

Article

Perception of Climate Change Risk and Adaptation in the Czech Republic

Eliška Krkoška Lorencová, Blanka Loučková and Dava Vačkářů * 

Global Change Research Institute of the Czech Academy of Sciences, Bělidla 986/4a, 603 00 Brno, Czech Republic; lorencova.e@czechglobe.cz (E.K.L.); louckova.b@czechglobe.cz (B.L.)

* Correspondence: vackar.d@czechglobe.cz; Tel.: +420-601-383-185

Received: 20 February 2019; Accepted: 23 April 2019; Published: 26 April 2019



Abstract: Public perception of climate change is an important element that affects attitudes towards adaptation and mitigation. Understanding the general public's perception of the issue can assist decision-makers, though the climate change perception is affected by multiple factors. This study examines the main sociodemographic factors, including gender, and the role of previous personal experience with extreme weather events on climate change perception and engagement in individual adaptation and mitigation actions among the general population in the Czech Republic. Based on statistical analysis, gender, age and previous experience with extreme weather events have been found to play a significant role in the climate change beliefs of individuals and in the perception of the cause of the changing climate. The analysis revealed that respondents with previous experience with extreme weather events were significantly more likely to implement adaptation and mitigation actions than respondents with no experience. The survey represents insights into climate change perception and beliefs of the general public at the national level.

Keywords: climate change; public perception; willingness to adapt; questionnaire survey; Czech Republic

1. Introduction

Public perception of climate change is an important element that affects attitudes towards adaptation and mitigation and influences climate policy and communication [1–3]). Understanding public perception of climate change as well as perception of risks can assist decision-makers in supporting publicly preferable adaptation and mitigation actions [4]. Moreover, public policies need broader acceptance and understanding of the rationale by those who will be affected [2,5–7]. Public views on climate change and perception of risks resulting from the changing climate differ between countries. For instance, Lorenzoni and Pidgeon [5] investigated public views and conceptualization of climate change from European and American perspectives and found, among other things, widespread awareness and concern about environmental issues and climate change. However, climate change is generally perceived as less important compared to other social issues. Ratter et al. [8] even found widespread declining public attention and concern about climate change.

In a Special Eurobarometer Survey, half of Europeans (50%) in EU member states perceived climate change as one of the most serious global problems. When compared to the importance of the single most serious problem, climate change scored third, whereas poverty, hunger and lack of drinking water received the highest priority (35%), followed by the economic situation (24%) [9]. In all of the surveys, Czech citizens scored below the EU average in climate change perception. In 2008 and 2011, the Czech population had one of the lowest scores in climate change perception. Thus, this is the first study at the national level focused on a relatively climate-skeptical country with relatively high greenhouse gas emissions intensities [10]. Other studies are also indicating that Central and Eastern

European post-communist countries show lower levels of environmental support and higher climate change skepticism compared to Western countries [3,11].

Perception of climate change as a risk (threat) affects people's behavior, particularly with regard to risk preparedness and attitudes towards adaptation. Sociodemographic characteristics play a key role in climate change perception and the capacity to adapt [12]. Oppenheimer et al. [13] identified the following factors that shape risk perception: (1) interpretations of the threat, including the understanding and knowledge of the root cause of the problem; (2) exposure and personal experience with the events and respective negative consequences, particularly recently (i.e., availability); (3) priorities of individuals; (4) environmental values and value systems in general.

According to Brulle et al. [14], the main factors affecting public perception and concern about climate change are experiences with extreme weather events, understanding of scientific information, media coverage of the issue, efforts of advocacy groups, and cues from the political elite and economic and political factors. Analysis of these factors showed that cues from the political elite and economic factors had largely affected public concern; media coverage was also found to be an important element. On the other hand, experience with an extreme weather event and scientific information had minimal effect on aggregate public opinion with respect to the threat of climate change. This finding is in contrast with the study carried out by Spence et al. [15], who found that personal experience with an extreme weather event (in this case flooding) increases concern about the climate change issue and has an effect on actual willingness to undertake individual mitigation measures, such as energy savings. Fownes and Allred [16] found that while respondents agreed more that they had experienced the effects of extreme weather or climate change as temperature increased, climate change beliefs were better predictor of perception of a personal experience.

Many studies focusing on natural hazards, especially floods, have found that people who have not experienced flooding were less aware of future risks resulting from climate change [15,17,18]. Risk perception and decisions related to personal experience are often dependent on personal encounters with the climate-related hazards [19]. When individuals react to climate change risk based on personal experience, their perceptions might be weak due to the relatively small effects of climate change in the near-term future [19]. On the other hand, recent research shows that individuals who have first-hand experience with extreme weather events (such as flooding) are more likely to be concerned about climate change and to undertake actions to mitigate the impacts of climate change [4,15,20].

The aim of this paper is to investigate climate change perception and the role of personal experience with extreme weather events, as well as future risks shaping concern about climate change. We focus on the main sociodemographic factors such as gender, age and education influencing climate change beliefs among citizens in the Czech Republic. We hypothesize that gender and previous experience with climate change increases the sensitivity to climate change perception and willingness to implement adaptation measures. Furthermore, our analysis explores related aspects of the willingness of people to engage in adaptation and mitigation actions.

