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Climate Change Concern, Personal Responsibility and Actions Related to Climate Change Mitigation in EU Countries: Cross-Cultural Analysis

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Abstract: To achieve the targets of climate change policy, it is important not only to enhance concerns about climate change but also to promote climate-friendly behaviour. Encompassing European Union (EU) countries, the objective of this paper was to analyse how economic development and Hofstede's cultural dimensions contributed to climate change concerns, personal responsibility, and actions related to climate change mitigation. Furthermore, considering that actions related to climate change mitigation have different costs and benefits, in this study, we revealed whether climate change concerns and personal responsibility equally influenced all actions related to climate change mitigation and whether all types of actions were guided by the same goals. The results showed that the performance of actions related to climate change mitigation varied across European countries. The largest share of respondents declared that they reduce waste and regularly separate it for recycling. Meanwhile, a smaller share of people noted that they perform high-cost actions such as purchase of low-energy homes and electric cars. Economic development level significantly influenced the assumption of personal responsibility and the number of actions related to climate change mitigation, but not climate change concerns. Hofstede's cultural dimensions differently influenced climate change concerns, responsibility, and the number of actions. Considering separate actions related to climate change mitigation, the assumption of personal responsibility significantly and positively influenced almost all actions. Climate change concerns positively and significantly affected only low-cost actions. Due to the different costs and guiding goals, respondents who performed one action did not necessarily perform other actions related to climate change mitigation.

Keywords: climate change, climate change concern, pro-environmental behaviour, responsibility, cost of behaviour, climate change policy.

1. Introduction

Undoubtedly, climate change over the past decade is the most discussed environmental problem. Stopping the increase of greenhouse gas emissions and keeping the global average temperature growth to "well below" 2 °C are the most important climate change policy targets (Vaughan, 2019). Seeking these achievements, greater attention is paid to the development of a low-carbon economy, technologies, and renewable energy. Successful implementation of these tools requires citizen involvement from the support of implementing policy to active behavioural change (Capstick et al., 2015; Lacroux and Gifford., 2018; Luis et al., 2018; Kuthe et al., 2019). However,

despite that the household is one of the primary contributors to climate change (Brizga et al., 2017), the public's engagement on climate change mitigation actions has not received much attention on political or research levels (Broomell et al., 2015). A vast number of authors analysed the changes in climate change concern, scepticism, and perception (Whitmarsh, 2011; Poortinga et al., 2011; Brulle et al., 2012; Scruggs and Benegal 2012; Pidgeon, 2012; Franzen and Vogl, 2013; Capstick et al., 2015; Bergquist and Warshaw, 2018; Whitmarsh and Capstick, 2018) and the primary determinants such as extreme weather events; media coverage (information dissemination about climate change); accuracy of scientific information; elite cues; movement against climate change; changes in economic activity, political situation, foreign conflict, and socio-demographic variables (Poortinga et al., 2011, 2019; Whitmarsh, 2011; Scruggs and Benegal 2012; Brulle et al., 2012; Brügger et al., 2015; Van der Linden 2015; Hornsey et al., 2016; Carlton et al., 2016; Weber 2016; Shi et al., 2016; Carmichael and Brulle, 2017; Sisco et al., 2017; Sohlberg 2017; Pelham, 2018; Visschers, 2018; Lawson et al., 2019; Druckman and McGrath, 2019; Whitmarsh and Capstick 2018 and others). The growth of public climate change concern is necessary, but the increase of pro-environmental behaviour related to climate change mitigation is the most important objective implementing climate change policy (Burke et al., 2018).

Climate change concern and actions related to climate change mitigation have been analysed extensively, particularly in the United States of America (Punzo e al., 2019). Considering European Union (EU) countries, Poortinga et al. (2019) analysed climate change perception in 22 EU countries. Lo and Chow (2015), who studied 33 countries, including some from the EU, examined the relationship between climate change concern and national wealth. McCright et al. (2016) explored the impact of political ideology on the views of climate change in 25 EU countries. Doran et al. (2019) examined moral concern about climate change in four EU countries. Other authors considered several or one EU country analysing the determinants of climate change concern and belief or perception (von Borgstede et al., 2013; Ziegler, 2017; Papoulis et al., 2015; Pidgeon, 2012; Kuthe et al., 2019). Therefore, in this study encompassing all EU countries, we analysed how economic development and Hofstede's cultural dimensions contribute to climate change concern and personal responsibility and actions related to climate change mitigation. To the best of our knowledge, these aspects have not been analysed by previous researchers.

Authors analysing actions related to climate change mitigation usually consider general pro-environmental behaviour which is related to climate change mitigation (et al., 2019; Wiest et al.,

2015; Gifford and Comeau, 2011; Kuthe et al., 2019; Yilmaz and Can., 2019; Kwon et al., 2019; Stevenson and Petyerson., 2016; Choon et al., 2019; Jones et al., 2017; Masud et al., 2016; Sohlberg, 2017; Bain et al., 2012. Helm et al., 2018). However, to analyse the impact of climate concern on climate-friendly behaviour, it is not enough to consider general behaviour due to the different costs and benefits of behaviours. Thus, Bain et al. (2015) divided behaviours into citizenship, personal, and donation behaviour. Broomell et al. (2015) distinguished between specific and general climate change mitigation behaviour. Van Borgstede et al. (2013) analysed low- and high-cost behaviour. Hall (2018) explored the belief in climate change impact separately concerning recycling, public transportation, purchase of eco-friendly products, usage of reusable shopping bags, and policy composite. Doherty and Webler (2016) analysed protest, voting, and donating to climate change behaviour. Shi et al. (2015) analysed the acceptance of climate-friendly policies and willingness to change behaviours to mitigate climate change. Large number of authors examined energy consumption, saving, or efficiency behaviour (Urban and Ščasný, 2012; Dwyer et al., 2015; Chen., 2016; Li and Just, 2018; Trotta, 2018; Paço and Lavrador 2017; Lopes et al., 2019; Wang et al., 2018; Lacroix and Gifford., 2018; Jakučionytė-Skodienė et al., 2020). In this paper, we analysed the impact of climate change concern on separate actions related to climate change mitigation from purchasing electric cars to the usage of less disposable items. To the best of our knowledge, the impact of climate change concern and responsibility on climate-friendly behaviour was not analysed in such detail. This analysis revealed whether climate change concern and personal responsibility equally influence all actions related to climate change mitigation. Furthermore, analysing the actions related to climate change mitigation separately, we explored whether individuals perform all types of analysed actions; for example, people who buy an electric car, whether they are also linked to reducing energy consumption or perform other action related to climate change mitigation. Therefore, we explored whether all actions related to climate change mitigation were guided by the same goals.

