



Citizen engagement in climate adaptation surveyed: The role of values, worldviews, gender and place

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ABSTRACT

Local governments' limited mandate and capacity to adequately deal with increasing climate risk and impacts means that citizen engagement is becoming increasingly important for adapting to hazards such as floods and storms. Stronger collaborative approaches are urgently needed. At the same time, there is little research and hardly any empirical evidence on what inspires adaptation engagement in different citizen groups. Against this background, this paper examines the external/material (e.g., resources, hazards, public support) and internal aspects (e.g., values and worldviews) that shape people's engagement in and for adaptation. Based on a survey of Swedish citizens at risk from severe climate events, we show that engagement is a gendered process, which is mediated by personal values, worldviews and place—aspects rarely considered in public adaptation. While a high level of diverse citizen action is often related to past experiences of hazards, motivation to adapt goes beyond the idea of acting out of rational self-interest. Economic considerations (e.g., low cost) are not the only motivation to adapt; the potential of an adaptation action to contribute to green, thriving surroundings and mitigate global climate change was found nearly as (and among female respondents, more) motivating. Women were also found to be more motivated to engage in adaptation if this supports other community members at risk. At the same time, past adaptation action could not be linked to motivation to adapt, and was found to be negatively correlated with communitarian and ecological values or worldviews. This confirms that motivation to adapt does not automatically translate into action, and indicates a 'mitigation–adaptation gap' in people's climate awareness, which can lead to ineffective climate responses. Given these findings, we discuss alternative approaches to support increased citizen engagement and more effective and transformative climate action. We end with a call for public adaptation and risk communication that takes greater account of inner/subjective dimensions.

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1. Introduction

There is an urgent need for urban societies worldwide to adapt to dangerous climate change (IPCC, 2014). Climate change adaptation (hereinafter 'adaptation') is defined as "the process of adjustment to actual or expected climate and its effects" (IPCC, 2014, p. 1758). At the local level, this includes both individual and institutional efforts to (increase capacity to) prevent, reduce vulnerability to, respond to, and recover from adverse climate impacts in the current and future climate (Wamsler, 2014).

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Local governments' limited mandate and capacity to address climate risk comprehensively require increased action from private actors and civil society, including citizens (Adger et al., 2013b; Brink and Wamsler, 2018; Hegger et al., 2017). Citizens' adaptation actions concern both proactive and reactive responses to local climate hazards (e.g., floods, storms and sea-level rise). They can be economic (e.g., home insurance), social (e.g., warning or helping neighbours at risk), physical (e.g., adapting the house to withstand extreme weather), and ecological (e.g., use plants to improve drainage or create a more comfortable climate), and are often important for supporting comprehensive adaptation at higher (e.g., municipal) levels (Tompkins and Eakin, 2012). At the same time, municipalities have limited experience of citizen engagement for climate adaptation (Wamsler and Pauleit, 2016), often lack a mandate to enforce action on private property (Jönsson et al., 2017),

and may even obstruct individual adaptation (Wamsler and Brink, 2014a; Wamsler and Pauleit, 2016). More collaborative approaches are urgently needed.

There is, however, little research and hardly any empirical evidence on the aspects that inspire citizens' engagement in and for adaptation (cf. Blennow et al., 2012; Glaas et al., 2015; Hegger et al., 2017; Mees et al., 2017, 2016; Porter et al., 2014). Previous studies indicate the importance of contextual aspects, such as resonating with the setting of the target audience; nevertheless, knowledge of context-specific barriers and the driving forces for citizen engagement in climate adaptation remains scarce (Glaas et al., 2015, p. 57, p. 57). In addition, inner/subjective dimensions that can support or hinder adaptation—including aspects like emotions, values, beliefs, and worldviews—are rarely considered, nor linked to material/objective aspects (Adger et al., 2013a, 2009; Enander, 2010; O'Brien and Hochachka, 2011; O'Brien, 2009; Wamsler, 2018).

Against this background, and based on a survey of at-risk citizens in southern Sweden, this study examines the external/material (e.g., hazards, resources, public support) and inner/subjective aspects (e.g., beliefs, values and worldviews) that shape people's engagement in and for adaptation. The following section describes the analytical framework and survey methodology. Next, we present the results (Section 3) and discuss the identified key patterns and limitations of the study (Section 4). Finally, we outline both practical and theoretical implications of this study (Section 4).

2. Methodology

We use a survey and case study methodology (Flyvbjerg, 2011; Sieber, 1973; Yin, 2008) to investigate the factors of citizen engagement in adaptation in the coastal municipality of Lomma, Sweden.

2.1. The study area

While Sweden has a strong tradition of environmental and participatory planning, adaptation is a relatively recent priority for municipalities (SCCV, 2007; Westlin et al., 2012)—and certainly for citizens (Pettersson-Strömbäck et al., 2012). Lomma was not selected as a representative sample of the Swedish population, but as a *most-likely*, i.e. information-rich, case (Glaser and Strauss, 1967; Marris et al., 1998). The municipality is located in one of the Swedish regions that are expected to be hardest-hit by climate change (Hall et al., 2015; SCCV, 2007). Recurrent flooding in recent years (e.g., 2007, 2011, 2013 and 2014) has been used to lobby for a progressive municipal adaptation policy, which includes flood mapping, ecosystem-based approaches, and involving citizens and users of the coast (Palo, 2013; Wamsler, 2017). Lomma's coastal zone covers about a quarter of the municipality's total area (consisting of 56 km² land and 34 km² sea) and plays a central role in the local identity and economy.

2.2. Survey development and implementation

In January 2017, a written questionnaire was distributed to 600 households at risk from adverse climate events. The selection was based on information about past events (including floods and storms) as well as future flood scenarios for the area. The aim of the selection was to obtain enough variation between a number of features (including external/material and inner/subjective aspects) to allow comparison between these (e.g., more and less hazard affected, gender) (see Marris et al., 1998). The response rate was 36% (n = 217). Nearly half of the final respondents had experienced personal damage from weather-related events (mainly pluvial and coastal flooding and storms), and there was a 3:2 ratio between men

and women (see Table 1). An overview of the respondents' age, education and income levels is shown in Fig. S1 in the Supplementary material.

The survey questions were developed based on theories of climate change adaptation, risk and environmental behaviour (e.g., Grothmann and Patt, 2005; IPCC, 2014; Stern et al., 1999; UNISDR, 2009; Wisner et al., 2004). Accordingly, we operationalise adaptation as reducing adverse climate risk by taking actions to i) prevent or avoid climate hazards, ii) reduce (physical and non-physical) vulnerability to such hazards, and increase capacity or preparedness to iii) respond and iv) recover (IPCC, 2012; Wamsler, 2014). Notably, a higher number and diversity of activities implemented (including economic, social, physical/technical and ecological actions) can create more flexible and sustainable adaptation (Wamsler and Brink, 2014b). Motivation for adaptation, here, is related to willingness or intention to adapt (Botzen et al., 2009; Grothmann and Patt, 2005).

