

Does information inspire action? On the relationship between climate change awareness and adequate response

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Abstract

While climate change is a global phenomenon, action must be taken at all levels – global, national, local and individual. Although the information on climate change is more accessible than ever, the adequate action is still lagging. People are engaged in mitigation and adaptation activities to varying degrees. Using the data from a survey on the sample of citizens of Košice, Slovakia, we are able to identify which characteristics are connected to higher probability that person would engage in climate-friendly activities. Apart from socioeconomic factors, we study whether the knowledge about climate change impact, own experience and the sense of being sufficiently informed affects the likelihood to act. We distinguish between activities require substantial financing and those that are for free. The research tries to shed light on the topic of translating information into real-life action. This relationship needs to be understood in order to design effective climate change education and awareness activities. Our findings suggest that perceived vulnerability is the most important factor associated with climate-friendly activities.

Points for practitioners

Current research on climate change awareness points to the importance of identities and values, which shape peoples' perceptions of climate change. Politization of the issue may cause lower efficiency of education and campaigns, and therefore should be avoided if possible. Policies should be designed and communicated in such way, so that they reflect different worldviews and respect values of different population groups. This is best achieved through targeted campaigns aimed at specific audiences.

In our research, experience with weather extremes and their impacts on human health, business, agriculture, infrastructure and property is the most important factor associated with climate-friendly action. Extreme weather events should therefore be considered as opportunities for public authorities to raise awareness about the relationship between human activity, climate change and these types of events. This is necessary, as there seems to be feedback loop type of mechanism between belief in climate change and perceptions of extreme weather. Residents of Košice seem to be responsive to available information about climate change adaptation, especially when engaged in inexpensive adaptation/mitigation activities. Local authorities could therefore try to disseminate information on these types of measures, which can be easily implemented even when resources are limited. Engaging in these cheap climate-friendly activities is also associated with higher life satisfaction.

Keywords: climate change awareness, citizen engagement, vulnerability, adaptation, mitigation

Introduction

„Climate change is the most diabolically complex problem the world faces today“ (Khan & Munira, 2021).

The doubts about the gravity of the situation are steadily dissipating as more and more evidence about the anthropogenic causes is brought to light. Climate change will in some areas have substantial impact on economically relevant factors, as it will both shift means and variability of meteorological variables. In addition, extreme events are expected to become more frequent and severe. IPCC's most recent report confirmed that climate has been warming due to human influence at the unprecedented rate in at least past 2000 years (IPCC, 2021). The report also notes that human-induced climate change is already present in every region across the globe. Hot extremes (including heatwaves) and heavy precipitation events have become more frequent and more intense over most land area since 1950s. Agricultural and ecological draught has also increased in Western and Central Europe. As for future development, global surface temperature will continue to rise under all considered scenarios.

Climate change and its consequences are major global challenges, which require an active approach at different levels. At the local level, it is vital to focus on adaptation activities, which will help agents to acclimate, or ideally take advantage of the climate change. The local authorities can act only if the residents understand the potential impacts of climate change and acknowledge the importance of action. Designed policies must be perceived as a legitimate way how to tackle this issue. Otherwise, they might not be prioritized (Cashmore & Wejs, 2014).

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Citizen engagement and bottom-up approach is also highlighted in current academic literature (Apostolopoulos & Liargovas, 2018). Climate friendly behaviour is not only good for the society, but also for individuals, as green self image and related activities are connected to higher subjective well-being (Welsch et al., 2021)

As cities and individuals can play an important role in climate action, this study focuses on individual climate change awareness and climate-friendly activities in the urban context. Košice, the second largest city in Slovakia, until recently has not suffered from any major climate-change related problems. Now residents start to experience some of the manifestations of global warming in their own lives and expect some intervention by local authorities. So far, there is no climate adaptation strategy planned for Košice; therefore better understanding of climate change awareness, attitudes and activities of citizens, is vital at this stage. The survey was conducted as one of the initial steps in the process of preparation of adaptation strategy for the city.

