$) and in *green consumption* (ICC = 0.109 with a 95% confidence interval from 0.07 to 0.17, $p < 0.05$). This means for both policy support and green consumption, some of the effects came from the country-level variables. We then fitted two other models for each of the two dependent variables (i.e., *policy support* and *green consumption*). Model 1 only assessed individual-level variables, while model 2 included country-level variables and also tested for cross-level interaction effects between the country-level and the three environmental news source variables. Demographics were also included in the two models as control variables (See Tables 1–3 for details).

3 Results

Of the four demographic variables, in both models, *gender* ($b = 0.037$, $SE = 0.037$, $p < 0.001$) *social class* ($b = -0.006$, $SE = 0.002$, $p < 0.01$) significantly predicted *policy support* (see Table 2 for details). The results mean those who identified as working class and female were more likely to support policy on plastic waste management. All the four demographic variables including *gender* ($b = 0.275$, $SE = 0.031$, $p < 0.001$), *age* ($b = -0.004$, $SE = 0.001$, $p < 0.001$), *social class* ($b = 0.09$, $SE = 0.012$, $p < 0.001$), and *political ideology* ($b = -0.004$, $SE = 0.001$, $p < 0.001$) were statistically significant predictors of *green consumption* (see Table 3 for details). Specifically, female,

Table 2: Results of multilevel regression analysis of the influence on policy support.

Variables	Policy support		
	M0 (N = 26,417) (SE)	M1 (N = 21,946) (SE)	M2 (N = 21,946) (SE)
<i>Individual level</i>			
Gender		0.038 ^b (0.006)	0.037 ^b (0.006)
Age		−0.0003 (0.0002)	−0.0003 (0.000)
Social class		−0.006 ^a (0.002)	−0.006 ^a (0.002)
Political ideology		−0.001 (0.000)	−0.001 (0.000)
Env'l news source (traditional)		0.018 ^b (0.004)	0.019 ^b (0.004)
Env'l news source (online social network)		0.011 ^b (0.004)	0.011 ^a (0.004)
Env'l news source (other online sources)		0.011 (0.007)	0.014 (0.007)
Attitude		0.001 (0.001)	0.001 (0.001)
Injunctive norms		−0.126 ^b (0.008)	−0.123 ^b (0.008)
Risk perception		0.330 ^b (0.006)	0.327 ^b (0.006)
<i>Country level</i>			
GDP per capita			−0.0001 (0.001)
Recycling rate			0.0004 (0.001)
EPI			0.006 (0.005)
<i>Cross-level</i>			
GDP*Env'l news source (traditional)			0.000 (0.001)
GDP*Env'l news source (online social network)			0.001 (0.000)
GDP*Env'l news source (other online sources)			−0.000 (0.001)
Recycling rate*Env'l news source (traditional)			0.001 (0.001)
Recycling rate*Env'l news source (OSN)			0.001 (0.001)
Recycling rate*Env'l news source (other online sources)			−0.001 (0.001)
EPI*Env'l news source (traditional)			0.001 (0.001)
EPI*Env'l news source (online social network)			−0.000 (0.001)
EPI*Env'l news source (other online sources)			0.002 (0.002)
Variance components			
Intraclass correlations	0.059	0.054	0.045
Akaike's	30,528	22,309	22,316
Wald Chi-square		41,000 ^b	1,847 ^b

Notes: ^a $p < 0.01$; ^b $p < 0.001$.

younger, left-leaning people and those who belong to higher classes in society were more likely to practice *green consumption*.

H1 was about the effects of source diversity for information about environmental issues from traditional media on *policy support* and *green consumption*. Regression results showed *environmental news use* from traditional media sources

Table 3: Results of multilevel regression analysis of the influence on green consumption.

Variables	Green consumption		
	M0 (N = 26,417) (SE)	M1 (N = 21,946) (SE)	M2 (N = 21,946) (SE)
Individual level			
Gender		0.282 ^c (0.031)	0.275 ^c (0.031)
Age		−0.004 ^c (0.001)	−0.004 ^c (0.001)
Social class		0.091 ^c (0.012)	0.090 ^c (0.012)
Political ideology		−0.004 ^c (0.001)	−0.004 ^c (0.001)
Env'l news source (traditional)		0.526 ^c (0.022)	0.526 ^c (0.022)
Env'l news source (online social network)		0.198 ^c (0.018)	0.195 ^c (0.018)
Env'l news source (other online sources)		0.796 ^c (0.036)	0.802 ^c (0.036)
Attitude		0.0043 (0.004)	0.004 (0.004)
Injunctive norms		−0.464 ^c (0.043)	−0.44 ^c (0.043)
Risk perception		0.777 ^c (0.031)	0.771 ^c (0.031)
Policy support		0.653 ^c (0.036)	0.659 ^c (0.036)
Country level			
GDP per capita			0.001 ^b (0.000)
Recycling rate			0.023 (0.013)
EPI			0.013 (0.026)
Cross-level			
GDP*Env'l news source (traditional)			−0.001 ^a (0.000)
GDP*Env'l news source (online social network)			0.000 (0.000)
GDP*Env'l news source (other online sources)			−0.000 (0.000)
Recycling rate*Env'l news source (traditional)			−0.002 (0.003)
Recycling rate*Env'l news source (OSN)			−0.004 (0.002)
Recycling rate*Env'l news source (other online sources)			−0.009 ^a (0.005)
EPI*Env'l news source (traditional)			0.013 ^a (0.005)
EPI*Env'l news source (online social network)			−0.010 ^a (0.004)
EPI*Env'l news source (other online sources)			0.016 (0.009)
Intraclass correlations	0.109	0.097	0.055
Akaike's	120,001	86,200	86,181
Wald Chi-square		4,584 ^c	4,655 ^c