2. Methods

2.1. Study Area

The Czech Republic is a Central European country with a population of 10.5 million inhabitants. Increasing frequency and severity of extreme weather events (floods, droughts and heat waves) have been observed in recent years and are expected to increase. Eight severe floods hit the country in the last 16 years, leaving behind total damage in the amount of EUR 6.7 billion and 122 dead in the period 1997–2013 [21]. The occurrence and frequency of flooding are expected to have an increased impact in Western and Central Europe (including the Czech Republic) in the future in terms of damage costs and the number of people affected [22,23].

Regarding climate change impacts, the average annual temperature increased by 0.8 °C in the last five decades and a further increase of 0.24 °C every 10 years is projected [24]. Projections of

precipitation show an increase in precipitation in the winter and spring months and a decrease in the summer and autumn months. In terms of the observed trends of changes in the average number of days with extreme temperatures in the Czech Republic, the number of summer and tropical days rose between the periods 1961–1990 and 1991–2010. The number of summer days (maximum air temperature ≥ 25 °C) increased between these two periods by 12 days on average and growth was also recorded in the number of tropical days (maximum air temperature ≥ 30 °C), specifically by six days [24]. The July 2006 heat wave, which lasted 33 days, was the longest and most severe individual heat wave in Prague since 1775 [25] and heatwaves have been increasing in occurrence and impact in the last decade [26]. The impacts of heat waves are especially pronounced in urban areas due to the increase in urban heat islands. Projections for the near-term future (2021–2050) indicate a 50% increase in the number of tropical days; a similar trend is also expected for tropical nights [27].

2.2. Data Collection and Analysis

We performed a quantitative national survey on climate change perception and willingness to adapt in the Czech Republic. Data in this study were collected by the professional company Ipsos, which recruited the panel of respondents and distributed the questionnaire. The survey was conducted as a programmed, structured online questionnaire administered by means of computer-assisted self-interviewing (CASI) in October 2014. A total of 1024 respondents from the Czech general population aged 18–65 completed the survey.

The questionnaire consisted of 14 questions. The majority of questions were multiple choice questions following a Likert scale design. The first part of the questionnaire focused on individuals' beliefs and opinions relating to the issue of climate change. The second part included questions about personal experience with extreme weather events in the last ten years (such as storms, floods and torrential rains, hailstorms, heat waves, droughts), damage to respondents' property and the respondents' opinions on intensity and frequency of occurrence of these events. The final part of the questionnaire investigated respondents' willingness to adapt to future consequences of climate change and to engage in adaptation actions.

The sampled data were analyzed in IBM SPSS Statistics 21. Descriptive statistics were calculated to assess the distribution of data in the dataset. A Chi-square test of independence was performed to examine the relationship between selected variables (sociodemographic, previous experience with extreme weather events) and climate change beliefs and concerns, and willingness to undertake adaptation actions.

3. Results

The sample included responses from 1024 respondents from the general population (Table 1). Males and females were equally distributed in the sample (49.5:50.5%). Age categories, as well as town size categories were nearly equally represented (Table 1). Regarding education, 16% of the individuals surveyed were university graduates; most of the respondents had secondary education (73.3%). A majority of respondents experienced some type of extreme weather event in the last ten years, with heat waves being the most frequent type of event (91.9% of all respondents) (Table 1).

3.1. General Attitudes towards Climate Change

The majority of respondents (78%) agreed that climate change is occurring (34.8% strongly agreed, 43.3% agreed). Only 59 respondents (5.8%) disagreed and 166 (16.2%) selected the category "Neither agree, nor disagree" (Table 2). The majority of respondents (75%) were convinced that climate change is caused by human activity and only 22% said that it is due to natural causes (3% selected the category "Neither agree, nor disagree"). When asked about possible future climate change-related risks, 67.5% of respondents expressed concern (17.1% very concerned, 50.4% concerned), 27.5% did not show any concern and 5% were not sure.

Table 1. Characteristics of respondents in the dataset (N = 1024).

Category	N	%
Gender		
Male	507	49.5
Female	517	50.5
Age		
18–24	174	17.0
25–34	224	21.9
35–44	207	20.2
45–54	253	24.7
55–65	166	16.2
Education		
Elementary	106	10.4
Secondary without exam	447	43.7
Secondary with exam	307	30.0
University	164	16.0
Town size (Number of inhabitants)		
Under 1000	177	17.3
1000–5000	195	19.0
5000–20,000	190	18.6
20,000–100,000	240	23.4
100,000 or more	222	21.7
Monthly income		
Under CZK 10,000	376	36.7
CZK 10,000–20,000	443	43.3
CZK 20,000 or more	205	20.0
Experience with extreme weather events (type of event)		
Storms	710	69.3
Floods and torrential rains	867	84.7
Hailstorms	775	75.7
Heat waves	942	91.9
Droughts	701	68.4
Shifts in temperature patterns	923	90.1
Experience with extreme weather events (property damage)		
Under CZK 10,000	364	35.5
CZK 10,000 or more	187	18.3
Not known	111	10.8
No damage	362	35.4

A significant relationship was found between age and awareness of climate change, with younger respondents (18–34 years of age) being more aware of the changing climate in comparison to individuals in the age category 35 and above ($X^2 = 31.065$, $p = 0.002$). Approximately 87% of respondents in the age category 25–34 supported the statement “Climate change is occurring” (strongly agreed or agreed),

whereas only 71% in the age category 55–65 were of the same opinion. Older respondents were also more likely to disagree with this statement (9.9% in the age category 45–54 compared to 3.1% of people aged 25–34). However, the fewest negative answers were given by the age category 35–44 (2.4%).