Aspects that are said to influence (support or constrain) adaptation actions and related motivation are both external/material and inner/subjective (Adger et al., 2009; Grothmann and Patt, 2005). External/material aspects (and their unequal distribution) have long been a focus of disaster and vulnerability studies, and include issues such as hazard experience, income, education, gender and age, as well as access to social networks and institutional support (Cutter et al., 2003; Nieminen Kristofersson, 2007; Pelling, 2003; Wamsler, 2014; Wisner et al., 2004).

Inner/subjective aspects, which to date have been less studied, include issues such as emotions, values, beliefs and worldviews, which in turn translate in different risk perceptions and actions (Enander, 2010; O'Brien and Hochachka, 2011; Wall, 2011). While many applications exist, here we understand *emotions* as affective reactions or relationships (Kollmuss and Agyeman, 2002; O'Brien and Selboe, 2015; Shouse, 2005; Slovic et al., 2004), *values* as what is intrinsically desirable for individuals or society (O'Brien, 2009; O'Brien and Wolf, 2010; see also Stern et al., 1999), *beliefs* as what people hold for 'true' about an object or issue (cf. Kollmuss and Agyeman, 2002), and *worldviews* as systems of values and beliefs that justify certain decision-making and (social) behaviour (Dake, 1992; O'Brien, 2009). Emotions (such as dreading a risk or feeling connected to nature) can be important aspects of decision-making and action (Shouse, 2005; Slovic et al., 2004) and lately, 'climate angst' has emerged as an umbrella term for people's feelings of anxiety and depression about climate change (Svoboda, 2017). Regarding values, while different models of human behaviour place differing importance on self-interest and rational-choice deliberation (e.g., Theory of Planned Behaviour; Ajzen, 1985) vis-à-vis moral norms and values (e.g., Value-Belief-Norm; Stern et al., 1999), we consider three broad value orientations that can motivate or constrain action. They are economic (or more broadly speaking "ego-focused", which also comprises non-financial returns such as private risk reduction), ecological (pro-environmental, biospheric or "eco-focused") and social (altruistic, pro-social or "other-

Table 1

Distribution of households (n = 217) as a function of previous hazard experience and gender.

Respondent gender	Household experience of climate-related hazard	
	Affected	Unaffected
Male	58	70
Female	41	40
Other ^a	2	6

^a Respondents in this category either selected a third gender option or indicated that a male and female householder had filled out the survey together. These participants were omitted from analyses based on gender.

Table 2
Actions for risk reduction and adaptation taken by respondents.

Adaptation action	#	%
1. Bring in loose possessions before a storm (Organisational)	195	91%
2. Preparation for power outages (candles, radio with battery) (Organisational)	131	61%
3. Use/build storage on shelves (or completely avoid storage) in the basement due to flood risk (Technical)	53	25%
4. Adapt the property to better withstand heavy rain/strong winds (e.g., improve drainage, anchor tiles) (Technical)	49	23%
5. Using plants or trees to create a more pleasant summer climate (Ecosystem-based)	45	21%
6. Acquire pumps and/or sand bags to use in case of flooding (Technical)	38	18%
7. Remove trees that could fall on the property during a storm (Technical)	37	17%
8. Revise home insurance with regard to coverage of weather-related events (Economic/Institutional)	37	17%
9. Warn neighbours when a storm or other weather event is coming/has occurred (Social)	37	17%
10. Look after elderly relatives/neighbours during a heat wave (Social)	26	12%
11. Building barriers or flood protection in front of the home (Technical)	10	5%
12. Applying for a building permit/beach protection to implement a measure (Institutional)	4	2%
13. Move to an area that is less at risk from extreme weather events (Organisational)	4	2%
14. Try to influence the property owner/housing cooperative to take measures ^a (Institutional)	3	1%
Total households that had taken any measure	214	99%

^a Only 5 people who lived in apartments answered the survey.

focused”) (Kollmuss and Agyeman, 2002; Stern et al., 1999; Tompkins and Eakin, 2012). People's beliefs include here their acceptance (or denial) of climate change (O'Brien and Hochachka, 2011), but can also concern the expected effectiveness or consequences of one's own actions (Ajzen, 1985; Grothmann and Patt, 2005; Stern et al., 1999). Finally, based on Cultural Theory of Risk, we consider four main worldviews or “ways of life”: individualist, communitarian, hierarchical and fatalist (Douglas, 1978; Thompson et al., 1990). Each worldview has been ascribed its own view of risk and nature, the need for pro-environmental behaviour, preferred policy options and social order (Fig. 1) (Dake, 1992; O'Riordan and Jordan, 1999; Poortinga et al., 2002; Wamsler, 2007). The survey was pre-tested with a small group (including people of different educational backgrounds and non-native Swedish speakers), who, after completing it, were interviewed about its intelligibility and suitability, leading to the revision of some questions. See Table S2 in Supplementary material for further details about survey questions and variables.

2.3. Data analysis

In order to identify patterns and links concerning people's reported adaptation actions and the external and internal aspects that motivate them, the data analysis used descriptive statistics (comparing means, illustrative graphs, etc.), quantitative correlation analysis, and qualitative content analysis of free-text answers. For the correlation analysis (Spearman's rho), the statistical software SPSS was employed.

People's adaptation actions were assessed based on a checklist of 14 common household actions for risk reduction and adaptation (Table 2; cf. Wamsler and Brink, 2014a,b), plus a free-text option. This allowed the creation of a quantitative measure for the type and the level/diversity of adaptation activity.

To assess people's motivation for future adaptation action, respondents were asked to rate, on a 5-point Likert scale, the extent to which they felt motivated to take action to address local climate hazards given nine different motivational factors, such as low cost, or being encouraged by friends. Seven of the motivational factors could be categorised as linked to either economic, ecological or social values. Four indices were created from these nine items: economic motivation (two items), ecological motivation (two items), social motivation (three items), and overall motivation (all nine items; Cronbach's $\alpha = 0.802$).

To assess external/material dimensions that influence people's adaptation engagement, we considered past hazard experience, socioeconomic status, gender, and public support. To assess inner/

subjective dimensions, we considered the value orientations that underlie people's motivation (categorised as economic, ecological and social; see above). In addition, ecological values were assessed through questions about general environmental behaviour, such as vegetarianism¹ and membership of environmental organisations. Beliefs and emotions were assessed through questions about the perceived seriousness of climate change, and climate angst. Finally, people's worldviews were analysed based on respondents' rating of eight statements adapted from Dake (1992). These aimed to capture to what extent people's worldviews were communitarian (“I support stricter legislation to make people behave more climate-friendly.”, “If the world were more egalitarian, climate change would not be such a big problem.”), individualist (“A free society can only exist by giving companies the opportunity to prosper.”, “If a person has the get-up-and-go to acquire wealth, that person should have the right to enjoy it.”), hierarchical (“I am more strict than most people about what is right and wrong.”, “I support compulsory National Military Service.”), or fatalist (“The future is too uncertain for a person to make serious plans.”, “It feels pointless for me to take climate action if no one else does.”).