2. Literature review

2.1. Cross-cultural analysis of climate change concern, personal responsibility, and actions related to climate change mitigation

Cultural worldview is an important factor for climate change concern, scepticism, or risk perception (Shi et al., 2015; Lacroux and Gifford., 2018). Authors considering cultural values

usually analysed how individualism-collectivism or hierarchy-egalitarianism values impact climate change concern or climate-friendly behaviour (Shi et al., 2016; Horsney et al., 2016). In a meta-analysis, Horsney et al. (2016) showed that people who exhibited more individualistic and hierarchical cultural values believed less in climate change. In later studies, Horsney et al. (2018) found that in separate countries, the relationship between individualism (and hierarchical values) and climate change scepticism differed, but in major countries, the effect was positive. Pelham (2018) revealed that individuals from collectivistic societies are less sceptical about climate change, or in other words, as Capstick and Pidgeon (2014) found, that individualism is the most powerful predictor of scepticism. Bellamy and Hulme (2011) revealed that egalitarianists are more concerned about climate change than individualists and fatalists. Meanwhile, Newman et al. (2018) found that due to the increase in exposure of left-leaning media, climate change concern increased for individuals who exhibited hierarchical and egalitarian cultural values. Furthermore, Shi et al. (2015) revealed that hierarchical and individualistic worldviews are negatively related not only to concern but also to a willingness to change behaviour and acceptance of climate-friendly policies. Lacroux and Gifford (2018) found that egalitarian worldviews were correlated with weaker perceived barriers to reported energy conservation behaviour.

In this paper, referring to Hofstede's cultural dimensions (Hofstede, 2001), we have expanded the cross-cultural analysis. The impact of six cultural dimensions (i.e., masculinity, power distance, individualism, uncertainty to avoidance, long-term orientations, and indulgence) on environmental concern, personal responsibility, and actions related to climate change mitigation was analysed. In the literature, researchers rather extensively analysed how Hofstede's cultural dimensions influenced the green purchase or sorting behaviour (see Onwezen et al., 2014; Tseng and Hung, 2013; Ritter et al., 2015; Liobikienė et al., 2016, Minelgaitė and Liobikienė, 2019). Therefore, in this case, cross-cultural analysis can take useful insights into climate change policy implementation (Doran et al., 2019).

2.2. Economic development impact on climate change concern, personal responsibility, and actions related to climate change mitigation

Authors declared that climate change concern and risk perception differed between poor and rich nations (Lee et al., 2015). Whitmarsh, 2011, Brulle et al. (2012), Scruggs and Benegal (2012), and Carmichael et al. (2017) highlighted that the reduction of GDP reduced climate change concern,

particularly during the economic crisis period both in the Unites States of America and EU countries. Furthermore, a vast number of authors found that economic development negatively influenced the concern for climate change (Kim and Wolinsky-Nahmias, 2014; Kvaløy et al., 2012; Mostafa, 2016). Meanwhile, Pelham (2018) found an insignificant impact of GDP on scepticism about global warming when considering 117 nations. A different result was found by Carmichael and Brulle (2017), who revealed that economic development has a positive impact on public concern about climate change using data from 74 separate surveys. Lo and Chow (2015) and Knight (2016) also revealed that economic development increases climate change concern. Shum (2012) stated that due to the growth of income in Eastern Europe, growth in concern about climate change can be expected. Therefore, there is a lack of consensus among researchers about how economic development contributes to climate change concern. In this paper, analysing the year of economic stabilization, we explored how the economic development of EU countries contributes to climate change concern, personal responsibility, and action related to climate change mitigation.

2.3. Determinants of actions related to climate change mitigation

The actions related to climate change mitigation depend on how people think about climate change (Whitmarsh et al., 2011; Doran et al., 2019). A large number of authors found that climate change concern (or perceive threat) is an important factor for actions (intentions) related to climate change mitigation (Shi et al., 2015; Stevenson and Peterson; Masud et al., 2016; Jones et al., 2017; Sohlber, 2017; Lacroix and Gifford., 2018; Yu et al., 2019). Meanwhile, Yilmaz and Can. (2019) revealed concern had an insignificant effect on environmental behaviour. Kuthe et al. (2019) also showed that concern about climate change is not always related to willingness to act climate friendly among teenagers. Therefore, people may not react to the climate change problem the same way they think about it (Scruggs and Benegal 2012). Bain et al. (2012) revealed that even climate change deniers can be engaged to act related to climate change mitigation, not due to accepting climate change.

The gap between climate change concern and behaviour could occur due to "psychological distance" (Broomell et al., 2015) described in detail by Brügger et al. (2015) and McDonald et al. (2015). Considering that climate change is an abstract phenomenon which is difficult to assess and not always related to personal experience (Weber, 2016; Van der Linden et al.; 2015), people are

not always motivated to engage in climate change mitigation actions. Furthermore, due to the global aspect of climate change, people felt powerless (Van der Linden et al.; 2015) and perceived climate change as irrelevant to their day-to-day lives (Burke et al., 2018) which also reduced the motivation to behave in a more environmentally friendly mode.

Furthermore, the relationship between climate change concern and behaviour depends on the cost of behaviour. Brügger et al. (2015), Helm et al. (2018), and Doran et al. (2019) highlighted behaviour cost and inconvenience level which can reduce the likelihood of individuals to mitigate climate change. High-cost behaviour is a psychological barrier to pro-environmental behaviour. Alternatively, Clayton et al. (2015), Fujita et al. (2014), and Obradovich and Guenther (2016) emphasized the beneficial effects on pro-environmental behaviour considering, for example, the willingness to install low-emission technologies. Bain et al. (2015) revealed that co-benefit (economic and scientific advancement) could promote actions related to climate change mitigation. Von Borgstede et al. (2013) also showed that people are linked to saving electricity not due to environmental friendliness but due to saving money. Therefore, analysing actions related to climate change mitigation, it is not enough to consider general behaviour due to the different costs and benefits of behaviours. Thus, in this paper, we separately analysed the impact of climate change concern on separate actions related to climate change mitigation from purchasing electric cars to the usage of less disposable items.

It is not enough to be concerned about environmental problems but also it is important that it initiates taking responsibility which, according to Value Belief Norms (Stern, 2000) and Norm Activation theory (Schwartz, 1977), is an important variable influencing not only norms (Doherty and Webler, 2016) but also directly determining pro-environmental behaviour (Obradovich and Guenther, 2016; Punzo et al., 2019). Climate change is a public problem that requires the assumption of personal responsibility (Choon et al., 2019). Yilmaz and Can (2019) revealed that people with a high level of concern about global warming can only perform environmental behaviour when they develop an awareness which requires more responsibility to resolve the problem. Thus, personal responsibility promotes behavioural changes that protect the environment (Bolsen et al. 2014; Rickard et al. 2014). Punzo et al. (2019) found that the feeling of responsibility is the strongest contribution to pro-environmental behaviour. Chen (2016) stated that if respondents treat climate change as a problem and have responsibilities to perform carbon reduction behaviours, the intention to behave climate-friendly increases. Well et al. (2011)

revealed clear relationships between responsibility and environment-related consumer behaviour. Even considering climate change adaptation behaviour, people who perceive less personal responsibility are less likely to engage in adaptation behaviour (Van Valkengoed and Steg, 2019). Meanwhile, other authors found that personal responsibility moderates the influence on energy conservation behaviour (Dwyer et al., 2015). Analysing personal responsibility, Obradovich and Guenther (2016) showed an insignificant impact on altering donations to climate change advocacy or the intent for future climate-friendly behaviour. Other authors found ineffective or even reverse effects of responsibility on actions related to climate change (Stoll-Kleemann et al. 2001; Markowitz and Shariff 2012). According to Brügger et al. (2015), the impact of responsibility could also depend on belief in respondents' efficacy and cost and benefit of behaviour. Therefore, in this paper, we analysed the impact of personal responsibility on separate actions related to climate change mitigation. This aspect, to the best of our knowledge, was not analysed by previous researchers.