The aim of this study is to analyse how residents of Košice perceive climate change, what is their experience, degree of vulnerability and how they translate their awareness into action. We study what are the characteristics connected to climate-friendly action, in order to better understand the mechanisms that motivate human behaviour in this area. Understanding these can serve as a basis for targeted policies, which will have better impact and will not exacerbate existing social tensions and inequalities.

Adaptation and mitigation

Dealing with climate change can be either focused on mitigation, that is, on reducing the magnitude of changes, or adaptation, aiming to make adjustments so that the harmful impacts are minimized. Proactive adaptation is prepared *ex ante*, trying to reduce vulnerability or take advantage of the forthcoming changes (Smit et al., 2000). In order to be more efficient, it would be optimal to focus on mitigation, since uncertainty makes costs of proactive adaptation measures higher and reactive measures do not, by their nature, prevent the damages (Shalizi & Lecocq, 2010). In reality, mitigation is most effective at global level, and thus it is vital to focus on adaptation in regional scope (Hallegatte et al., 2011). Some empirical findings point to existence of mitigation-adaptation gap, when citizens adopt dichotomous relationship to these activities and only choose only one set of activities (Brink & Wamsler, 2019). This might be explained by lower awareness of the need to adapt or the fact that some adaptation activities are contradictory to mitigation principles (e. g. air-conditioning).

Hallegatte (2011) puts adaptation and mitigation into context of economic theory. While mitigation produces public goods, adaptation mostly produces what is known to be private goods (or “club goods” in some cases, or geographically specific public goods). In international context, countries have to design their adaptation policies based on other countries’ efforts to mitigate. Domestic mitigation policies are most impactful when adopted in countries which are large emitters of emissions. As public goods are not spontaneously produced in sufficient amount due to selfishness of economic actors, public action is legitimate and necessary. From public opinion and policy perspective, empirical results showed that people are more inclined to support mitigation rather than adaptation policies (Alló & Loureiro, 2014). According to Stern (2008) (cited in Khan & Munira (2021)), climate change is the greatest market failure, which externalizes the emissions’ cost. Local, more than national policies are regarded as more legitimate for environmental management (Apostolopoulos & Liargovas, 2018). In addition, individual action should be encouraged, especially in case of adaptation, where the private or community benefits prevail.

Adaptation in cities

How climate change manifests itself in specific cities depends on multiple factors which affect micro-climatic conditions in the area. These include horizontal and vertical structure of settlements, proportion of built-up area, ratio of permeable and impermeable surfaces, spatial allocation of green areas, shading, and morphological features which influence air flow (Ministerstvo životného prostredia, 2018).

Urban areas are a specific case because the original natural structures have been obliterated and the new materials have different properties, such as impermeability or capacity to accumulate heat (Gill et al., 2007). In such conditions, various micro-climatic phenomena occur. One such problem is the urban heat island, which is an urbanized area, that differs from its rural surrounding by having higher temperature. This phenomenon was also identified in Košice, where higher temperatures were present in areas with impermeable surfaces and lack of green spaces or water (Hofierka et al., 2020; Onáčillová & Gallay, 2018).

In general, cities are lagging behind with their adaptation strategies and activities. According to the global survey by Araos et al. (2016), a substantial number of studied cities had not prepared adaptation strategies or they had not provided any information about such activities.

Climate change awareness

According to the Eurobarometer survey conducted in 2019 (European Commission, 2019), 78% of the Slovak population considers climate change to be a serious problem, a figure roughly corresponding to the average in the

EU. It is important to notice the trend – since 2017, the percentage has increased by 11 percentage points. Two-thirds of respondents declared that in the last six months they took part in activities focused on combatting climate change. This figure is higher than the EU average and again, has increased by 22 percentage points. When specific examples are provided, the number increases to 94%.

The perceptions of climate change have been studied from many different angles. Research has been directed towards identifying factors influencing climate change awareness, trying to find mechanisms which translate people's internal or external characteristics and context into their opinions, and subsequently to actions.