3. Results

In the first two subsections (3.1 and 3.2), we give an overview of people's adaptation actions and motivations, before we delve into the analysis of how these are employed by different groups based on both external/material and inner/subjective dimensions (sections 3.3 and 3.4).

3.1. Hazards and adaptation actions

The results showed that the vast majority of households (99%) had engaged in activities related to adaptation to local hazards (Table 1). In fact, only three households did not report any related actions. Half of the 217 surveyed households reported having experienced personal injury or damage to property from weather-related events, including flooding (30%), storms (24%) and heat-waves (1%). While nearly half (46%) checked between three and five of the adaptation actions listed in Table 1, few (11%) had engaged in more than five. In their free-text answers, some people provided further details as to how they had adapted their house to storms

¹ Concerns for environment and climate are often cited as the main motivation for a changing diet in Sweden, and while the number of full vegetarians remains low, the number of vegetarian meals consumed per week are on the increase (Axfood, 2017; SVT Nyheter, 2017).

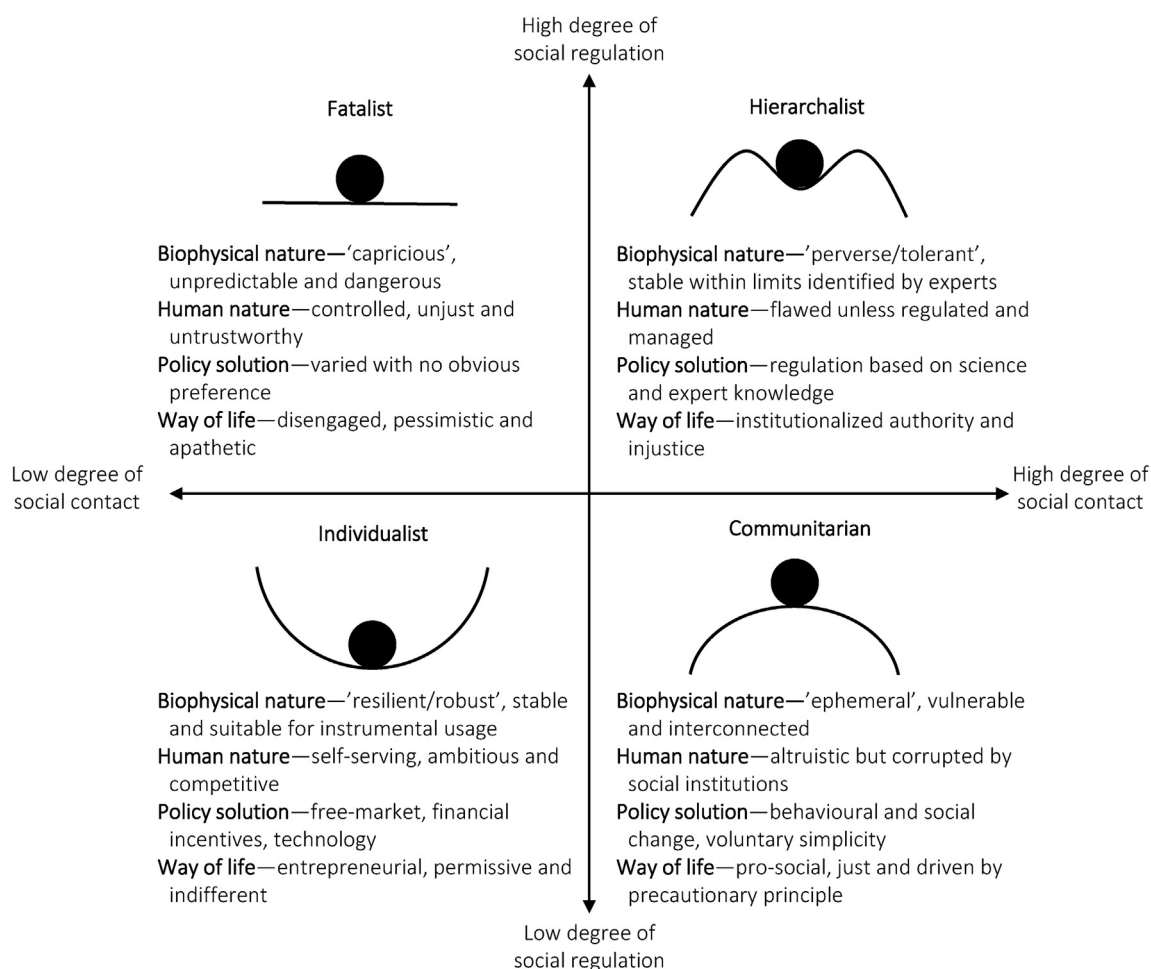


Fig. 1. Four worldviews or 'ways of life' according to Cultural Theory, and their respective views of nature (adapted from O'Riordan and Jordan, 1999; Poortinga et al., 2002; Price et al., 2014).

Table 3
Ranking of motivational factors.

Motivation type (value orientation)	Motivational factor	Mean ranking (0–4)
Economic	<i>Low cost</i> : The action has low or no cost	2.32
Ecological	<i>Greening</i> : The action also contributes to a green and thriving local environment	2.30
Ecological	<i>Climate change mitigation (CCM)</i> : The action also contributes to mitigating greenhouse gas emissions	2.28
Economic	<i>Economic incentive</i> : I get financial benefits if I take action (e.g., tax deductions)	2.14
Social	<i>Good conscience</i> : I have a good conscience knowing I'm doing the "right" thing	2.02
Other	<i>Little know-how</i> : The action requires no or few skills or know-how	2.01
Social	<i>Family/friends</i> : I am encouraged by family members, friends or neighbours to take action	1.92
Other	<i>Public adaptation</i> : I am encouraged by the municipality to take action	1.74
Social	<i>Others' risk</i> : The action can reduce the risk of other community members, who are more at risk	1.72

and floods, e.g., attaching the chimney with extra bolts or using water-proof materials on the ground floor. Others reported on preparedness for response measures, e.g., filling buckets with water in anticipation of extreme weather, or acquiring a camper van to have electricity-independent heating and mobility should an extreme event occur. The mean number of adaptation actions taken was 3.2 (3.7 and 2.6 for previously affected and unaffected households, respectively).