Notes: ^a $p < 0.05$; ^b $p < 0.01$; ^c $p < 0.001$.

was significantly associated with both *policy support* ($b = 0.019$, $SE = 0.004$, $p < 0.001$) and *green consumption* ($b = 0.526$, $SE = 0.022$, $p < 0.001$). H1 was strongly supported.

H2 predicted statistically significant relationships between respondents' *diversity of environmental news sources* from social network sources and *policy support* and *green consumption*. Test results indicated statistically significant

effects of environmental news use from social network sources on *policy support* ($b = 0.011$, $SE = 0.004$, $p < 0.001$) and *green consumption* ($b = 0.195$, $SE = 0.018$, $p < 0.001$). H2 was strongly supported.

H3 was concerned with the associations between *environmental news use* from other internet sources (i.e., weblogs, forums, blogs, etc.) and *policy support* as well as *green consumption*. Regression results revealed that the variable only predicted *green consumption* ($b = 0.802$, $SE = 0.036$, $p < 0.001$). Only H3b was supported.

H4 assumed positive associations between participants' *injunctive norms* and *policy support* and *green consumption*. According to the results of regression tests, *injunctive norms* negatively predicted both *policy support* ($b = -0.123$, $SE = 0.008$, $p < 0.001$) and *green consumption* ($b = -0.044$, $SE = -0.29$, $p < 0.001$). H4 was not supported.

H5 was about the relationships between *risk perception* and *policy support* as well as *green consumption*. Regression results revealed that *risk perception* was a statistically significant predictor of both *policy support* ($b = 0.327$, $SE = 0.006$, $p < 0.001$) and *green consumption* ($b = 0.771$, $SE = 0.031$, $p < 0.001$). H5 was strongly supported.

H6 hypothesized positive relationships between *Europeans' attitudes toward environment protection* and the two dependent variables. Results indicated no statistically significant relationship between participants' attitudes towards both policy changes and green consumption practices. H6 was not supported.

H7 was, however, about the relationship between respondents' *policy support* for plastic waste management and their *green consumption* practices. Regression results showed a statistically significant relationship ($SE = 0.27$, $p < 0.001$). H7 was strongly supported.

RQ1 asked about the predictability of three country-level variables including GDP per capita, Environmental Performance Index, and recycling rate on policy support and green consumption. Results showed that of the three, *GDP per capita* was the only statistically significant predictor of *green consumption* ($b = 0.013$, $SE = 0.026$, $p < 0.001$). This means those in wealthier countries practice green consumption more than those in economically disadvantaged nations.

RQ2 inquired about the cross-level interactions between the country-level and the three diversity of environmental news source variables in predicting respondents' policy support and green consumption. No interaction effect was found on policy support. Green consumption, however, saw four cross-level effects. Specifically, *GDP* interacted with environmental news use from traditional sources ($b = -0.001$, $SE = 0.000$, $p < 0.05$); *recycling rate* interacted with environmental news use from non-social network internet sources ($b = -0.009$, $SE = 0.005$, $p < 0.05$), and; *EPI* had two statistically interaction effects with *environmental news use* from traditional media ($b = 0.013$, $SE = 0.005$, $p < 0.05$) and *environmental news use* from online social network sources ($b = -0.010$, $SE = 0.004$, $p < 0.05$). The results mean the

effects of environmental news from traditional sources use on green consumption increase in less wealthy countries or those with higher EPI scores. The influence of environmental news use from non-social network online sources decreases in countries with higher recycling rates. The effects of environmental news use from online social network, however, subside in countries with higher EPI scores.

The multilevel model for *policy support* reduced the ICC value from 0.059; AIC = 30,528 in the base model where we assessed whether there were clustering effects on the dependent variable to 0.045; AIC = 22,316. Similarly, the multilevel model for *green consumption* reduced the ICC value from 0.109; AIC = 120,001 in the base model to 0.055; AIC = 86,181. The changes in the ICC and AIC values are evident that the three country-level factors accounted for the variance in the two dependent variables.