Furthermore, in this study, we explored whether, for example, individuals who insulated homes to reduce energy consumption also used environmentally friendly alternatives to a private car and engaged in other activities related to climate change mitigation. Therefore, this analysis also presents whether all types of actions are guided by the same goals. Liobikienė and Juknys (2016), Lindenberg and Steg (2013), and Steg et al. (2014) showed that separate types of pro-environmental behaviour could be guided by different goals (e.g., gain, hedonistic, normative). The gain goal promotes people's saving behaviour, the hedonistic goal concerns behaviour related to the enhancement of individuals' status, and normative goals guide people to behave in an environmentally friendly mode because they think that for other people and generations, it is important. Broomell et al. (2015), Gifford and Comeau, 2011, Kwon et al. (2019), Stevenson and Peterson (2016) revealed that demographic variables are important factors as well which contribute to actions related to climate change mitigation.

3. Methodology

The analysis of climate change concern, personal responsibility, and actions related to climate change mitigation in the EU in this study has been conducted based on the Eurobarometer 91.3 survey performed in April 2019. The respondents in all EU countries from different social and demographic groups were interviewed face-to-face. The detailed interview methods and

confidence intervals are presented in a report by the European Commission. The study encompasses all EU countries.[1]

The climate change concern was evaluated by answering the question, "How serious a problem do you think climate change is at this moment?" The scale was from 1 to 10, with '1' meaning it is "not at all a serious problem" and '10', meaning it is "an extremely serious problem". Personal responsibility was measured assigning dichotomous values to the question of who is responsible for assuaging climate change (1=I personally, 0=not I personally). The action related to climate change mitigation was evaluated by answering the questions: "Which of the following actions apply to you?": a) I have bought a new car which consumes low fuel; b) I have bought an electric car; c) I regularly use environmentally friendly alternatives to private cars such as walking, cycling, taking public transport, or car-sharing; d) I have insulated my home better to reduce energy consumption; e) I have bought a low-energy home; f) when buying a new household appliance (e.g. washing machine, refrigerator, television), lower energy consumption is an important factor in my choice; g) I have switched to an energy supplier which offers a greater share of energy from renewable sources; h) I have installed equipment at home to control and reduce my energy consumption (e.g., smart meter); i) I have installed solar panels at home; j) I consider the carbon footprint of food purchases and adapt shopping accordingly; k) I consider the carbon footprint of transport when planning holidays and other long-distance travel and adapt plans accordingly; l) I try to reduce waste and I regularly separate it for recycling; m) I try to cut down on consumption of disposable items whenever possible (e.g., plastic bags from the supermarket, excessive packaging). The items were measured using dichotomous values. Respondents were able to choose none, few, or all of the actions. Analysing the impact of economic development and cultural dimensions on action related to climate change mitigation, we summed these dichotomous variables.

Executing the cross-culture analysis, we performed panel analysis considering all EU countries. Analysing the influence of economic development on climate change concern, personal responsibility, and actions related to climate change mitigation, the GDP per capita in purchasing power parity (constant 2011 international dollars) in 2018 was used. To evaluate the impact of

[1] AT-Austria, BE-Belgium, BG-Bulgaria, CY-Cyprus, CZ-Czech Republic, DK-Denmark, EE-Estonia, ES-Spain, FL-Finland, FR-France, GE-Germany, GR-Greece, HR-Croatia, HU-Hungary, IE-Ireland, IT-Italy, LV-Latvia, LT-Lithuania, MT-Malta, NL-Netherlands, PL-Poland, PT-Portugal, RO-Romania, SK-Slovakia, SL-Slovenia, SE-Sweden, and UK-United Kingdom.

cultural dimensions, Hofstede's six cultural dimensions taken from http://geert-hofstede.com/lithuania.html database were applied. In this paper we analysed the impact of these cultural dimensions: a) masculinity—when societies place greater importance on assertiveness, competition, achievement, and success; b) power distance—this dimension includes the extent to which the less-powerful members of organizations and institutions accept and expect that power is distributed unequally; high power distance societies emphasize wealth, power, prestige, and status symbols; c) individualism—is a value where loose ties among people prevail; independence, pleasure, self-reliance, personal achievement, and competition are attributed to individualists; d) uncertainty avoidance—this dimension shows to what extent a culture programs its members to feel uncomfortable in unstructured situations; in cultures with low uncertainty avoidance, people tolerate unstructured situations and tend to be innovative and less apprehensive; e) long-term orientation—this cultural dimension system fosters pragmatic virtues oriented towards future rewards such as saving, persistence, and adapting to changing circumstances; and f) indulgence—this value allows relatively free gratification for basic and natural human drive related to enjoying life and having fun.

For assessing the relationship between economic development, values of cultural dimensions, and climate change concern, personal responsibility, and actions related to climate change mitigation, the Spearman correlation analysis was applied. $P<0.05$ was considered to be the correlation coefficient between significant analysed variables. To reveal whether climate change concern, personal responsibility, actions related to climate change mitigation, gender, or age contribute to separate actions in EU countries, a binary logistic regression was applied. This statistical method was chosen because the dependent variables (actions related to climate change mitigation) were dichotomous. This statistical method also was applied by other authors (Ezebilo and Animasaun, 2011; Dhokhikah et al., 2015; Minelgaitė and Liobikienė, 2019). Using SPSS statistical software to evaluate the fit of the model, the Neglekre R2, overall percentage, and omnibus test's *p*-value were measured. The binary logistic regression model is statistically significant if the omnibus test's *p*-value is smaller than 0.05.

4. Results and discussion

4.1. Performance of actions related to climate change mitigation in EU countries

The results of the performance of actions related to climate change mitigation are presented in Table 1. As we see, the performance of actions related to climate change mitigation varied across European countries, and in separate EU countries, people were more willing to perform different types of actions. Generally, in the EU, the largest share of respondents mentioned that they try to reduce waste and regularly separate it for recycling. Particularly in Luxemburg and Sweden, respondents declared that they reduce and separate waste. This result reveals that this action is acceptable compared to other pro-environmental actions. Waste separation does not require any additional cost. Moreover, in recent decades, people have become extensively informed about waste problems, and waste recycling facilities and infrastructure are rather well developed in almost all EU countries. Meanwhile, in Bulgaria and Romania, only one-third of respondents stated that they reduce and separate waste. Therefore, in these countries, policymakers should concentrate more on the successful implementation of waste management policy.