3.2. Motivation for future adaptation

Asking how motivated they felt to carry out future adaptation actions in nine different circumstances (Table 3), respondents

generally favoured ecological factors, such as the possibility that adaptation would also contribute to climate change mitigation (i.e., reducing greenhouse gas emissions) or a green and thriving environment (mean ranking 2.29 out of 4), and economic values, such as low costs and financial benefits (e.g., tax deductions) associated with the action (mean ranking 2.23 out of 4).² However, social motivational factors were, on average, not far behind (1.79 out of 4) (Table 3).

Free-text answers (from 14 respondents) provided additional qualitative details about what people found motivating. Four of

² Two motivating factors, requiring no prior knowledge and being encouraged by the municipality, were categorised as "Other" (cf. Table 3).

these responses focused on the reduction of individual risk as the main motivational factor.³ They illustrate that such motivation can either be linked to reactive adaptation, such as “*I would do what was necessary [during hazard occurrence]! If we had flooding or storm damage I would take measures to reduce further damage*”, or proactive thinking, e.g.:

“If I can avoid going out in the rain and storm to rescue property or avoid the situation deteriorating by taking anticipatory measures, it is a clear motivation—then I can confidently sit inside and cuddle when the wind whips and the seas are rough!”

Three additional responses highlight the role of specific knowledge in people's motivation to act. This includes knowledge of the actual hazard and associated risk (e.g., hearing early warnings on the local weather report) and regarding the best action to take and how (e.g., “*The action is simple to implement, I can do it myself or easily get help from craftsmen or the municipality*”). Three respondents emphasised simple implementation, for instance “reduced bureaucracy and greater flexibility” from authorities in issuing permits to residents to build protective structures. Regarding the latter, one respondent stated that “*Man is part of nature and should have the right to protect [himself] when nature strikes*”.

Six respondents highlighted their attachment to place and the community as an important motivation factor. They stated that their motivation to act increased if an adaptation action had positive effects on their property and also the surroundings during “normal” times, or made it more likely that they could continue living where they were in the long run, or if “*the community decides, and the village, the street, and the neighbours jointly carry out a project for the common good*”. One respondent wanted adaptation to be “*fun and not a burden*”.

3.3. External dimensions: the context and resources shaping adaptation

3.3.1. Hazard experience

The results show that past experience of climate-related hazards is a key determinant of citizen action. In fact, a positive correlation was identified between hazard experience and the number/diversity of different measures taken ($r = 0.292^{**}$, $p < .001$).⁴ Apart from this result, few significant correlations were found for the number/diversity of past adaptation actions, which is why the following sections mainly report on (the factors shaping) motivation for future adaptation. Interestingly, we found no correlation between respondents' overall level of motivation and their past adaptation activity.

Hazard experience was also linked to a higher overall motivation for future action-taking ($r = 0.170^{*}$, $p = .012$; cf., Fig. 2). The biggest difference between hazard-affected and non-hazard-affected respondents was found for economic motivational factors (low-cost adaptation and receiving economic benefits), which were rated as considerably more motivating by affected respondents ($r = 0.236^{**}$, $p < .001$). Conversely, the smallest difference between the two groups appears for adaptation actions that can contribute to greener immediate surroundings and mitigate emissions of greenhouse gases to the atmosphere, which were found highly

motivating in both groups (Fig. 2).

3.3.2. Gender

The analysis by gender gave further insight into people's adaptation motivation. The comparison of mean rankings of motivational factors showed that male respondents appear more influenced by economic values, such as receiving economic benefits, while female respondents appear to be more motivated by social values, such as being encouraged by family/friends and having a good conscience (Fig. 3).

The greatest gender difference, confirmed by the correlation analysis, appears for “communitarian” factors such as an adaptation action's contribution to reducing others' risk ($r = 0.186^{*}$, $p = .010$), green surroundings ($r = 0.158^{*}$, $p = .027$) and climate change mitigation ($r = 0.229^{**}$, $p < .001$), which were rated as considerably more motivating by women (Fig. 3). In general, there is a correlation between being female and being motivated by ecological values in adaptation ($r = 0.202^{**}$, $p = .005$). We found no other significant correlations between gender and type of motivation.

3.3.3. Income, education and age

Our results show that household income is correlated with overall motivation for taking future action ($r = 0.184^{**}$, $p = .008$). In other words, people with higher incomes generally rated all of the different circumstances (see Table 3) as more motivating than those with lower income. The same relationship, but even stronger, was found for respondents' level of education ($r = .226^{**}$, $p < .001$).

While income and education were not linked to the overall number/diversity of actions taken, income was found correlated with certain actions. More specifically, income was positively correlated with having applied for a building permit to carry out adaptation ($r = 0.207^{**}$, $p = .003$) and taking in loose possessions before a storm ($r = 0.149^{*}$, $p = .034$), and negatively correlated with having prepared for electricity cuts ($r = -0.152^{*}$, $p = .030$) (i.e., less affluent households were more prepared for blackouts).

Meanwhile, motivation for action-taking decreased with respondents' age ($r = -0.361^{**}$, $p < .001$). In particular, age was negatively correlated with motivation from economic incentives ($r = -0.216^{**}$, $p = .002$), and encouragement by family ($r = -0.245^{**}$, $p < .001$) and the municipality ($r = -0.176^{*}$, $p = .014$); in other words, younger respondents were open to being told to adapt by someone else. However, older respondents had more often been in touch with the municipality regarding risk and adaptation ($r = 0.150^{*}$, $p = .030$).

3.3.4. Resources

Participants were asked to rate and select the most important determinants of their individual adaptive capacity,⁵ which illustrated the resources (and associated needs) that shape adaptation in the community. Among the respondents, 4% rated their capacity as very low, 19% as low, 43% as average, 29% as high and 4% as very high. People who rated their capacity as higher generally named *technical know-how* ($r = 0.281^{**}$, $p < .001$) and *access to equipment* ($r = 0.141^{*}$, $p = .041$) as key determinants. In contrast, those who reported lower capacity generally selected *municipal support* ($r = 0.161^{*}$, $p = .019$). Regarding the latter, examples (provided by 36 respondents) include traditional and technical risk management efforts, such as improving drainage, strengthening the shoreline, and emergency planning, including pumps and sandbags, to be deployed during floods. Only one respondent mentioned the need

³ Private risk reduction was not among the surveyed motivational factors (which focused on additional motivations), but can be categorised within the “ego-based” or non-financial returns (cf., section 2.2).

⁴ Here, r denotes the strength and p the significance of the relationship; the larger the r and the smaller the p , the stronger and more significant is the correlation. ** indicates the correlation's significance at the 0.01 level (99%), and * at the 0.05 level (95%), respectively. (2-tailed).

⁵ Respondents were asked to select three out of the following eight options: hazard experience, economic resources, insurance, health, technical know-how, family and friends, support from the municipality, and access to equipment.