4 Discussion and conclusion

This study examined the influence of several individual and country-level factors on Europeans' support for policies related to plastic waste management and their green consumption practices. Of the individual factors, diversity of environmental news use from traditional and online social networks, news use from other internet sources, as well as risk perception were the strongest predictors of Europeans' policy support and green consumption on plastic waste. With regards to the effects of environmental news use, findings of this study echo result in other countries including China (Sun et al. 2019) and the United States (Roser-Renouf et al. 2016) on general environmental behaviors. However, this research is one of very few studies (Borg et al. 2021) that investigated such effects on "policy support" for plastic waste management and "green consumption," thus confirming that diversity of sources for environmental information use can (positively) change citizens' attitude toward policies and their behaviors on plastic waste reduction and management. Theoretically, while most previous studies using the social cognitive theory have found media use an important factor in predicting knowledge or behaviors of participants, results of this study indicate the important role of information source diversity in users' pro-environmental behaviors, thus contributing to this theoretical framework. Additionally, since little has been done to examine the effect of multi-platform use for news on people's attitudes and behaviors, this study is among a few that contribute to the literature in this area.

In supporting the social cognitive theory's argument, this study highlights the importance of both traditional and digital media in creating a learning environment about plastic pollution and motivating people to take actions on plastic waste. It also

provides advocacy campaign managers with evidence of the important roles that traditional media sources and digital media play in influencing attitudes and behaviors with regards to plastic waste.

This research also found a strong predictability of *risk perception* on both *policy support* and *green consumption*. Risk perception has been examined with pro-environmental behaviors in general (Bradley et al. 2020; Der-Karabetian et al. 1996; Macias 2015) and climate change attitude and actions specifically (Choon et al. 2019; You and Ju 2018). Moreover, this study contributes to a limited but growing body of research that examines the effects of risk perception on behavioral changes to curb plastic waste pollution (Menzel et al. 2021; Yoon et al. 2021). The finding of risk as a significant predictor of citizens' pro-environmental cognitions and behaviors may be helpful to environmental advocates and policy makers in shaping future social influence strategies for plastic waste reduction and management.

Our study also unearthed unexpected results. The analysis revealed that injunctive norms were negatively associated with the two dependent variables. This finding corroborates previous findings that examined the influence of injunctive norms. In general, norm variables are weak predictors of the public's pro-environmental actions (Aral and López-Sintas 2020).

Results also suggest that attitudes toward the protection of the environment did not predict policy support or green consumption. Similar to previous studies, attitudinal variables are not strongly associated with environmental behaviors (Hines et al. 1987). One explanation could be that respondents' attitudes to protect the environment were measured in general terms, instead of focusing on specific environmental mitigation tactics or behaviors.

This study also found a strong association between policy support for plastic waste management and green consumption related to plastic waste. This result suggests consistency among public members who adopted green consumption behaviors and also desired institutional changes in response to managing plastic waste.

Several demographic variables predicted policy support and green consumption related to plastic waste. Gender was a strong predictor of both dependent variables with women being more likely to support policy changes and green behaviors. Numerous studies have found that women often prioritize and give greater importance in improving the environment (Kennedy and Kmec 2018; Vicente-Molina et al. 2018). Younger Europeans and those who belong to the higher classes in the society tended to adopt green consumption behaviors. This finding is in line with findings from previous research (Aral and López-Sintas 2020). While right-leaning participants tended to support policy changes, left-leaning Europeans were keen on changing their own behaviors. This divergence suggests that political ideology influences Europeans' locus of control in terms of effecting changes regarding plastic waste.

An important finding of this research is concerned with the influence of country-level variables on participants' policy support and green consumption related to plastic waste. While EPI and recycling rate in European countries did not show direct effects on the two dependent variables, the GDP per capita exerted strong effects on green consumption, demonstrating the association between this factor and the European public's pro-environmental actions. All three variables showed some cross-level effects with the diversity of environmental news source variables. This corroborates the importance of nationally macro variables, which constitute the broader environment of a country or community, and contextualizing individuals' behaviors (Echavarren et al. 2019; Vu et al. 2019). The cross-level interactions of the country-level variables and the diversity of environmental news sources further confirm the moderation effects of these nationally macro factors on individual-level variables.

This study has several implications for the literature of behavioral change as well as for policy making. Our analysis provides empirical evidence of factors that change Europeans' attitudes and behaviors related to plastic waste and the influence of media. Besides individual factors, this study also identifies country-level variables that can strengthen the social cognitive theory model, hence extending the theory. Like nearly all research designs, the current study is not without limitations. First, the use of secondary data did not allow for inclusion of other traditional individual variables used in behavioral change research (e.g., subjective norms, perceived control). Second, the data only covered the European continent, with countries having many economic, political, and cultural similarities. Including additional continents and countries would potentially reveal more diverse and generalizable findings. Third, although the results provide evidence to the influence of the diversity of environmental news sources on waste management policy support and green consumption, reverse causality between these variables has not been ruled out. An experimental study might be helpful in ensuring the direction of the effects between the variables. Additionally, how the respondents defined environmental news is unclear, leaving a potential issue with how valid their responses to the survey questions might be. Lastly, comparing different sets of Eurobarometer studies in a longitudinally study could help identify people's attitudes at multiple time points (e.g., during major environmental crises). These limitations notwithstanding, our results reinforce the value of considering the influences of both individual and contextual factors and considering them through established theoretical lenses to better understand and predict pro-environmental behaviors.

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