Table 2. Sociodemographic factors and climate change beliefs among the general population in the Czech Republic, N (%).

Variable	Strongly Agree	Agree	Disagree
Age ($p < 0.01$)			
18–24	69 (39.7)	66 (37.9)	10 (5.7)
25–34	84 (37.5)	111 (49.6)	7 (3.1)
35–44	73 (35.3)	91 (44)	5 (2.4)
45–54	79 (31.2)	108 (42.7)	25 (9.9)
55–65	51 (30.7)	67 (40.4)	12 (7.2)
Education ($p < 0.01$)			
Elementary	34 (32.1)	38 (35.8)	10 (9.4)
Secondary without exam	148 (33.1)	185 (41.4)	22 (4.9)
Secondary with exam	112 (36.5)	140 (45.6)	19 (6.2)
University	62 (37.8)	80 (48.8)	8 (4.9)

With respect to age, younger people were more likely to agree with the fact that climate change is caused by human activity rather than it being a natural occurrence ($X^2 = 21.584$, $p = 0.006$). Approximately 82% respondents in the age category 25–34 believe that climate change is caused by human activity and only 15% were convinced it is a natural process. Conversely, respondents aged 55–65 were much less likely (69%) to believe in the anthropogenic cause of climate change and more likely (26%) to be convinced of natural causes of climate change.

Education level was another important factor revealed by the analysis. Individuals with secondary-school and university degrees were found to be more aware of ongoing climate change than those with only elementary education ($X^2 = 25.608$, $p = 0.002$). Nearly 87% of respondents with a university degree agreed (strongly agree, agree) that climate change is happening and only 5% disagreed, whereas in the case of respondents with elementary education, only 67% gave positive answers and 9.4% gave negative answers. Other sociodemographic factors (town size, monthly income) did not show any significant effect.

3.2. The Role of Gender

Concerning the general perception with respect to the existence of climate change, there were no significant differences in the agreement on climate change occurrence between males and females. However, men were found significantly more likely to disagree with the statement “climate change is occurring” in comparison with women (8.3% compared to 3.3%; $X^2 = 16.124$, $p = 0.001$) (Table 3). Moreover, the analysis revealed a significant difference in opinion about the cause of climate change between males and females, with men more likely to agree that climate change is caused by natural processes (60% of men compared to 40% of women) and women concurring that it is more likely a result of human activity (54% of women compared to 46% of men; $X^2 = 16.266$, $p = 0.000$).

Gender also played an important role in perception of climate change-related risks. As in the case of climate change beliefs, women expressed greater concern about the future possible consequences of climate change ($X^2 = 10.202$, $p = 0.017$). Approximately 72.3% of women selected the categories “very concerned” and “concerned”, compared with 62.7% of men, who were more likely than women to state “not concerned” (31.7% to 23.1%).

Table 3. Gender and perception of climate change-related risks among the general population in the Czech Republic, N (%).

Variable	Question		
	Do you agree with the statement “Climate change is happening”?		
Gender ($p < 0.01$)	Strongly Agree	Agree	Disagree
Male	187 (36.9)	204 (40.2)	42 (8.3)
Female	169 (32.7)	239 (46.2)	17 (3.3)
	Are you concerned about the potential impacts of climate change?		
Gender ($p < 0.05$)	Very concerned	Concerned	Not concerned
Male	76 (15.6)	229 (47.1)	154 (31.7)
Female	89 (18.5)	258 (53.8)	111 (23.1)

3.3. Previous Experience with Extreme Events

A significant relationship was found between previous personal experience with climate change-related extreme weather events and climate change beliefs (Table 4). Respondents who had experienced a very strong extreme weather event were more likely to agree (strongly agree, agree) with the statement “Climate change is happening” (91.5% compared to 38.9% of those with no prior experience with extreme weather events; $X^2 = 159.857$, $p = 0.000$). Only 1.1% of respondents who had experienced an extreme weather event disagreed that climate change is occurring.

Table 4. Previous personal experience with extreme events and attitudes towards climate change (beliefs, perception of future risks, engagement in adaptation actions) among the general population in the Czech Republic, N (%).

Variable	Intensity of Experience		
	Very Strong	Intermediate	None
CC Beliefs ($p < 0.001$)			
Strongly agree, agree	86 (91.5)	318 (74.1)	7 (38.9)
Disagree	1 (1.1)	34 (7.9)	6 (33.3)
Perception of Risks ($p < 0.001$)			
Very concerned, concerned	79 (85.8)	244 (60.7)	3 (21.4)
Not concerned	11 (12)	138 (34.3)	9 (64.3)
Engagement in Individual Adaptation Actions ($p < 0.001$)			
Yes	73 (77.7)	184 (42.9)	4 (22.2)
No	21 (22.3)	245 (57.1)	14 (77.8)

Respondents with previous experience were also more aware of future risks resulting from climate change ($X^2 = 122.598$, $p = 0.000$). The majority of people with a very strong experience showed high levels of concern about risks in the future (nearly 86% compared to 21.4% of those with no experience). Nearly 65% of respondents with no experience at all did not express any concerns about future climate change-related risks.