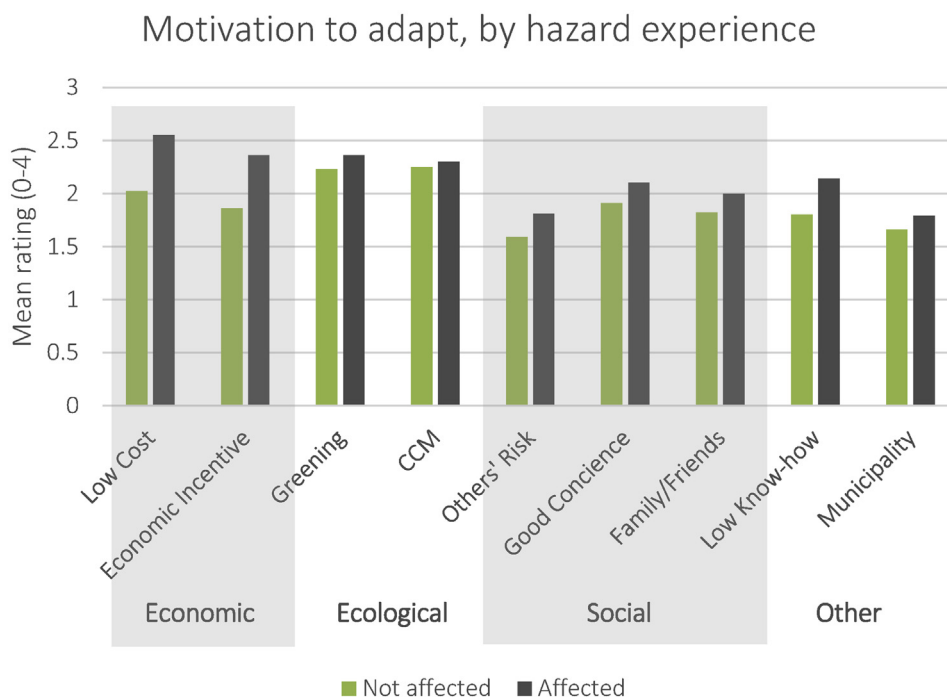


Fig. 2. Motivational factors, grouped by economic, ecological, social and other, in households with and without hazard experience. CCM = Climate change mitigation.

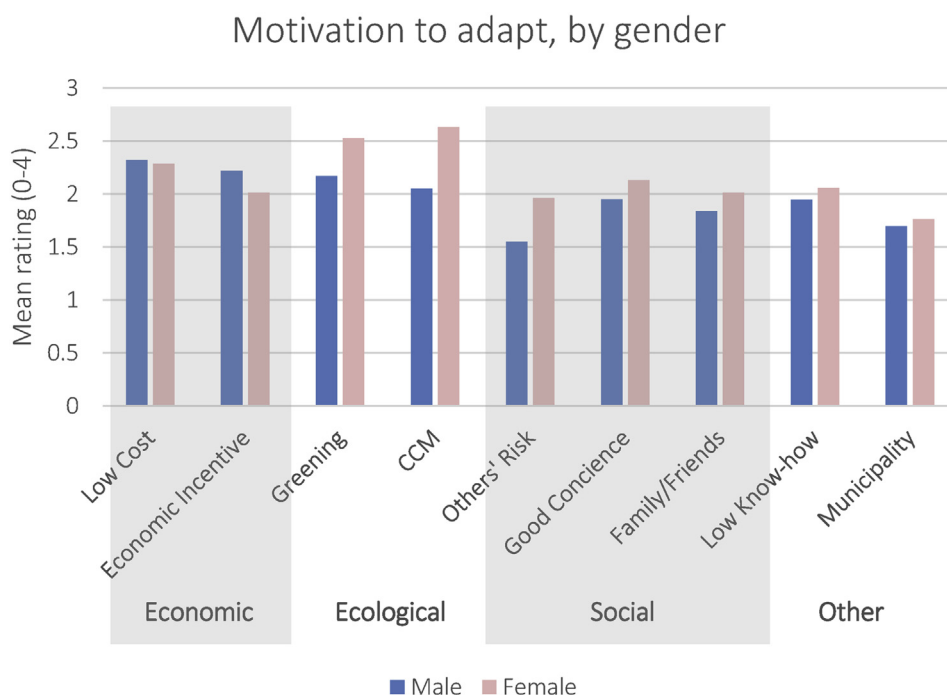


Fig. 3. Motivational factors, grouped by economic, ecological, social and other, in male and female respondent groups. CCM = Climate change mitigation.

for providing knowledge about what citizens can/should do as an important determinant for individual adaptive capacity.

Furthermore, it became clear that adaptation is determined by the resources people have at their disposal. Respondents with higher household income selected *economic resources* as an important factor in adaptive capacity ($r = 0.175^*$, $p = .013$). Similarly, and even more significant, *experience* was singled out by those who had been affected by hazards ($r = 0.274^{**}$, $p < .001$) and taken

more adaptation actions ($r = 0.254^{**}$, $p < .001$). Selecting *technical know-how* as important for capacity was correlated with a specific action: namely cutting down trees that threaten to fall on the property during high winds ($r = 0.213^{**}$, $p = .002$).

While there was no pattern concerning gender and high/low adaptive capacity, there was a correlation between being female and selecting *family* as important for adaptive capacity ($r = 0.155^*$, $p = .027$), and between being male and selecting *technical know-how*

($r = 0.235^{**}$, $p < .001$). Single-person households more often selected *insurance* as an important factor ($r = 0.217^{**}$, $p < .001$). There was no correlation between age and capacity, either with respect to high/low capacity, or selecting health as an important factor.

3.3.5. Public support

One in every four households reported that it had interacted with the municipality on adaptation-related issues, most of which were in the hazard-affected group. The nature of these interactions can be assessed from the free-text answers (given by 40 respondents). Nine of these mentioned interactions that sought to influence general municipal action in favour of adaptation. Examples are: reporting maintenance issues in the stormwater system (*"Rainwater gullies are blocked. Have informed the municipal staff who were out on inspection."*), lobbying for action against erosion (*"The sea is 'eating' the beach. (...) Lomma must protect its shores against the ongoing erosion. They hide behind the County Administrative Board's rules, which basically imply that nature should take its course."*) and trying to influence long-term urban planning (arguing that *"The stormwater system is not built for all these houses"*, *"New houses in Lomma were allowed to be built too close to the present sea level."*). Thirteen respondents had contacted the municipality after flood impacts to their property (e.g., *"We reported being flooded during a rainstorm. The municipality was here and interviewed us and carried out an inspection."*). In addition, a rather large number of interactions (15) concerned a specific case: an ongoing controversy about the municipality's construction of a protective sea-wall. In this context, four respondents were explicitly against it and reported negative effects on place (*"They are building a wall, outside the plot towards the water, which does not need to be so high and we do not want it."* *"We have protested against the 'security barrier' along the beach – design, location, etc."* *"Destroyed living environment due to climate [adaptation] action" (floodwall).* *"Elevation of the ground outside our house"*).