The degree of climate change awareness differs across countries, regions and individuals. A meta-analysis by Hornsey et al. (2016) offers a comprehensive overview of the relevant factors. Firstly, there are intuitive characteristics such as gender, age, education or other socioeconomic variables. People who believe in climate change are usually younger, more educated, and with higher income, while gender or race have smaller effect. Different stances towards adaptation to climate change of male and female respondents are thought to be associated with their motivations – men are more likely to be motivated by financial reasons and advancing technology, while women tend to be more egalitarian and think more about community and ecology (Alló & Loureiro, 2014; Brink & Wamsler, 2019). The phenomenon that minorities and women tend to view risks as more pronounced, is termed “white male effect”.

Apart from sociodemographic context, there are factors that could be classified as psychological. Subjective knowledge of scientific findings concerning climate change is according to the meta-analysis approximately the same for “believers” and “sceptics”, but higher level of objectively measured knowledge is connected to stronger belief in climate change (Hornsey et al., 2016).

Hornsey et al. (2016) argue that one of the psychological determinants of climate change belief is a cognitive heuristics, when people believe in validity of information based on trustworthiness of its source or existence of consensus (‘scientists are trustworthy, and therefore scientific findings are true’ and ‘There is a scientific consensus on this topic, and therefore it is true’). However, a newer research cautions against communicating the need to adopt climate change policies based on scientific consensus messages, as those might be inefficient when one is expected to change their beliefs (Chinn & Hart, 2021). Moreover, willingness to support climate-related policies also stems from attitude towards long-term planning (Alló & Loureiro, 2014). In addition, place attachment also plays a role – those expressing stronger global than national attachment are more likely to be aware of climate change and positively view climate change responses (Devine-Wright et al., 2015).

Based on theories of risk perception, personal experience should affect perceived risk and personal relevance of the issue more than cognitive information (Howe et al., 2014). Whether personal experience with extreme weather conditions and their impacts is connected with stronger belief in climate change is a vital question. The meta-analysis shows that although this nexus is statistically significant, its magnitude is low (Hornsey et al., 2016). Even those who have direct experience of extreme weather events were not convinced there is a need to adopt policies directed to climate change mitigation and adaptation (Gärtner & Schoen, 2021). Overall, the evidence on the relationship between own experience of extreme weather and climate change opinions remains inconclusive. A meta-analysis by Alló & Loureiro (2014) showed that experience with extreme weather increases willingness to pay for mitigation and adaptation policies. However, in other studies, only small effect of temperature variations on climate change perceptions have been identified (Howe et al., 2019). On the other hand, the relationship also works in opposite direction, as experience itself can be influenced by our beliefs.

That is, people's belief about global warming affect their likelihood to recollect extreme weather events (Howe & Leiserowitz, 2013). The effect is strongest among those who do not believe in climate change. Global warming sceptics then may argue their position is based on religious and political factors (Borick & Rabe, 2014).

Indeed, in the analysis by Hornsey et al. (2016) the socioeconomic and psychological characteristics were in their magnitude overshadowed by variables connected to values, beliefs, political affiliation, worldviews and culture. For example, whether a person is liberal, or conservative has two times stronger effect on belief in climate change than other sociodemographic characteristics.

One of the most important factors are social identities (Fielding & Hornsey, 2016; Hornsey et al., 2016; McCright et al., 2013). The most prominent factor in predicting climate change belief was the “New Ecological Paradigm”, which is a set of assertions concerning the environment and the need for limiting the harmful impacts of human activity on the nature. Also those who identified themselves with “green” or activist identity, or declared environment as something they value, were more likely to believe in climate change. Hornsey et al. (2016) then elaborate on the Theory of Cultural Cognition, which claims that people perceive risks based on how they think society should function. If they value individualism and hierarchy, they also respect elites and prefer keeping the status quo. These people then do not believe that industry causes harm to environment. Scepticism towards climate change is also connected to belief in free market. On the other hand, people who are proponents of egalitarian society and value community values, are more likely to morally suspect industry and its impact on nature.