People with previous experience were also more likely to engage in actions involving individual adaptation and mitigation measures ($X^2 = 85.861$, $p = 0.000$). Only 22.2% of respondents with no previous experience with extreme weather events had taken any action to adapt to the changing climate, as compared to 77.7% of those who had experienced an extreme weather event.

3.4. Adaptation and Mitigation Actions

We were also interested in investigating whether the Czech citizens are willing to implement specific climate change adaptation and mitigation actions. Approximately half of all respondents (50.6%) reported that they had already been engaged in some individual actions including mainly mitigating

actions (energy and water savings, recycling, rainwater harvesting), soft adaptation measures (early warning systems, insurance) and various technical adaptation measures aimed mainly at protecting property against flooding (Figure 1).

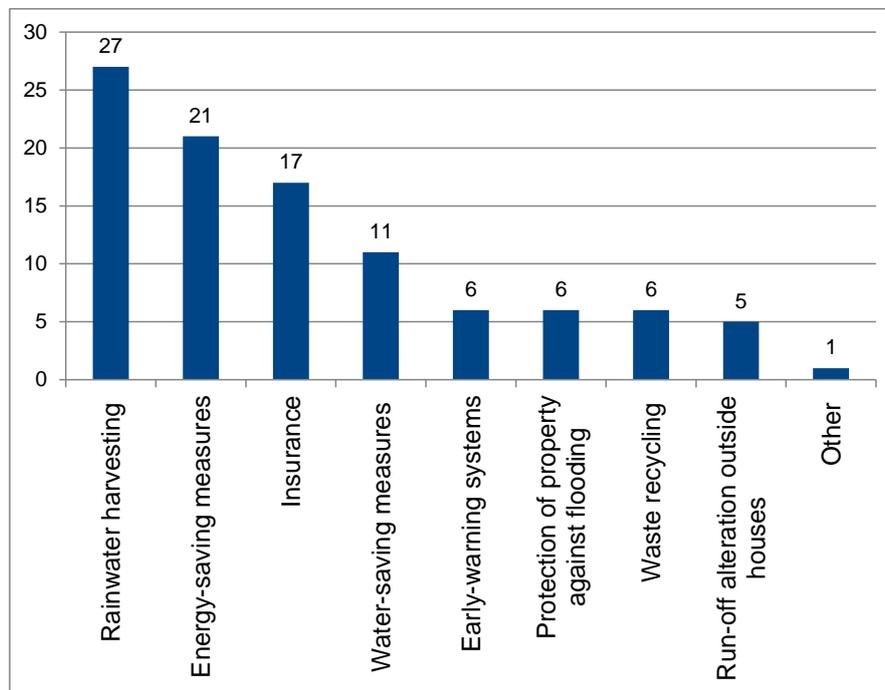


Figure 1. Individual adaptation measures already taken by respondents (% respondents, N = 522).

The analysis of the relationship between sociodemographic factors and adaptation to future climate change consequences suggested that age was an important variable playing a role in individuals' adaptation attitudes (Table 5). Older respondents were significantly more likely to engage in adaptation actions than younger respondents ($X^2 = 16.241, p = 0.003$; 54.8% in the age category 55–65 compared to 36.8% in the age category 18–24).

Table 5. Sociodemographic factors and engagement in adaptation and mitigation actions among the general population in the Czech Republic, N (%).

Variable	Have You Already Engaged in Any Adaptation Actions?	
	Yes	No
Gender (NS)		
Age ($p < 0.01$)		
18–24	64 (36.8)	110 (63.2)
25–34	120 (53.6)	104 (46.4)
35–44	108 (52.2)	99 (47.8)
45–54	135 (53.4)	118 (46.6)
55–65	91 (54.8)	75 (45.2)
Education (NS)		
Town size ($p < 0.01$)		
Under 1000	98 (55.4)	79 (44.6)
1000–5000	118 (60.5)	77 (39.5)
5000–20,000	96 (50.5)	94 (49.5)
20,000–100,000	104 (43.3)	136 (56.7)
100,000 or more	102 (45.9)	120 (54.1)
Monthly income (NS)		

* NS = not significant.

A significant association was also found between town size and implementation of adaptation actions ($\chi^2 = 16.269$, $p = 0.003$). People living in smaller municipalities were more likely to show an interest in adaptation actions than those living in bigger cities (60.6% of respondents living in towns with 1000–5000 inhabitants in comparison with 43.3% of people living in municipalities with 20,000–100,000 inhabitants) (Table 5).

3.5. Climate Change Beliefs and Perception of Climate Change-Related Risks versus Engagement in Adaptation and Mitigation Actions

When examining the relationships between attitudes towards climate change (beliefs, perception of risks and adaptation action), the analysis revealed that respondents who were concerned about the future impacts of climate change were more likely to implement adaptation and mitigation actions than those who were not concerned about these risks or were not sure (nearly 74% very concerned compared to 37% not concerned and 30.6% not sure, $\chi^2 = 67.061$, $p = 0.000$).