As for the quantitative analysis, having interacted with the municipality on adaptation matters was positively correlated to the number/diversity of adaptation actions taken ($r = 0.390^{**}$, $p < .001$). This can mainly be explained by the links between hazard experience and the number of actions ($r = 0.292^{**}$, $p < .001$), and hazard experience and municipality interaction ($r = 0.154^{*}$, $p = .024$). Regarding the latter, we found that households that have suffered damage engage in more diverse activities, including trying to get compensation or support from authorities. Some households had recently received information from the municipality regarding climate-friendly stormwater management in private gardens, but at this point in time, having received the folder was not found correlated with adaptation action.

3.4. Inner dimensions: the hidden factors shaping adaptation

3.4.1. Beliefs, values, and emotions

The belief that the severity of climate change is exaggerated was found to be negatively correlated to motivation for adaptation ($r = -0.200^{**}$, $p = .003$). In other words, respondents who believe that climate change is a threat were generally more motivated to take adaptation measures.

The results showed that climate denial was negatively correlated to feeling motivated by municipal recommendations ($r = -0.143^{*}$, $p = .045$) and adaptation's contribution to mitigation ($r = -0.156^{*}$, $p = .026$). Female ($r = 0.149^{*}$, $p = .033$), highly educated ($r = 0.188^{**}$, $p = .006$) and young ($r = 0.282^{**}$, $p < .001$) respondents, as well as respondents with personal experience of hazards ($r = -0.151^{*}$, $p = .028$), were less prone to see climate change as exaggerated. Similarly, seeing climate change as real, but distant in space and time was also negatively correlated to overall motivation for adaptation ($r = -0.187^{**}$, $p = .006$). For those who

saw climate change as distant, municipal encouragement ($r = -0.223^{**}$, $p = .002$) and reducing others' risk ($r = -0.181^{*}$, $p = .011$) worked especially poorly as motivational factors. This view was more common among elderly ($r = 0.211^{**}$, $p = .002$) and less-educated respondents ($r = 0.191^{**}$, $p = .005$). There was no correlation between seeing climate change as exaggerated/distant and the number/diversity of adaptation actions taken.

While pro-environmental values seemed to increase *motivation* to adapt, interestingly, they were sometimes in opposition to *actual* adaptation activity. More specifically, a vegetarian diet, which can in some cases be seen as an indicator of pro-environmental values, was positively correlated to motivation for adaptation ($r = 0.138^{*}$, $p = .044$). Similarly, being a member of an environmental/risk organisation, another indicator of pro-environmental values, was linked with having warned neighbours before a storm ($r = 0.182^{**}$, $p = .008$). However, being motivated by ecological factors (namely an adaptation action's contribution to climate mitigation) was *negatively* correlated with the number/diversity of adaptation actions taken ($r = -0.184^{**}$, $p = .009$) and in particular, having carried out adaptation actions of a technical nature ($r = -0.173^{*}$, $p = .014$). Finally, feeling "climate angst" was found to be correlated to higher motivation for adaptation ($r = 0.156^{*}$, $p = .023$)—but to a lower rating of one's adaptive capacity ($r = .175^{*}$, $p = .011$). Female respondents were more often vegetarians ($r = 0.286^{**}$, $p < .001$) and experienced climate angst ($r = 0.197^{**}$, $p = .005$).

3.4.2. Worldviews

Analysis of the Cultural Theory questions (see Section 2.2) estimated the individualist worldview to be predominant in 31% of respondents, communitarian views in 28%, hierarchalist in 15%, and fatalist in 1%. In the remaining 25%, no worldview predominated.

People who scored highly on communitarian questions generally reported high motivation for adaptation ($r = 0.231^{**}$, $p < .001$) and were more motivated by social ($r = 0.191^{**}$, $p = .006$) and ecological factors ($r = 0.255^{**}$, $p < .001$) (specifically, good conscience [$r = 0.211^{**}$, $p = .002$], green surroundings [$r = 0.230^{**}$, $p < .001$] and climate mitigation [$r = .252^{**}$, $p < .001$]). They were more prone to feel climate angst ($r = 0.262^{**}$, $p < .001$) and be vegetarian ($r = 0.182^{**}$, $p = .008$).

Interestingly, however, a high communitarian score was negatively correlated with the number/diversity of adaptation actions taken ($r = -0.159^{*}$, $p = .020$). A significant negative correlation was also found between communitarian values and having interacted with the municipality ($r = -0.212^{**}$, $p = .002$).

Individualist views were positively correlated with high self-rated adaptive capacity ($r = 0.244^{**}$, $p < .001$) and naming technical know-how as important for adaptive capacity ($r = .197^{**}$, $p = .005$). At the same time, it was found to be negatively correlated with seeing municipal support as important for capacity ($r = -0.184^{**}$, $p = .009$). The individualist worldview was positively correlated with high income ($r = 0.185^{**}$, $p = .009$), young age ($r = -0.211^{**}$, $p = .003$), and *not* feeling climate angst ($r = -0.209^{**}$, $p = .003$).

Those who scored highly on fatalist questions had low overall motivation ($r = 0.218^{**}$, $p < .001$), and were especially poorly motivated by ecological factors ($r = 0.221^{**}$, $p = .002$). Fatalist worldviews were found to be correlated to old age ($r = 0.165^{*}$, $p = .017$), whereas they were less common among respondents who: were members of environmental organisations ($r = -0.199^{**}$, $p = .004$), were motivated by adaptation actions that could contribute to mitigation ($r = -0.238^{**}$, $p < .001$), and had a vegetarian diet ($r = -0.187^{**}$, $p = .006$).

No adaptation patterns were identified for the hierarchalist questions. Being male was weakly correlated to individualist ($r = .165^{*}$, $p = .020$), hierarchalist ($r = 0.159^{*}$, $p = .024$) and fatalist

($r = 0.164^*$, $p = .019$) worldviews. No other correlations for gender and cultural theory category were identified.

4. Discussion and conclusions

4.1. Discussion of key findings

Based on a survey of Swedish citizens at risk from severe climate events, this study shows that citizens' engagement in adaptation is a gendered process (Section 4.1.1), which is mediated by values, associated worldviews (Section 4.1.2), and issues of place attachment (Section 4.1.4), three aspects which have so far received little attention in public adaptation. The results further indicate a "mitigation–adaptation gap" in citizens' climate awareness and action, which, if not addressed, may hamper effective climate responses (Section 4.1.3).