Climate change awareness also differs across countries. While the reasoning that human activities contribute to climate change is a predictor of risk perceptions in Latin America and Europe, in Asia and Africa it is the changes in temperature that take the lead (Lee et al., 2015). A more recent study finds that even the effect of education is not the same across countries or political affiliation of citizens (Czarnek et al., 2020). In more developed countries, the topic of climate change is more politicized. In this context, education might not be enough to raise awareness about the risks of climate change, and especially for right-wing voters.

Table 1: Factors affecting climate change awareness and climate-friendly activities

Sociodemographic	Psychological	Cultural and political	Country context
Race	cognitive heuristic	Political ideology/affiliation	Country
Gender	motivation	Identities:	Level of development
Age	place-attachment	-New Ecological Paradigm	Municipal support
Income	own experience	-Activist/Green Identity	
Education	knowledge (objective/subjective)	Values:	
	trust in science	- biosferic values	
	short vs. long term orientation	-individualistic cultural values	
		-hierarchical cultural values	
		-free market	
		worldviews	

Source: own summary based on literature review

However, research shows that belief in climate change is not a sufficient predictor of environmentally friendly action. It is more connected with intention to act, than with real activity (Hornsey et al., 2016). Brink and Wamsler (2019) propose three groups of value orientations that motivate or constrain action – economic or ego-focused (including also non-financial benefits such as private risk reduction), ecological/environmental, and social/altruistic/other-regarding. Public support for adaptation measures, even when awareness of risks is high, might be hindered by unrelated issues – such as aesthetics or perceived quality of environment (Brink & Wamsler, 2019). Some authors stipulate, that low willingness to participate in adaptation might stem from the blurred lines of responsibility and incomplete understanding of appropriate response (Bichard & Kazmierczak, 2012). In general, there are both external and internal factors that influence motivation and adaptation activities (Brink & Wamsler, 2019). Among external, or material, aspects studies have focused on topics such as hazard experience, income, education, gender and age, as well as access to social networks and institutional support. Inner, or subjective, include issues such as emotions, values, beliefs and worldviews. Since the capacity and mandate of local authorities are limited, other actors must also engage in adaptation activities (Brink & Wamsler, 2019; Hegger et al., 2017). However, empirical studies on drivers of citizen engagement in adaptation remain scarce (Brink & Wamsler, 2019).

Data and methodology

Data used in this paper originate from a survey among residents of Košice, which was conducted primarily online, from October 2019 to January 2020. The questionnaire was accessible and advertised through social media, the web page of the project KOŠICE ± 40 and web pages of the partners of the project. Moreover, the information about the questionnaire was sent by Košice municipality to all its affiliated institutions with request to distribute it among employees. In addition, the questionnaire was sent to 100 businesses in Košice. In schools or retirement homes, the questionnaire was available also in paper format. Only responses from residents of Košice were considered.

In total, the sample consisted of 598 of valid responses. A random sample was then drawn so that it could represent the structure of residents in Košice based on three characteristics: sex, age category and Košice district. The process of gathering the data and adjusting the sample was adopted from standard methodologies applied in market research (Trnka, 2016). The final sample after selecting only complete responses contains 337 observations. The use of survey data concerning climate change issues was shown to be appropriate for scientific and policy objectives, as the small changes in wording of questions do not have impact on collected information (Chen et al., 2021). However, survey data gathered on internet were shown to be more biased towards supporting climate change policies (Alló & Loureiro, 2014).

Table 2 summarizes the main climate-related variables which were used in the analysis. There were six explanatory variables, mostly in form of indices compiled from several Likert scale responses to provided statements on the topic. The dependent variable – climate-friendly activities – is also compiled from several examples. These variables were then used in classic OLS model, together with sociodemographic indicators.