Also those who agreed that climate change is occurring were found to be more likely to engage in adaptation and mitigation measures than those who did not agree or were not sure (62.6% strongly agreeing compared to 27.1% disagreeing and 28.9% who were not sure, $\chi^2 = 65.310$, $p = 0.000$).

A relationship was found between beliefs about the existence of climate change and beliefs about the cause of climate change. Those who believed that climate change is occurring were significantly more likely to support the statement that climate change is caused by human activity, in contrast to those who were not convinced about climate (86% compared to 14.6% of respondents), ($\chi^2 = 248.079$, $p = 0.001$). Only 13% of respondents strongly agreeing with the statement “Climate change is happening” gave the answer “It is due to natural causes”, compared to 75% of people who were not convinced about climate change.

4. Discussion

Public perception of climate change has been a subject of numerous papers in recent years [1,4,5,12,14,15,28–31]. Climate change beliefs and concerns and engagement in adaptation and mitigation actions have been attributed to various factors including sociodemographic, political and economic factors, as well as personal values and experience with extreme weather events.

The main aim of the present study was to examine the role of selected sociodemographic factors (gender, age, education, town size, income) and the role of previous experience with extreme weather events and willingness to undertake individual adaptation and mitigation actions among the general public in the Czech Republic. The most important findings of this study are discussed below.

4.1. The Role of Gender and Socio-Demographic Factors in Attitudes towards Climate Change

4.1.1. Gender Difference

Women were found to be more likely to believe in the existence of ongoing climate change and expressed greater concern about future climate change-related risks than their male counterparts. Females were also more supportive of the statement that climate change is caused by human activities. Male respondents were less likely to attribute climate to human activities and also less likely to perceive future climate change-related risks. Similar results have been reported by other authors [4,28,29]. Davidson and Haan [29], who carried out a survey on attitudes towards climate change in Alberta, Canada, attribute these gender differences predominantly to political ideology (women having a lower tendency to subscribe to conservative political ideology and agreeing more with liberal ideology).

Perception of climate change offers a theoretically and empirically interesting case for examining gender dynamics. Women exhibit slightly higher levels of both knowledge (more scientifically accurate) and pro-environmental concerns [32]. Our results are consistent with McCright’s [32] analysis, in which he found that a greater percentage of women than men believe that global warming is happening and

is primarily caused by human activities. However, we did not find any association between gender and engagement in adaptation actions.

4.1.2. Age Difference

Some papers previously identified age as an important factor influencing the perception of climate change risks—older people were found to express both less concern about climate change risks and willingness to engage in adaptation actions [17,33]. Other key sociodemographic factors are education and income—there is evidence that people with higher education and higher income are more aware of climate change risks and more likely to adapt in the case of, for example, flood risk [33].

Younger respondents were more likely to believe in the existence of climate change and to be more aware of climate change risks than their older counterparts, consistent with other studies with similar results [4,12,29]. Age was also found to play a significant role in opinions on the cause of climate change—younger people were considerably more likely to attribute the cause of climate change to human activities than older respondents, who perceived it more as a natural phenomenon. On the other hand, the conducted analysis revealed that older people in smaller municipalities are those who undertake most adaptation measures. This is in contrast to some studies that found that older respondents tend to be less willing to adapt [12,28,33].

4.2. The Role of Personal Experience with Extreme Weather Events

This study confirmed an association between previous experience and greater awareness and stronger perception of climate change and related risks. Respondents with previous experience with an extreme weather event were characterized by strong beliefs in climate change and expressed considerable concern about future risks compared to people with no experience, who assessed future risks as low or none. Rather predictably, individuals with first-hand experience were also more inclined to undertake adaptation and mitigation actions, including changing their place of residence.

Many other authors report similar results [12,17,34–37]. Bichard and Kazmierczak [12] report a significant association between previous experience with extreme flooding and willingness to undertake flood protection measures in UK households. Another study from the UK found a relationship between first-hand experience with flooding and implementation of some form of flood protection [38]. A survey of homeowners in Dresden, Germany, also confirmed a strong association between flood protection measures and prior experience with flooding [37]. However, as Ray et al. [7] suggest, the relationship between previous experience and support for adaptation policies is probably not clear-cut, as support for specific adaptation-related measures differed by policy.

This study's findings support the hypotheses that experience with extreme weather events can reduce the effect of psychological distance and increase support for adaptation policies [31,39], as individuals with direct experience of climate change phenomena are more concerned and undertake adaptation or mitigation actions [15]. Several studies show that people are often aware of the consequences of climate change but often underestimate their extent and magnitude. Taylor et al. [31] conclude two important concepts influencing the level of concern about climate change threads: optimism bias (awareness of the risk, but lack of awareness of personal vulnerability) and psychological distance (impacts of climate change are perceived as affecting distant geographical areas, occurring in the future or in other social groups). These two concepts can considerably affect people's perception of climate change risks (reducing concern), as well as people's willingness to engage in adaptation actions.