4.1.1. Gendered adaptation

While previous research has mainly emphasised the role of gender in shaping vulnerability and risk perception (Cutter et al., 2003; Enander, 2010; Wisner et al., 2004), our results suggest that it also affects motivation and preferences for adaptation. Male respondents were generally more motivated by economic incentives, and saw technical know-how as important for the capacity to adapt. Meanwhile, women regarded their social network as a more important resource, and reported higher motivation for adaptation if it could enhance ecological values at both local and global level, and support other community members at risk (see also the discussion of values in Section 4.1.2). These findings highlight the differential role of women in adaptation, which has so far mainly been highlighted by research in low-income countries, e.g., through income, education, land titles and caregiving responsibilities, and their influence on vulnerability (Wamsler et al., 2012).

Adaptation cannot be separated from culture (see e.g., Krüger et al., 2015), and it is therefore comprehensible, even in a gender-progressive country like Sweden, that gender-based expectations of interests and responsibilities also show up in adaptation and risk reduction. The fact that, in general, women and minorities appraise risks as higher than white males is commonly known as the "white male effect" (Kahan et al., 2007). Higher levels of environmental behaviour and altruism among females have also been shown by other studies that focus on climate change mitigation (e.g., Hoff and Gausset, 2015). Consequently, the practical challenge is to design adaptation communication and interventions that appeal to all genders, while also being conscious of gender-based vulnerabilities, especially in single-person households (for instance, in his analysis of the 1996 Chicago heatwave, Klinenberg (2003) attributed the higher death rates of elderly men to the loss of social relationships after retirement). In this context, some adaptation actions may be more successfully promoted if they are multi-purpose and presented as activities that are already familiar to citizens (e.g., gardening, caring for property), rather than something that is impersonal and not part of culture (Wamsler and Riggers, 2018).

4.1.2. Multiple values behind adaptation motivation

Current attempts to promote adaptation often consider citizens as a homogenous group of actors, motivated by rational self-interest to reduce their own risk, and therefore draw upon economic incentives or penalties. However, our survey showed that motivation to adapt is differentially shaped by ego-focused, eco-focused and other-focused values (an outcome that finds increasing support in the literature on behavioural economics and social neuroscience [e.g., Singer and Lamm, 2009]).

In general, ecological and economic considerations were found to be equally effective in inspiring motivation to adapt, while social factors were not far behind. In fact, two-thirds of the total sample stated that "a good conscience" was a motivation for adaptation, and one-third found it considerably or highly motivating. Surprisingly, economic incentives were found to be more motivating among hazard-affected respondents. This contrasts with the common use of financial incentives for inspiring actions whose main purpose is to benefit adaptation on the larger scale (e.g., decoupling stormwater pipes or reducing soil sealing), rather than the reduction of individual risk. However, the finding may also indicate that hazard experience makes adaptation more tangible for citizens—specific issues like cost become more relevant vis-à-vis more abstract values such as environment or justice.

Overall, these findings are in line with other research that call for a better match between individual and institutional efforts to support transformative climate adaptation (Wamsler and Brink, 2014a; Wamsler and Riggers, 2018).

In this context, our study provides insights regarding how people's worldviews (based on Cultural Theory of Risk) can be used to frame or 'bundle' the identified values, perceptions and their interrelations. In fact, three⁶ types of citizen 'adaptors' emerge from our data:

- The Communitarian Adaptor has high motivation for adaptation in general, and especially adaptation that can enhance social and ecological values. Women are overrepresented in this group. Communitarian Adaptors are more prone to feeling climate angst and be engaged in general pro-environmental behaviour. However, he/she is less likely to have taken actual adaptation actions or interacted with the municipality in matters concerning local climate hazards.
- Individualist Adaptors are 'self-made men' (and, to a lesser extent, women) who consider themselves to have high capacity for adaptation, of which technical know-how is an important part. They can feel discouraged when municipalities or other authorities interfere with their adaptation efforts. The Individualist Adaptor is generally younger, with a high-income, and does not feel anxious about the ongoing climate breakdown.
- Fatalist Adaptors usually have low motivation for adaptation, and are especially unmotivated by ecological concerns. They are on average older, more sceptical about the idea of climate change and related messages from authorities, and are thus less often engaged in general environmental behaviour. Men are slightly overrepresented.

While they could be considered stereotypical (there are surely also male Communitarians, female Individualists, young Fatalists, etc.), these categories may be a helpful heuristic to design adaptation interventions that consider opposing perspectives and inspire engagement and approval across different worldviews—sometimes also described as 'clumsy' solutions (Thompson, 2011; Verweij et al., 2006). For instance, in relation to old age, the elderly respondents in our survey consistently rated their motivation as lower, in particular regarding being told to adapt by someone else. Since old age can be linked to higher vulnerability/lower adaptive capacity in the literature (Cutter et al., 2003), the identified lack of motivation to take action could imply that they are doubly at risk—and thus in need of special support.

Importantly, the influence of worldviews on adaptation is not limited to people's different views of environmental risk. The worldviews lens also emphasises how adaptation responses and

⁶ No specific adaptation pattern was identified for the hierarchalist respondents.

their impacts may threaten the preferred social order of different groups (e.g., IPCC, 2014). This shows the importance of addressing both inner and outer dimensions in public adaptation.

4.1.3. The mitigation–adaptation gap

Our results point to the (sometimes) conflicting goals of adaptation and mitigation, which also seem to be present in citizens' climate awareness and resultant actions. As illustrated by the adaptor profiles above, we found an opposing relationship between, on one hand, having communitarian or pro-environmental values (as assessed by worldviews and type of motivation) and, on the other hand, having engaged in concrete adaptation actions (as assessed by the related checklist and the free-text answer). This was especially noted for technical adaptation actions (see Sections 3.4.1 and 3.4.2). In addition, while respondents with a high communitarian score generally reported high motivation for adaptation, there was no correlation between high motivation and past action, which resonates with previous studies which find that intention, motivation or values do not automatically translate into action (Grothmann and Patt, 2005; Scavenius and Rayner, 2018).

These findings lead us to propose a mitigation–adaptation gap, according to which citizens seem to *either* adopt climate change mitigation (environmental) or adaptation (risk reduction) thinking and values. A dichotomous relationship between mitigation and adaptation (albeit not specifically for citizens) is noted in Dymén and Langlais (2013), referencing Biesbroek et al. (2009). The identified gap might relate to a lower awareness of adaptation (versus mitigation) in the Swedish context, as well as the fact that some adaptation activities may be inconsistent with ecological values or goals (including that of mitigation). Examples include cutting down trees that can fall on the house or, as one respondent complained (regarding the municipality's strict environmental licencing scheme), “*man must have the right to protect himself again nature*”. It also emphasises how, in adaptation, citizens' values and intentions are muddled by complex interactions on both biophysical and societal scales: an adaptation action may be effective in reducing risk at one level (e.g., the household), but increase risk at another (e.g., the neighbourhood or municipality). At the same time, in adaptation, managing individual risk can also be seen as a communitarian action (i.e., not necessarily “ego-focused”), since private risk reduction can free up public resources (such as emergency services) for protecting critical societal infrastructure and vulnerable groups.