In the EU, more than half of the respondents stated that they reduce the usage of disposable items. The largest share was observed in the Netherlands and Sweden, and the least, in Romania and Bulgaria. However, in latter countries, individuals were more linked to use of fewer disposable items rather than separating waste. Less than half of EU-28 respondents declared that they buy energy saving appliances. Meanwhile, only one-third of respondents in EU-28 are less linked to using environmentally friendly alternatives to private cars. Particularly in Portugal and Poland, only 13-16 % of respondents stated that they use alternatives to private cars. Decreasing the usage of a car is not convenient and requires additional efforts. Furthermore, about one-third of EU-28 respondents insulated homes to reduce energy consumption (Table 1).

Table 1. Share of actions related to climate change mitigation in EU countries.

	I have bought a new car low fuel consumption	I have bought an electric car	I use environment-tally-friendly alternatives to private car	I insulated home better to reduce energy consumption	I have bought a low-energy home	Buying a new household appliance lower energy consumption is an important factor	I have switched to an energy supplier which offers a greater share of energy from renewable sources	I have installed equipment in home to control and reduce your energy consumption	I have installed solar panels in home;	I consider the carbon footprint of food purchases and adapt shopping accordingly	I consider the carbon footprint of transport and adapt plans accordingly	I try to reduce waste and regularly separate it for recycling	I try to cut down on consumption of disposable items whenever possible
FR	16.3	1.3	38.1	33.6	8.8	56.6	9.2	20.3	3	25.4	11.4	87.5	68.5
BE	18.7	2.9	43.7	36.1	9.4	58.3	24.9	16.1	12.7	29.1	15.4	78.1	67
NL	19.6	2.4	64.3	42.1	13.6	78.7	24.5	51.7	24.7	38.6	28.6	88.6	84.9
GE	12.8	0.6	57.3	22.7	4.3	63.8	21	14.7	8.4	27.3	24.6	84.6	80.1
IT	9.4	2.2	21.8	14.3	3.3	40.6	10.7	7.9	5.4	4.8	4	66.2	43.4
LU	21.5	4	41.8	33.7	12.9	60.2	11.4	25.7	10.8	32.3	19.9	90.4	79.1
DK	27.3	1.5	45.2	35.6	10.2	63	16.3	25.8	7.9	29.5	19.6	77.2	71
IE	15	2.8	37.8	33.8	8.4	39.7	14.1	18.4	8	26.1	13.7	72.1	61.9
UK	17.5	2.5	46	36.9	6.7	42.9	22.2	30.7	5.1	28.4	17.3	84.7	66.6
GR	3.9	0.5	29.5	25	1.4	40.3	2.6	2.5	14.9	2.1	2.3	73.2	63.3

ES	4.5	0.8	31.5	15.6	3	39.2	4.2	17.7	1.8	10.3	3.5	84.5	59.4
PT	4.4	1	13.4	17.4	1.6	40.5	3.6	6.2	4	5.3	3	75	51.9
FL	16.4	1.8	42.4	22.6	3.7	48.8	16.1	22.5	3.9	39.9	24.2	81.5	75.6
SE	20.8	2.9	64.1	18.3	2.5	60.9	26.5	16.2	3.8	40.9	39.8	91.4	83.8
AT	11.9	3.1	37.4	18.5	4.1	46.3	15.3	17.1	7.9	20.8	13.9	69.4	60.3
CY	14.1	1	19.6	31.2	6	53	4	10.7	20.8	8.1	3	78.4	69.4
CZ	11.2	1	28.7	25.1	2.2	53	5.4	9.7	5.2	8.9	5	76.6	54.9
EE	15.8	0.6	33.9	40.6	5.3	56.6	3.7	11.3	2	12.1	3.8	78.4	67.1
HU	8.3	2	20.9	224	6.3	44.8	4.6	8.1	4.6	12.9	9.7	60	54.2
LV	17.5	0.9	41	31.4	2	64.1	4	15.9	1	10.9	4.1	62.9	62.3
LT	7.2	0.3	21.7	19.2	1.4	46.8	0.5	7.3	0.9	6.2	2.7	78.9	45.9
MT	5.3	1.4	30.4	4.7	24	48.7	1.2	25.4	12	11.4	4.5	85	58.8
PL	4.7	0.5	16.3	16.2	3.1	37.9	2.9	8.4	2.6	5.3	2.9	56.6	46.6
SK	6.3	0.7	27	25.7	0.9	34.8	3.9	7.3	3.1	4.8	2.3	72.1	52.8
SL	13.2	0.9	43.5	32.1	5.4	55.7	16	14.1	6.9	23.4	7	84.6	69.8
BG	5.2	0.6	22.1	33.1	2.3	48.3	1.6	3.2	4	2.5	2.2	30.8	35.5
RO	5	1	21.7	25.6	1.4	35.3	3.6	6.5	2.8	4.3	3.3	33.1	34.9
HR	7.7	0.2	20.6	24.1	2.2	40.7	3.5	5.2	0.9	4.9	3.1	69.3	49.6
EU-28	12.2	1.4	34.8	26.3	4.6	49.8	10.3	14.8	6.3	17	10.6	73.4	61.2

Only 17 % of EU-28 respondents stated that they considered the carbon footprint and adapted food shopping accordingly. In Scandinavian countries, people were the most linked to considering the carbon footprint. Meanwhile, only 2 % of respondents in Bulgaria and Greece mentioned that the carbon footprint is an important factor in choosing food (Table 1). These results reveal that the information and the labelling of the carbon footprint on food products is not popular in the EU. Therefore, the provision of a carbon footprint should be required, that consumers could compare the information and choose a more climate-friendly product. The consumers also should be educated about what carbon footprint means. Furthermore, more rarely, people in EU countries considered the carbon footprint of transport and adapted plans accordingly. Therefore, the provision of this information should be important for transport services as well.

One-seventh of EU-28 respondents installed equipment in the home to control and reduce energy consumption. Of respondents in EU-28, 12 % purchased a new low-fuel-consumption car; 10.3 % of respondents switched to an energy supplier offering a greater share of energy from renewable sources (Table 1). To perform these behaviours, it is important to have enough income and ability, for example, to switch energy suppliers. Therefore, only about 1 % of respondents in Malta and Lithuania switched energy suppliers due to the lack of ability to switch energy suppliers.

The fewest people in EU countries were linked to installing solar panels in the home, buying a low-energy home, and purchasing of electric cars (Table 1). These behaviours are very expensive, particularly buying low-energy homes. Furthermore, as we see, people in the EU countries were more linked to buying new low-fuel-consumption electric cars, due to the lack of infrastructure

facilities and supplies. However, in the near future, when the EU takes leadership in assuaging climate change, the transport sector will be a priority when seeking a low-carbon economy.