4.3. Engagement in Adaptation and Mitigation Actions

People who believe in ongoing climate change as well as those who were more concerned about future climate change-related risk were more likely to implement adaptation measures. Furthermore, individuals with stronger beliefs in climate change attributed the cause to human activities. Some recent studies from developed countries examining the relationship between climate change beliefs and willingness to undertake adaptation measures have confirmed this correlation [12,28,30,40]. On the

other hand, some authors report only a weak relationship between climate change awareness and willingness to adapt and found other factors more important [37].

Quite surprisingly, neither perception of climate change risks nor engagement in adaptation processes were found to be influenced by respondents' income or level of the education, as reported by some authors [28]. Education level was significant only in the case of climate change awareness, where people with a higher level of education were more likely to support the statement that climate change is happening. However, these results do not confirm the assumption that people with higher levels of education and income are more environmentally conscious and involved in adaptation actions.

The majority of respondents (50.6%) had already undertaken some form of individual actions, which is a substantially higher proportion when compared to 38% of respondents in 2013 [9]. These actions are closely linked to adaptation (particularly soft and technical measures) and mitigation efforts (mainly energy, water savings, recycling, etc.). Among the most preferred measures were water harvesting and water and energy savings, undertaken by 59% of respondents in total. Insurance against extreme weather events was preferred by 17%, early warning and waste recycling by 6% of respondents. Brügger et al. [41] found that mitigation and adaptation responses are closely associated. Other studies also adopted a framework interlinking adaptation and mitigation actions [42]. Moreover, people who believe climate change will have negative impacts have positive attitudes towards both of these responses.

There are several other factors influencing personal attitudes toward climate change and willingness to accept adaptation and mitigation measures not addressed in this study. Values, particularly pro-environmental values, play a significant role in climate change risk perception. For instance, studies in the UK show that the perception of anthropogenic climate change is strongly associated with pro-environmental values [33,43]. However, climate change concern and pro-environmental values might not lead to direct support for adaptation measures [31]. To a great extent, perception of climate change risk is influenced by emotional factors, including individual values and political preferences [4]. Risk perception is also affected by emotional processes; people often favor emotional feelings to predictions of climate change-related hazards [19].

4.4. Limitations of the Study

In our study, we are focusing on the perception of climate change and adaptation in the general population. We found that gender and other sociodemographic factors such as age and education, as well as previous experience with extreme events, play role in the climate change concerns and willingness to accept adaptation measures. However, further work is required on understanding the factors driving the climate change attitudes and adaptation, such as for example community level impact and most vulnerable groups of people or specific sectors [44]. There are also methodological limitations resulting from the bivariate analysis of data. Another limitation is the time scale of the analysis where comparison of attitudes in different points in time would enable the analysis of change in the attitudes and factors which influence changing concerns and preferences for different adaptation options.

5. Conclusions

This study investigated factors influencing climate change perception and willingness to engage in individual adaptation and mitigation actions among the general public in the Czech Republic. Moreover, we examined the role of gender and previous personal experience with extreme weather events in climate change beliefs and willingness to undertake individual actions. We identified a strong link between gender as well as other sociodemographic factors (age and education), climate change perception and willingness to undertake individual actions. Previous experience with extreme weather events also played an important role with regard to individual actions. Interestingly, the majority of respondents are already undertaking some type of individual actions (adaptation

or mitigation). However, these individual efforts would need to be addressed and supported by a consistent climate policy.

Climate change is expected to increase the frequency and severity of extreme weather events (mainly droughts, floods and heat waves) in the Czech Republic in the next 50 years. Therefore, understanding how individuals with prior experience perceive future risks and respond to adaptation policy is crucial for the support of such policy. Gender can provide a useful perspective on climate change adaptation. Further research is needed to explore the relationship between the particular type and intensity of experience of extreme weather events and its impacts on climate change beliefs, concerns and willingness to adapt. This knowledge would enable more effective translation of national climate change adaptation and mitigation policies into individual actions, for example by targeting specific groups of people by adaptation and mitigation programs. The provided results can support decision-making regarding adaptation policy and individual adaptation actions, as well as the directing of communication strategies of climate change issues towards the public.

Author Contributions: Conceptualization, E.K.L and D.V.; Formal analysis, E.K.L. and B.L.; Investigation, E.K.L.; Software, B.L.; Supervision, D.V.; Writing—original draft, E.K.L.; Writing—review and editing, D.V.

Acknowledgments: This work was supported by the Ministry of Education, Youth and Sports of the Czech Republic within the National Sustainability Program I (NPU I), grant number LO1415.

Conflicts of Interest: Authors declare no conflict of interest.