Table 2: Climate-related variables

Variable	Type	Description
Awareness	score from 10 statements with Likert scale responses	statements concerning anthropogenic causes of climate change, scientific consensus on climate change, and impacts of climate change
Seriousness	Likert scale score	degree of seriousness of climate change as an issue
Own experience	Score from 11 examples	examples of climate change manifestations
Vulnerability	score from 8 statements with Likert scale responses	statements concerning negative climate change impacts on health, agriculture, infrastructure and property, services or business
Information	Likert scale score	degree of satisfaction with available information concerning climate change adaptation
Interest in climate change	dummy	interest in climate change
Climate-friendly activities (dependent variable)	score from 16 (10+6) examples of activities	10 free and 6 expensive adaptation/mitigation activities

Results

Table 3 summarizes the results of the simple regression model, where dependent variable was a score consisting from mitigation and adaptation activities. In the first model, we look at all climate-friendly activities. This model has the highest adjusted R-squared and therefore explains more variation in the data. As for sociodemographic characteristics – only age seems to play a role. The older a person, the more likely they are to engage in mitigation and adaptation activities. Higher life satisfaction is also associated with climate-friendly action. The most significant variable is vulnerability. And lastly, satisfaction with available information on adaptation also increases the likelihood of action.

The second model takes as dependent variable a composite index of all climate friendly activities, that are for free (or very cheap). Life satisfaction again seems to be positively associated with this subset of activities. Also gender starts to play a role – women are more likely to engage in free adaptation/mitigation activities. With lower significance level, also perceived seriousness of climate change and interest in the topic appear to be positively related to action. As in the previous model, vulnerability is the strongest predictor, and information on adaptation also contributes to raise the likelihood of climate-friendly activities.

The dependent variable in the third model was constructed from examples of expensive adaptation and mitigation activities. People engaging in this activities are older, with higher income and have children. Vulnerability is again the most important predictor. In comparison to the previous models, satisfaction with available information on adaptation does not seem to be relevant.

Table 3: Results

Variables	Estimate, Std. Error and Significance		
	All	Free/cheap	Expensive
Intercept	0.134 (0.092)	0.203 (0.092)*	-0.002 (0.13)
Age	0.001 (0.001)*	0.001 (0.001)	0.002 (0.001)*
Education	0.002 (0.003)	0.004 (0.003)	-0.002 (0.005)
Income	0.008 (0.015)	-0.015 (0.015)	0.044 (0.022)*
Sex (female)	0.026 (0.016)	0.04 (0.016)*	-0.003 (0.023)
Life satisfaction	0.024 (0.01)*	0.025 (0.01)*	0.02 (0.015)
Children	0.027 (0.021)	-0.012 (0.021)	0.087 (0.03)**
Awareness	-0.006 (0.079)	0.003 (0.079)	-0.021 (0.112)
Seriousness	0.007 (0.005)	0.009 (0.005).	0.002 (0.007)
Own experience	0.043 (0.058)	0.055 (0.058)	0.016 (0.082)
Vulnerability	0.234 (0.043)***	0.142 (0.043)**	0.347 (0.061)***
Information	0.023 (0.007)**	0.026 (0.007)***	0.015 (0.01)
Interest in climate change	0.056 (0.036)	0.083 (0.036)*	0.002 (0.051)
N	337	337	337
Adjusted R-squared	0.2062	0.1709	0.1713

Conclusion

In previous research, climate change awareness has been found to be associated with different sociodemographic, psychological, cultural or contextual factors. However, being aware of climate change is not a sufficient predictor of climate-friendly action. Although we identified awareness-action gap, which was found in previous research, the conclusion is not that straightforward. Our findings suggest that self-assessed vulnerability, which can also be viewed as a specific kind of awareness, is an important factor for action. This goes in line with hypothesis that not only cognitive information, but rather own experience shape human behaviour.

In our analysis, we distinguish between cheap and expensive measures. This can be relevant from policy-making perspective, when trying to design efficient schemes to promote solutions based on available resources. We found that having interest in climate change and sufficient information about how to adapt raises the likelihood that person will adopt inexpensive measures. On the other hand, information is irrelevant when it comes to costly solutions. Apart from vulnerability, the expensive measures are mostly associated with having children, higher income and age.

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