4.2. Economic development and cultural dimensions impact on climate change concern, personal responsibility, and actions related to climate change mitigation.

Climate change concern differed among EU countries. The lowest number of individuals concerned about climate change were in Latvia and Estonia. Meanwhile, in Malta, Greece and Spain, the largest share of respondents stated that climate change is a very serious problem (Fig. 1.). This can be related to the fact that the consequences of climate change (e.g., drought, the increase of water level) are felt the most in southern EU countries. However, generally in EU, people were rather concerned about climate change (on a scale of 10, respondents' average score was 8), which reveals that climate change is a rather important problem in the EU.

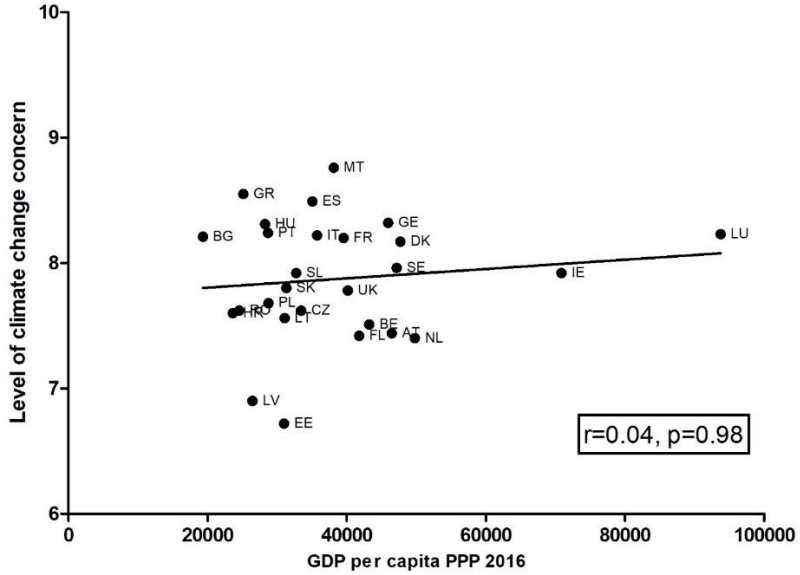

Fig.1. Relationship between level of climate change concern and economic development (GDP per capita)

Considering the impact on economic development, the results showed an insignificant relationship between economic development and the level of climate change concern (Fig. 1). In the literature, researchers measured negative (Kim and Wolinsky-Nahmias, 2014; Kvaløy et al., 2012; Mostafa, 2016smith), or positive impact on public concern about climate (Carmichael and Brulle, 2017; Lo and Chow, 2015; Knight, 2016). However, in our case, when considering developed countries and

the time when economic development stabilizes growth, almost all countries are equally concerned about climate change and it did not depend on countries' economic development level.

The assumption of personal responsibility also differed among EU countries. In the Netherlands, Sweden, and Finland, the largest share of respondents stated that they are personally responsible for assuaging climate change. Meanwhile, in Bulgaria, Hungary, Poland, and the Czech Republic, only about 20 % of respondents mentioned that they are responsible for climate change (Fig. 2). Considering that in these countries coal fuels are consumed the most, people look to the government to take more responsibility to lessen climate change. Therefore, in these countries, the information and education about behaviours' impact on climate change are very important, that people feel their responsibility for climate change personally.

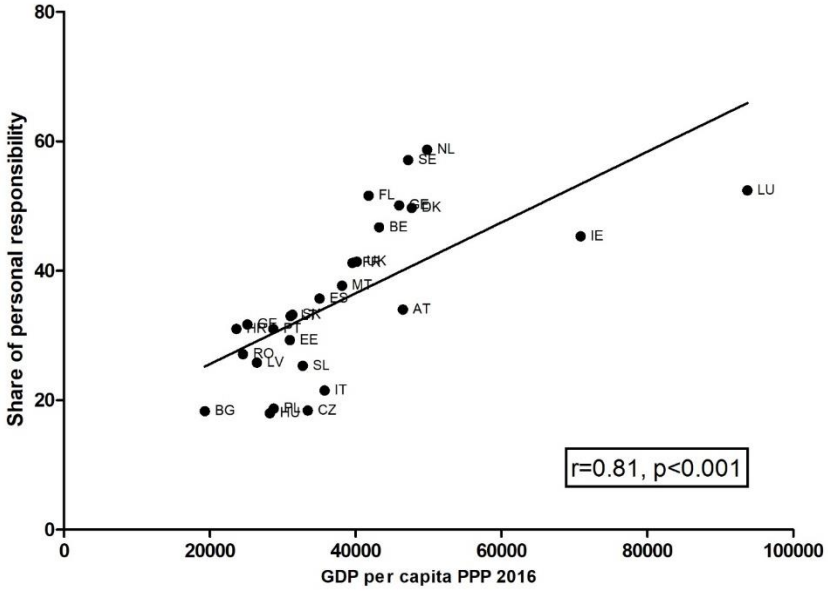

Fig.2. Relationship between share of personal responsibility and economic development (GDP per capita)

Furthermore, the results revealed a significant relationship between the share of personal responsibility and economic development (Fig. 2). Thus, the richer a country is, the more people tend to assume responsibility to manage climate change. It can be related that rich people are more linked to taking responsibility for themselves, rather than looking to government or enterprises.

The largest number of actions performed was by respondents in the Netherlands, Sweden, and Luxemburg. In Bulgaria, Romania, and Poland, on average, respondents performed about two actions related to climate change mitigation (Fig. 3). Furthermore, the relationship between actions related to climate change mitigation and economic development was positive and significant.

Thus, in countries where rich people live, they have abilities and enough income to behave climate-friendly because some of these actions are rather high-cost.

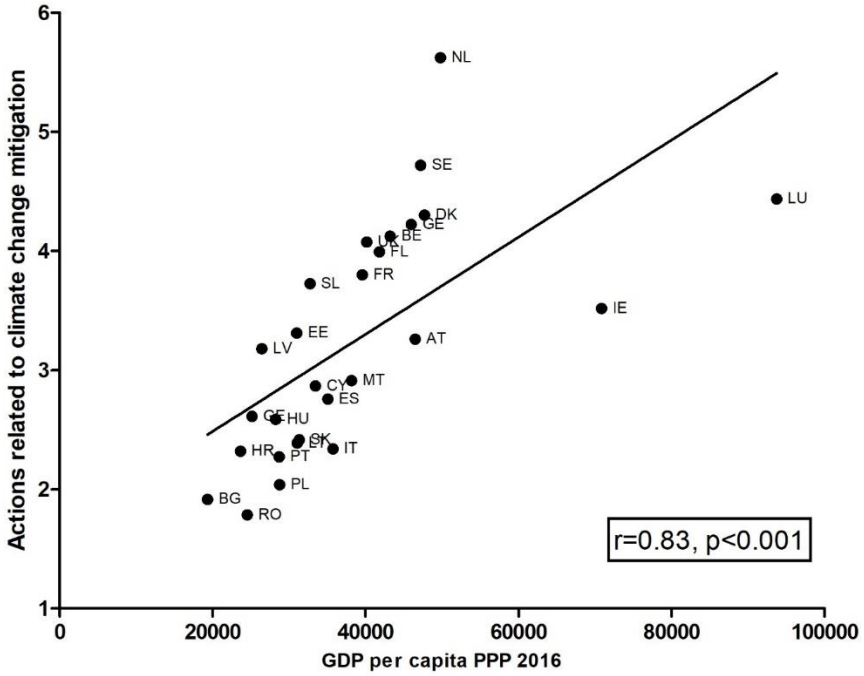

Fig. 3. Relationship between actions related to climate change and economic development (GDP per capita)