References

- Lorenzoni, I.; Pidgeon, N.; O'Connor, R.E. Dangerous climate change: The role for risk research. *Risk Anal.* **2005**, *25*, 1387–1398. [[CrossRef](#)]
- Hagen, B.; Middel, A.; Pijawka, D. European climate change perceptions: Public support for mitigation and adaptation policies. *Environ. Policy Gov.* **2016**, *26*, 170–183. [[CrossRef](#)]
- Poortinga, W.; Whitmarsh, L.; Steg, L.; Böhm, G.; Fisher, S. Climate change perceptions and their individual-level determinants: A cross-European analysis. *Glob. Environ. Chang.* **2019**, *55*, 25–35. [[CrossRef](#)]
- Lujala, P.; Lein, H.; Rød, J.K. Climate change, natural hazards, and risk perception: The role of proximity and personal experience. *Local Environ. Int. J. Justice Sustain.* **2015**, *20*, 489–509.
- Lorenzoni, I.; Pidgeon, N. Public views on climate change: European and USA. *Clim. Chang.* **2006**, *77*, 73–95. [[CrossRef](#)]
- Pidgeon, N.; Fischhoff, B. The role of social and decision sciences in communicating uncertain climate risks. *Nat. Clim. Chang.* **2011**, *1*, 35–41. [[CrossRef](#)]
- Ray, A.; Hughes, L.; Konisky, D.M.; Kaylor, C. Extreme weather exposure and support for climate change adaptation. *Glob. Environ. Chang.* **2017**, *46*, 104–113. [[CrossRef](#)]
- Ratter, B.M.W.; Philipp, K.H.I.; von Storch, H. Between hype and decline: Recent trends in public perception of climate change. *Environ. Sci. Policy* **2012**, *18*, 3–8. [[CrossRef](#)]
- European Commission. *Special Eurobarometer 409—Climate Change*; Directorate-General for Climate Action: Brussels, Belgium, 2014.
- Su, M.; Pauleit, S.; Xuemei, Y.; Ying, Z.; Chen, S.; Xu, C. Greenhouse gas emissions accounting for EU member states from 1991 to 2012. *Appl. Energy* **2016**, *184*, 759–768. [[CrossRef](#)]
- Chaisty, P.; Whitefield, S. Attitudes towards the environment: Are post-Communist societies (still) different? *Environ. Politics* **2017**, *24*, 598–616. [[CrossRef](#)]
- Bichard, E.; Kazmierczak, A. Are homeowners willing to adapt to and mitigate the effects of climate change? *Clim. Chang.* **2012**, *112*, 633–654. [[CrossRef](#)]
- Oppenheimer, M.; Campos, M.; Warren, R.; Birkmann, J.; Luber, G.; O'Neill, B.; Takahashi, K. Emergent risks and key vulnerabilities. In *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects*; Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change; Field, C.B., Barros, V.R., Dokken, D.J., Mach, K.J., Mastrandrea, M.D., Bilir, T.E., Chatterjee, M., Ebi, K.L., Estrada, Y.O., Genova, R.C., et al., Eds.; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2014; pp. 1039–1099.

14. Brulle, R.J.; Carmichael, J.; Jenkins, J.C. Shifting public opinion on climate change: An empirical assessment of factors influencing concern over climate change in the U.S., 2002–2010. *Clim. Chang.* **2012**, *114*, 169–188. [[CrossRef](#)]
15. Spence, A.; Poortinga, W.; Butler, C.; Pidgeon, N.F. Perceptions of climate change and willingness to save energy related to flood experience. *Nat. Clim. Chang.* **2011**, *1*, 46–49. [[CrossRef](#)]
16. Fownes, J.R.; Allred, S.B. Testing the Influence of Recent Weather on Perceptions of Personal Experience with Climate Change and Extreme Weather in New York State. *Weather Clim. Soc.* **2019**, *11*, 134–157. [[CrossRef](#)]
17. Burningham, K.; Fielding, J.; Thrush, D. 'It'll never happen to me': Understanding public awareness of local flood risk. *Disasters* **2008**, *32*, 216–238. [[CrossRef](#)] [[PubMed](#)]
18. Kazmierczak, A.; Bichard, E. Investigating homeowners' interest in property-level flood protection. *Int. J. Disaster Resil. Built Environ.* **2010**, *1*, 157–172. [[CrossRef](#)]
19. Weber, E.U. Experience-based and description-based perceptions of long-term risk: Why global warming does not scare us (yet). *Clim. Chang.* **2006**, *77*, 103–120. [[CrossRef](#)]
20. Wachinger, G.; Renn, O.; Begg, C.; Kuhlicke, C. The risk perception paradox. Implications for governance and communication of natural hazards. *Risk Anal.* **2013**, *33*, 1049–1065. [[CrossRef](#)]
21. Loučková, B. Eastern European Perspective on the Environmental Aspects in Current Flood Risk Management: The Example of the Czech Republic. In *The Global Water System in the Anthropocene. Challenges for Science and Governance*; Bhadurri, A., Bogardi, J., Leentvaar, J., Marx, S., Eds.; Springer: Berlin/Heidelberg, Germany, 2014; pp. 183–196.
22. Feyen, L.; Dankers, R.; Bódis, K.; Salamon, P.; Barredo, J.I. Fluvial flood risk in Europe in present and future climates. *Clim. Chang.* **2012**, *112*, 47–62. [[CrossRef](#)]
23. Jongman, B.; Hochrainer-Stigler, S.; Feyen, L.; Aerts, J.C.; Mechler, R.; Botzen, W.W.; Bouwer, L.M.; Pflug, G.; Rojas, R.; Ward, P.J. Increasing stress on disaster-risk finance due to large floods. *Nat. Clim. Chang.* **2014**, *4*, 264–268. [[CrossRef](#)]
24. Ministry of Environment. *Strategy on Adaptation to Climate Change in the Czech Republic: Executive Summary*; Approved in Government Resolution No. 861 Dated 26 October 2015; Ministry of Environment of the Czech Republic: Prague, Czech Republic, 2015; 13p.
25. Kyselý, J. Recent severe heat waves in Central Europe: How to view them in the long-term perspective? *Int. J. Climatol.* **2010**, *30*, 89–109. [[CrossRef](#)]
26. Urban, A.; Hanzlíková, H.; Kyselý, J.; Plavcová, E. Impacts of the 2015 Heat Waves on Mortality in the Czech Republic—A Comparison with Previous Heat Waves. *Int. J. Environ. Res. Public Health* **2017**, *14*, 1562. [[CrossRef](#)]
27. Brázdil, R.; Trnka, M.; Mikšovský, J.; Řezníčková, L.; Dobrovolný, P. *Drought in the Czech Lands: Past, Present and Future*; Centrum Výzkumu Globální Změny Akademie věd České Republiky, v.v.i.: Brno, Czech Republic, 2015; ISBN 978-80-87902-11-0.
28. Semenza, J.C.; Hall, D.E.; Wilson, D.J.; Bontempo, B.D.; Sailor, D.J.; George, L.A. Public Perception of Climate Change. Voluntary Mitigation and Barriers to Behavior Change. *Am. J. Prev. Med.* **2008**, *35*, 479–487. [[CrossRef](#)]
29. Davidson, D.J.; Haan, M. Gender, political ideology, and climate change beliefs in an extractive industry community. *Popul. Environ.* **2012**, *34*, 217–234. [[CrossRef](#)]
30. Arbuckle, J.G.; Wright Morton, L.; Hobbs, J. Farmer beliefs and concerns about climate change and attitudes toward adaptation and mitigation: Evidence from Iowa. *Clim. Chang.* **2013**, *118*, 551–563. [[CrossRef](#)]
31. Taylor, A.L.; Dessai, S.; Bruine de Bruin, W. Public perception of climate risk and adaptation in the UK: A review of the literature. *Clim. Risk Manag.* **2014**, *4–5*, 1–16. [[CrossRef](#)]
32. McCright, A.M. The effects of gender on climate change knowledge and concern in the American public. *Popul. Environ.* **2010**, *32*, 66–87. [[CrossRef](#)]
33. Whitmarsh, L. Are flood victims more concerned about climate change than other people? The role of direct experience in risk perception and behavioral response. *J. Risk Res.* **2008**, *11*, 351–374. [[CrossRef](#)]
34. Lamond, J.E.; Proverbs, D.G. Resilience to flooding: Lessons from international comparison. *Urban Des. Plan.* **2009**, *162*, 63–70. [[CrossRef](#)]
35. Werritty, A.; Houston, D.; Ball, T.; Tavendale, A.; Black, A. *Exploring the Social Impacts of Flood Risk and Flooding in Scotland*; The Scottish Government: Edinburgh, UK, 2007.