The identified mitigation–adaptation gap has implications for both research and practice. Research that aims to analyse and encourage citizens' adaptation should link to existing knowledge in (among others) the fields of environment, risk and behavioural economics. However, the complex nature of adaptation implies that related models for explaining motivation for action may also conflict (e.g., concerning the role of self-interest and ecological values). In addition, further research is needed to investigate the mitigation–adaptation gap, and its potential negative effect on climate action. In practice, transformational adaptation (e.g., Pelling et al., 2014) may require public policies that appeal to a logic of both mitigation and adaptation, and help people to recognise the link. In countries like Sweden, where mitigation has long been the dominant discourse, this may entail emphasising the communitarian side of adaptation: for instance, using language that reflects empathy and compassion for risk-exposed community members and the need to make space for nature to promote individual action (e.g., related to soil sealing and rainwater management on private properties). In this context, ecosystem-based adaptation, which uses ecosystem services and biodiversity to help people adapt to climate change, is increasingly identified as a potential platform to combine mitigation and adaptation values, and increase citizens' adaptation

engagement (Brink et al., 2016; Brink and Wamsler, 2018; see also Scarano, 2018). The outcomes could also be assessed in relation to existing literature on the adoption of nature conservation and management practices (Liu et al., 2018; Prokopy et al., 2008).

4.1.4. Place attachment and hazard experience

The qualitative results of this study illustrate that people's connection to place and community is a factor in both motivating and hindering adaptation. Respondents expressed strong support for adaptation measures that would support general community development and allow them to remain in their community. Nevertheless, a protective seawall (a measure that respects these criteria) was met with opposition, because it ruined the aesthetics and, for some, contributed to a “*destroyed living environment*” (see Section 3.3.5). This link (and possible contradiction) between place attachment and adaptation motivation resonates with earlier investigations (Amundsen, 2015; Gundersen et al., 2016; Moser, 2014; Quinn, 2014; Quinn et al., 2015). For instance, a common phenomenon in post-disaster reconstruction is that citizens prefer things to remain the same, rather than using reconstruction to address building and planning flaws (Scannell and Gifford, 2010).

The role of place and community is also linked to people's personal experience of hazards, which was found to be correlated with high/diverse adaptation activity (see also Brink and Wamsler, 2018). The fact that the main driver of citizens' adaptive action seems to be their own experience of hazards (i.e., reactive adaptation) is unfortunate, not only considering the damage, injuries and loss involved, but also the fact that adaptation requires action by people who are not themselves at risk, or in relation to other hazards that are outside personal (or community) experience (i.e., proactive adaptation).

4.2. Limitations

The relatively low *n* and many variables investigated mean that the study should be seen as exploratory, rather than explanatory of a particular theory or relation. The choice of Lomma as a *most likely* case (see Section 2.1), with a high incentive for adaptation (due to past hazards) and municipal engagement (the town is an adaptation forerunner), implies that the study's result may not (yet) be generalisable to communities that are less advanced and aware. In this context, targeting a relatively homogeneous, high-income population limits any conclusions that may be drawn about socioeconomic differences. In a more diverse population, resource constraints and social exclusion can be assumed to be more widespread as barriers to adaptation. Nonetheless, the barriers to citizen engagement found in Lomma—both external and internal—are also likely to be present elsewhere. In addition, Swedish society in general is characterised by high levels of concern for the environment, and a remarkably high degree of trust in institutions and other people (WVS, 2014) (including effective insurance and social security systems). At the same time, risk levels are comparably low, and past adverse climate events have mostly damaged property rather than people. This is likely to shape adaptation engagement by fostering public complacency and overconfidence in institutional help in extreme situations (e.g., O'Brien et al., 2006; Wolf, 2011).

The focus on values and worldviews has been tested and validated in diverse cultural contexts, and it provides a framework for translating and contrasting our results with those from different societies (e.g., with less communitarian and more fatalist views). At the same time, Cultural Theory has its critics (Boholm, 1996; Kahan, 2012), and there are various other frameworks for assessing values and worldviews. For instance, the World Values Survey suggests that most of the cross-cultural variation in the world can be explained by two axes: Traditional vs. Secular–Rational values, and

Survival vs. Self-expression values (WVS, 2014). Other scholars categorise worldviews as traditional, modern, postmodern, and integrative (De Witt, 2016; De Witt et al., 2016). The latter alludes to a *progression* (e.g., over a human lifetime, or as a culture develops), and implies that adaptation strategies can be tailored to the current stage, and simultaneously provide a learning ground for future states (O'Brien and Hochachka, 2011). While there are obvious links between all of these categorisations (e.g., our three Citizen Adaptors seems to correspond to the postmodern/integrative, modern and traditional worldviews, respectively), we found Cultural Theory to be most appropriate for this study, due to its direct linkages to environmental risk and policy (see Section 2.2).

The final limitation concerns the survey as a research method for examining adaptation behaviour. While this method proved successful in targeting varying levels of adaptation engagement (as opposed to, for example, sampling people who were clearly engaged), we acknowledge that surveys are not necessarily optimal for studying behaviour, given that they study people's *perception* of their behaviour.

5. Conclusion: linking inner and outer dimensions of adaptation

Taken together, the findings indicate the need to find a better match between institutional efforts and people's inner dimensions to support effective climate adaptation. Despite its limitations, this study supports theory development that links climate change adaptation with risk, environmental and behavioural studies (e.g., for theorising what drives people's motivation and action taking). It presents important findings that can be used to guide future research and develop policy that supports citizen engagement in climate adaptation. Moreover, it provides insights regarding recent calls from adaptation scholars to give more consideration to subjective, inner dimensions of adaptation, which have hitherto been widely ignored in research and practice (e.g., O'Brien and Selboe, 2015; Wamsler, 2018; Wamsler et al., 2018). The study also responds to the need identified in the latest IPCC Assessment Report (Working Group III) to address behavioural change in order to accelerate social transformation (IPCC, 2014; Stern et al., 2016).

We conclude that more value- and worldview-sensitive public support and risk communication is crucial to support more collaborative risk governance and better include, motivate and adequately address differential population groups in adaptation. The inclusion of inner dimensions should, however, not be confused with a focus on individuals and individual adaptations *per se*. On the contrary, our results point to the need for collective to increasingly consider inner dimensions in relation to: i) collective aspects (e.g., the importance of community, place identity, gender, culture and associated differences), and ii) institutional and policy changes at higher levels of governance (e.g., review barriers to citizen adaptation and collaboration).

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jclepro.2018.10.164>.

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