Cultural aspects are also important in terms of climate change concern and risk perception (Shi et al., 2015; Lacroux and Gifford., 2018). Analysing the influence of Hofstede's six cultural dimensions (Hofstede, 2001), we found that only the level of uncertainty avoidance had a positive and significant effect on climate change concern. These results reveal that individuals took more care about climate change where a culture of uncertainty avoidance dominated. Therefore, climate change is related to uncertainty. In the literature, authors found that individualists are more sceptical about climate change and less concerned about climate change (Pelham, 2018; Capstick and Pidgeon, 2014; Shi et al., 2015). In our study, we also found a negative impact of individualism's value on climate change concern. However, the relationship was insignificant. The residual cultural dimensions insignificantly determined climate change concern (Table 2).

Table 2. Spearman correlation coefficiens between the cultural dimension and climate change concern, personal responsibility, and actions related to climate change mitigation

Cultural dimensions	Power Distance	Masculinity	Individualism	Uncertainty Avoidance	Long-term Orientation	Indulgence

Climate change concern	0.127	0.309	-0.142	0.385*	-0.325	0.243
Personal responsibility	-0.557*	-0.201	0.396*	-0.457*	-0.06	0.688*
Actions related to climate change mitigation 0.833*	-0.64*	-0.237	0.572*	-0.528*	0.098	0.687*

* p<0,05 (N=28)

Analysing cultural dimensions' impacts on personal responsibility and actions related to climate change mitigation, the relationships were rather similar. We found that the level of masculinity and long-term orientation insignificantly influenced personal responsibility and actions related to climate change mitigation. Meanwhile, the power distance and uncertainty avoidance negatively and significantly determined the assumption of responsibility and the level of climate-friendly behaviour (Table 3). These results reveal that people were more linked to assume responsibility and performed more actions related to climate change mitigation in countries where the power distance and uncertainty avoidance culture dominated less. Thus, people assume responsibility and behave in a more climate-friendly manner in the countries where people tolerate unstructured situations less which climate change can raise; and where more conform to a hierarchy which can be motivated to trust government more, but not take responsibility and act to mitigate climate change.

The level of individualism and indulgence had a significant and positive effect on the assumption of personal responsibility and actions related to climate mitigation (Table 2). These results contradict Shi et al.'s (2015) findings that individualistic worldviews are related negatively to willingness to change behaviour and acceptance of climate-friendly policies. These results showed that in individualistic countries and societies where they believed themselves to be in control of their own lives are more willing to assume responsibility to assuage climate change and to behave in this manner.

4.3. The determinants of actions related to climate change mitigation.

Despite a great environmental concern, people do not always perform pro-environmental behaviour because it is sometimes not convenient and requires additional efforts. Alternatively, due to high-cost behaviour or lack of abilities, people do not behave environmentally friendly. Furthermore, although performing one type of pro-environmental behaviour, people are not always likely to perform another type of behaviour due to different efforts, costs, or benefits. Analysing the determinants of separate actions related to climate change mitigation, we found that personal

responsibility to manage climate change significantly and positively influenced the purchase of new low-fuel-consumption cars. However, the climate change concern negatively and insignificantly influenced the purchase of this type of car. Thus, this result shows that the cost of this behaviour is rather high, and people buy new cars not due to climate change concern, but due to the responsibility level. Chng et al. (2019) found that individuals who engaged with climate change were more likely to consider electric, environmentally friendly, and/or smaller-engine cars. Furthermore, young people and men were linked to buying new low-fuel-consumption cars. Thus, these results reveal that hedonistic goals could motivate people to buy these cars. Considering separate types of actions related to climate change mitigation, we found that all analysed actions, expect the reduction and separation of waste, significantly and positively influenced the purchase of new low-fuel-consumption cars. Thus, if respondents perform other actions related to climate change mitigation, they also were more likely to buy low-fuel-consumption cars.

Meanwhile, the motives and goals which encourage one to buy new low-fuel cars are different when we take into account waste reduction and separation actions. The purchase of an electric car insignificantly depended on the climate change concern and personal responsibility. Thus, the gap between this action and attitudes could occur due to the high-cost of this behaviour and the lack of ability (e.g., infrastructure, supply if electric cars).

Furthermore, older people are more linked to buying electric cars, while gender had an insignificant effect. This contrasts with a study by Simsekoglu (2018), which found that women are more likely to agree to buy an electric car than men and increasing age, significantly decrease the probability of owning only this type of car. Considering separate actions related to climate change mitigation, people who were more linked to buying energy-saving household appliances, reduce and separate waste, and cut down disposable items' consumption were less linked to buying electric cars. It can be related that these people have no ability to buy electric cars and those who purchase did not behave in an environmentally friendly mode. Furthermore, an insignificant effect of usage of environmentally friendly alternatives was observed instead of private cars and insulating homes better to reduce energy.

Climate change concern and personal responsibility significantly affected the usage of environmentally friendly alternatives to private cars. Thus, more people are concerned about climate change and assumed responsibility to assuage climate change. They were more liked to choose other alternatives instead of private car usage. Older people were more linked to perform

this type of behaviour but gender had an insignificant effect. Analysing the impact of other types of actions related to climate change mitigation, an insignificant effect was observed concerning the purchase of new, low-consumption, and electric cars. Thus, it is logical that people who buy new cars do not choose the alternative to use private cars. The respondents who installed the solar panels also were not linked to choosing environmentally friendly travel modes. The residual actions of climate-friendly behaviours significantly influenced the usage of environmentally friendly alternatives to private cars.

Analysing the determinants of willingness to insulate a home to reduce energy consumption, we found that climate change concern and personal responsibility insignificantly influenced this type of action. It could be related that people insulated a home due to the gain goal to save expenditures to heating but not due to environmentally friendly attitudes. Adua (2020) also suggested householders who believe their homes are sufficiently insulated may be worrying less about the energy-related consequences (e.g., higher costs or negative environmental impacts) of seeking warmer home temperatures during the colder months of the year. Furthermore, men and younger people noticed more that they insulate homes better to reduce energy consumption. Almost all separate actions related to climate change behaviour significantly influenced insulated behaviour. Only people who stated that they purchased electric cars and considered the carbon footprints choosing food products were not linked to insulating homes to reduce energy consumption.