36. Harries, T. The anticipated emotional consequences of adaptive behavior—impacts on the take-up of household flood-protection measures. *Environ. Plan. A Econ. Space* **2012**, *44*, 649–668. [[CrossRef](#)]
37. Kreibich, H. Do perceptions of climate change influence precautionary measures? *Int. J. Clim. Chang. Strateg. Manag.* **2011**, *3*, 189–199. [[CrossRef](#)]
38. Soane, E.; Schubert, I.; Challenor, P.; Lunn, R.; Narendran, S.; Pollard, S. Flood perception and mitigation: The role of severity, agency, and experience in the purchase of flood protection, and the communication of flood information. *Environ. Plan. A* **2010**, *42*, 3023–3038. [[CrossRef](#)]
39. Reser, J.P.; Bradley, G.L.; Glendon, A.I.; Ellul, M.; Callaghan, R. Public risk perceptions, understandings and responses to climate change in Australia and Great Britain. In *Gold Coast, Qld: Griffith Climate Change Response Adaptation Facility*; National Climate Change Adaptation Research Facility: Gold Coast, Australia, 2012; p. 298.
40. Buys, L.; Miller, E.; van Megen, K. Conceptualizing climate change in rural Australia: Community perceptions, attitudes and (in)actions. *Reg. Environ. Chang.* **2012**, *12*, 237–248. [[CrossRef](#)]
41. Brügger, A.; Morton, T.A.; Dessai, S. Hand in Hand: Public Endorsement of Climate Change Mitigation and Adaptation. *PLoS ONE* **2015**, *10*, e0124843. [[CrossRef](#)]
42. Jørgensen, S.L.; Termansen, M. Linking climate change perceptions to adaptation and mitigation action. *Clim. Chang.* **2016**, *138*, 283–296. [[CrossRef](#)]
43. Poortinga, W.; Spence, A.; Whitmarsh, L.; Capstick, S.; Pidgeon, N.F. Uncertain climate: An investigation into public skepticism about anthropogenic climate change. *Glob. Environ. Chang.* **2011**, *21*, 1015–1024. [[CrossRef](#)]
44. Ricart, S.; Olcina, J.; Rico, A.M. Evaluating Public Attitudes and Farmers' Beliefs towards Climate Change Adaptation: Awareness, Perception, and Populism at European Level. *Land* **2019**, *8*, 4. [[CrossRef](#)]



© 2019 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).