The highest cost behaviour, purchase of a low-energy home, was significantly influenced by personal responsibility. Meanwhile, climate change concerns insignificantly influenced this type of action. Furthermore, men were more linked to buying energy-saving homes. Age had an insignificant effect. Meanwhile, people who bought energy saving appliances considered the carbon footprint choosing the travel trip and reduced and separated waste were not linked to buying low-energy homes. The negative effect of cutting down the consumption of disposable items was observed. Therefore, the financial abilities are the primary factors which can enhance to buy low-energy home.

The purchase of energy saving appliances significantly depended on climate change concern and personal responsibility. Gender had an insignificant effect, but young people were more linked to buying these products and this could be attributed to lower social status and income. This was confirmed by Vogiatzi et al. (2018) who revealed that income was related to environmental awareness, being environmentally friendly, and engaging in no-cost energy saving practices.

Furthermore, people who bought low-energy homes were not willing to buy energy-efficient appliances. It could be related that people believe that in their home, they automatically save energy. It's very important that to legitimize less-energy-intensive design solutions, householders need to perceive comfort as something to be actively achieved by them (and achieved through their practices), rather than just as a feature that is delivered passively to them (through the installation of technology) (Romanach et al., 2017). Furthermore, people who purchased electric cars did not buy energy saving appliances. Hope et al. (2018) demonstrated that people curtailed resources used for making limited energy supplies last longer and managing energy bills. Therefore, the motives and goals of these behaviours are different. The residual actions significantly influenced this action.

Table 3. Results from the binary logistic regression on separate actions related to climate change mitigation in the EU.

	I have bought a new car low-fuel-consumption (1)	I have bought an electric car (2)	I use environment-tally-friendly alternatives to private car (3)	I insulated home better to reduce energy consumption (4)	I have bought a low-energy home (5)	Buying a new household appliance lower energy consumption is an important factor (6)	I have switched to an energy supplier which offers a greater share of energy from renewable sources (7)	I have installed equipment in home to control and reduce energy consumption (8)	I have installed solar panels in home (9)	I consider the carbon footprint of food purchases and adapt shopping accordingly (10)	I consider the carbon footprint of your transport and adapt plans according ly (11)	I try to reduce waste and regularly separate it for recycling (12)	I try to cut down on consumption of disposable items whenever possible (13)
Climate change concern	**-0.01**	**-0.01**	0.039	**-0.004**	**-0.013**	0.031	**0.013**	-0.05	**0.022**	0.079	0.078	0.086	0.089
Personal responsibility	0.143	**0.158**	0.328	**-0.037**	0.173	0.059	0.235	0.294	0.239	0.351	0.396	0.36	0.299
gender	-0.305	**-0.169**	**0.013**	-0.141	-0.145	**0.012**	-0.172	-0.218	-0.156	0.265	-0.135	0.156	0.234
age	-0.002	0.006	0.008	-0.007	**0.0003**	-0.08	**-0.001**	-0.004	**0.001**	0.005	0.005	-0.002	**0.0001**
(1)		1.23	**0.08**	0.579	0.712	0.674	0.414	0.468	0.296	0.285	0.261	**0.075**	0.279
(2)	1.236		**0.057**	**0.05**	0.832	-0.335	0.474	0.565	1.107	**0.255**	0.5	-0.513	-0.388
(3)	0.106	**0.089**		0.087	0.173	0.499	0.34	0.23	**0.072**	0.571	0.965	0.419	0.817
(4)	0.588	**0.078**	0.087		0.776	0.792	0.26	0.667	0.842	0.117	**0.028**	0.256	0.251
(5)	0.703	0.867	0.157	0.76		**0.022**	0.514	0.651	0.813	0.221	**0.168**	**-0.1**	-0.194
(6)	0.689	-0.298	0.499	0.794	**0.071**		0.373	0.522	0.306	0.415	0.213	0.549	0.874
(7)	0.393	0.478	0.316	0.25	0.508	0.348		0.523	0.469	0.712	0.653	0.131	0.268
(8)	0.458	0.553	0.212	0.657	0.649	0.502	0.53		0.618	0.43	0.352	0.19	0.295
(9)	0.294	1.103	**0.005**	0.829	0.809	0.275	0.478	-0.624		**0.1**	**0.076**	**-0.03**	**-0.006**
(10)	0.282	0.31	0.564	0.104	0.246	0.406	0.727	0.43	0.12		1.553	0.49	0.653
(11)	0.214	0.45	0.945	**-0.046**	**0.134**	0.195	0.649	0.318	**0.041**	1.542		**0.027**	0.321
(12)	**0.067**	-0.52	0.419	0.258	**-0.119**	0.551	**0.103**	0.176	**0.025**	0.442	**0.032**		1.01
(13)	0.296	-0.394	0.819	0.251	-0.188	0.874	0.267	0.303	**-0.016**	0.632	0.309	1.006	
Omnibus t-test	2231 p<0.05	464,3 p<0.05	4969 p<0.05	3362 p<0.05	1093 p<0.05	5971 p<0.05	2359 p<0.05	2970 p<0.05	1270 p<0.05	5152 p<0.05	4016 p<0.05	4078 p<0.05	6676 p<0.05
Overall Percentage	87.7	98.6	71.5	75.5	95.3	68.8	89.6	85.3	93.9	85.2	89.7	75.4	71.5
Neglekre R2	0.149	0.121	0.229	0.169	0.125	0.262	0.17	0.181	0.12	0.287	0.277	0.203	0.295

Bold colour means that $p > 0.05$

Analysing the actions related to renewable energy consumption, such as switching energy suppliers which offer energy from renewable source and installation of solar panels, we found that climate change concern insignificantly influenced these actions. Therefore, the consumption of renewable energy was motivated not due to the climate change concern, but due to other reasons such as monetary gain. Furthermore, so that people could switch the energy supplier, the possibilities are very important. Meanwhile, people who were linked to assuming responsibility to assuage climate change were linked to switching their energy supplier and to installing solar panels. Furthermore, men were linked to performing these behaviours. Age insignificantly affected actions related to renewable energy consumption. Analysing separate actions related to climate change mitigation, all actions except reduction and separation of waste, significantly contributed to switching energy suppliers.

Meanwhile, respondents who chose alternatives for private car usage, considered carbon footprint when planning trips, reduced and separated waste, and cut down consumption of disposable items were not linked to installing solar panels. This result reveals that people install solar panels guided by different gain goals.

Furthermore, the benefits and possibilities should be evaluated analysing these actions (Table 3). In terms of possibilities, Jackson et al. (2019) showed that while sociodemographic and housing characteristics, in particular, equivalent income and dwelling type, explain part of the investment decision of renewable technology, it is primarily the revenues and, in particular, the costs associated with investments. The implication is that residents' possibilities could make it difficult for renewable installations despite the estimated benefits or environmentally friendly beliefs. The installation of equipment in the home to control and reduce energy consumption significantly but negatively depended on climate change concern. Thus, the more people were concerned about climate change, the less they were linked to installing this equipment.

Meanwhile, more people were linked to assuming personal responsibility. Moreover, they were linked to installing equipment to control and reduce energy consumption. Considering that this action is related to technological innovations, men and young people were more linked to performing this action. All actions related to climate change mitigation significantly influenced the installation of equipment that controls and reduces energy consumption. Only respondents who installed solar panels did not install this equipment (Table 3).

Analysing the consideration of carbon footprint in choosing food products and trips significantly positively depended on climate change concern and personal responsibility. Thus, the environmental-friendliness aspect is very important to promote these actions. Older people were more linked to considering carbon footprint, possibly because they are more linked to reading product labels. Women were more linked to considering carbon footprint when choosing food products, while men were more linked to considering carbon footprint when choosing trips. These results could be explained by the fact that both women and men share their functions in daily life. This is confirmed by Smetschka et al. (2019) who stated that women's and men's carbon footprints depend on the traditional division of labour, as women spend more time with caring activities and men with employed work and with sports, hobbies, and watching television. Analysing the impact of separate actions on these behaviours, we found that all actions, expect the purchase of an electric car and installation of solar panels, were related to the consideration of carbon footprint when choosing food to consume. Meanwhile, people who insulated homes better to reduce energy consumption, bought low-energy homes, installed solar panels, and reduced and separated waste were not linked to considering carbon footprint when choosing trips (Table 3).

Considering actions related to waste management, climate change concern, and personal responsibility significantly and positively influenced both reduction and waste separation and cut down on consumption of disposal items. Thus, more people were concerned about climate change and assumed responsibility. Moreover, they were willing to take actions related to waste reduction. Thus, the normative goals could guide people to perform actions related to waste management. Considering the demographic variables, women were more likely to separate and reduce waste. The same results were found by Talaj and Walery (2015) Zhang et al. (2017) and Minelgaitė and Liobikienė (2019).

Meanwhile, younger people were more linked to separating waste but the effect of age on the reduction of consumption of disposable items was insignificant. Analysing separate actions related to climate change mitigation, people who purchased electric cars did not perform both waste reduction actions. The purchase of new low-fuel-consumption cars insignificantly determined the actions related to waste reduction and separation. People who bought low energy homes also stated that they did not perform waste reduction behaviour. Thus, people who performed high-cost actions did not perform low-cost actions. Therefore, these results reveal that people perform actions of high-cost due to hedonistic goals which show their status and they are not linked to

perform low-cost behaviour such as separating waste because it is not fashionable or pleasurable to perform. Furthermore, people who installed solar panels also were not linked to perform waste separation or reduction of disposable items. People who considered the carbon footprint when planning trips were not linked to reducing and separating waste (Table 3).

Conclusion and policy implication

A large number of authors concentrated on the changes and the primary determinants of climate change concern. However, for successful climate change policy implementation, the most important is the promotion of pro-environmental behaviour related to climate change mitigation. Both the level of climate change concern and pro-environmental behaviour could differ in the countries due to the different economic development levels and cultures. Encompassing the EU countries, the aim of this paper was to analyse how economic development and Hofstede's cultural dimensions contributed to climate change concern, personal responsibility, and actions related to climate change mitigation. Furthermore, considering that actions related to climate change mitigation have different costs and benefits, in this study, we revealed whether climate change concern and personal responsibility equally influenced all actions related to climate change mitigation and whether all types of actions were guided by the same goals.

Analysing the performance of actions related to climate change mitigation, these actions varied across European countries. The largest share of respondents declared that they reduce waste and regularly separate it for recycling. More than half of respondents stated that they reduce the usage of disposable items. Meanwhile, only one-third of respondents in EU-28 mentioned that they were less linked to using environmentally friendly alternatives to private cars. The consideration of carbon footprint in choosing food products or trips was even rarer. The fewest people in EU countries were linked to installing solar panels at home, buying a low-energy home, and the purchase of electric cars. Therefore, these results reveal that the more actions are expensive or inconvenient and require additional efforts, the less people are linked to perform them. Thus, promoting climate-friendly behaviour, policymakers should consider that the barriers and costs of non-environmentally friendly actions would be higher than the convenience level, for example, of care usage. Therefore, policymakers should not only improve the quality of public transport but trigger economic incentives (e.g., higher road and fuel prices, parking charges) to reduce private

car usage. Alternatively, it is important to reduce the cost of climate-friendly behaviour. The subsidies for household renovation or the electric car purchase would also be recommended to enhance climate change mitigation. The abilities such as better infrastructure for electric car usage or switching energy suppliers are also important and policymakers should provide them.

Climate change concern, assumption of personal responsibility, and the level of actions related to climate change mitigation differed among EU countries. In Malta, Greece, and Spain, respondents were mostly concerned about climate change. Meanwhile, in the Netherlands and Sweden, the largest share of respondents stated that they are personally responsible for assuaging climate change and performing the largest number of actions related to climate change mitigation.

Economic development level significantly influenced the assumption of personal responsibility and the number of actions related to climate change mitigation, but not climate change concern. Therefore, even in less-rich EU countries, people should be informed and educated that individuals are also responsible for climate change, and they personally should take actions related to climate change mitigation. Policymakers could only help to reduce the cost of behaviour and provide more abilities. Analysing the influence of Hofstede's six cultural dimensions, only the level of uncertainty avoidance had a positive and significant effect on the climate change concern. Meanwhile, the power distance and uncertainty avoidance negatively and significantly influenced the assumption of responsibility and the level of actions related to climate change mitigation while, the level of individualism and indulgence positively influenced them. Therefore, when implementing climate change policy, it is vital to consider cultural dimensions and promote climate change concern, responsibility, and climate-friendly behaviour.

Considering separate actions related to climate change mitigation, different factors influenced these actions. The assumption of personal responsibility to manage the climate change problem significantly and positively influenced almost all actions except the purchase of electric cars and insulation for homes to reduce energy consumption. Therefore, for policymakers, it is very important to enhance the personal responsibility that people behave more climate-friendly by providing information about the impact and the consequences of personal behaviour. Climate change concern positively and significantly affected only low-cost actions related to climate change mitigation as a consideration of carbon footprint when choosing products, actions related to waste reduction, purchase of energy efficiency appliances, and the usage of environmentally friendly alternatives instead of private cars. Meanwhile considering the high-cost actions as the

purchase of a new car, low-fuel-consumption, or electric cars, low energy homes, or contributions to climate change mitigation by using more renewable energy sources, climate change concern insignificantly influenced these actions. Therefore, policymakers should not only enhance the awareness and the concern about climate change but also to reduce the cost of high-cost climate-friendly behaviours and provide the ability to perform these actions.

Analysing the impact of separate actions, we did not find that if respondents performed one type of action related to climate change mitigation, they also were likely to perform other actions. Particularly, people who performed high-cost actions did not perform low-cost actions. These results reveal that actions related to climate change mitigation have different costs and were guided by different goals, and policymakers should consider these goals.

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