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Executives' engagement with climate science and perceived need for business adaptation to climate change

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Abstract The business community has been frequently criticized for its lack of engagement with climate change, not just in terms of mitigation but increasingly also in terms of adaptation. One reason why executives may not take more decisive action on adaptation is the type of information they rely on for decision-making purposes. From this perspective, executives who engage more with scientific information sources for decision-making purposes would be likely to have a more comprehensive understanding of climate change, and would consequently be more concerned about their company's vulnerability and adaptation needs. So far, however, there is limited evidence showing that executives' lack of engagement with scientific information influences their perception that climate change is a serious issue. In this paper, we use survey data collected from 125 executives across the top 500 companies on the Australian Stock Exchange (ASX-500) to examine the links between how executives obtain information on climate change and their perceived need for adaptation action. Findings show that executives who report greater engagement with scientific information express greater concern about their company's vulnerability, which also translates into a greater perceived need for adaptation action. Making scientific information accessible to executives is therefore important for communicating climate science to a business audience.

1 Introduction

Business will have a central role in supporting societal adaptation to the physical impacts of climate change. Adaptation is intended to reduce the harmful impacts of climate change, including adjustments to both gradual changes and extremes (IPCC 2012). The significance of corporate adaptation to climate change impacts becomes evident when looking at the importance of vulnerable sectors (such as agriculture, construction, energy or insurance) for providing services to society, welfare and economic progress (Wilbanks et al. 2007). To date, much of the public debate on corporate engagement with climate change has focused on mitigation,

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the cost of carbon and implications for industry competitiveness. However, given rising carbon emissions and the difficulties of coordinating a strong multilateral response on mitigation, adaptation is becoming an increasingly important response option alongside mitigation (Kates et al. 2012).

While the importance of adaptation is recognized within the scientific community, actual evidence of businesses adapting to climate change is sparse, and it is not established how the rate and magnitude of climate change relates to the adaptive capacity of businesses across sectors. Initial adaptation planning is occurring in some public sector organizations, such as those in water and coastal zone management (Moss et al. 2013). The Private Sector Initiative of the United Nations Framework Convention on Climate Change (UNFCCC) has published a database with isolated case studies of corporate adaptation. Some evidence of business adaptation has also been reported in industry surveys and consultancy reports (Surminski 2013) as well as in emerging publications in this area (Busch 2011; Hoffmann et al. 2009). However, even though individual business leaders have released statements urging for action on climate change adaptation to protect business profitability and economic progress (Acclimatise 2013), there are few examples of strong autonomous and anticipatory adaptation planning by private sector corporations.

Indeed, the business community has been frequently criticized for its lack of engagement with climate change, not just in terms of mitigation but increasingly also in terms of adaptation (Goodall 2008; Jones and Levy 2007; Patenaude 2011). Companies are typically less concerned about physical impacts than are climate scientists (Gardner et al. 2010). It appears that most companies struggle to fully comprehend the challenges ahead and do not share the same level of concern about the need for immediate action as is expressed in scientific studies. These discrepancies may be due to executives' opinions on the topic of climate change, which are not based on the same level of engagement with specialized scientific information as compared to a scientific audience (Pidgeon and Fischhoff 2011). Furthermore, adaptation planning is only just emerging in policy and legislative frameworks (Verschuuren 2013), meaning that there are few policy signals guiding anticipatory, planned adaptation. Decision-makers therefore need to rely on their own sensemaking of climate information.

Such observations lead us to ask whether there are links between the information executives obtain on climate change and how they evaluate their company's vulnerability and their need for adaptation action. One reason why executives may not take more decisive action on adaptation is the type of information they rely on for decision-making purposes. From this perspective, executives who engage more with scientific information sources for decision-making purposes would be likely to have a more comprehensive understanding of climate change, and would consequently be more concerned about their company's vulnerability and adaptation needs. The investigation of links between information use and concerns about the need for adaptation seems warranted, given that a direct relationship is well established in the business literature between the information used by executives and its influence on their decision-making intentions and outcomes (O'Reilly 1982).

So far, however, there is limited evidence showing that executives' lack of engagement with scientific information can influence their perception that climate change is a serious issue (Goodall 2008; Linnenluecke et al. 2013). In this paper, we use survey data collected from 125 executives across the top 500 companies on the Australian Stock Exchange (ASX-500) to examine the links between how executives obtain information on climate change and the perceived need for adaptation action. Findings show that executives who report greater engagement with scientific information express greater concern about their company's vulnerability, which also translates into a greater perceived need for adaptation action. Making

scientific information accessible to executives is therefore important for communicating climate science to a business audience.

2 The role of the decision-maker in adaptation

A great amount of theory-building effort in the business management field has gone into demonstrating that businesses need to adapt in order to remain viable within a changing environment (see Lewin et al. 2004 for a review). The main focus of these studies has been on corporate adaptation to a changed competitive environment (new competitors, technologies or market entrants), but not yet on corporate adaptation to a changed natural environment. This can be attributed to the fact that climate change has only recently emerged as a topic of concern within the business literature (Hahn et al. 2010; Patenaude 2011; Winn et al. 2011). Adaptation research in business management has a long tradition of explaining adaptation processes and the role of decision-makers in enabling and supporting adaptation (Astley and van de Ven 1983). Without uncertainty, decisions on how to adapt would be straightforward. However, in reality, likelihoods and consequences of environmental changes are rarely known (Porter and Reinhardt 2007), which places decision-makers in a position where they need to interpret environmental changes and make strategic decisions under conditions of uncertainty (Courtney et al. 1997).

2.1 Decision-makers as adaptation actors

The strategic choice perspective is a dominant standpoint in the business management field, which attempts to explain how companies adapt to a changing environment (Child 1972; Hrebiniak and Joyce 1985; Wilson and McKiernan 2011). According to this perspective, decision-makers assess information about their company's business environment, formulate strategic responses to changed conditions, and attempt to adapt their company to ensure its continued survival. While the extent of choice might be limited due to firm-internal restrictions (e.g., funding) or external constraints (e.g., legislative barriers), decision-makers are generally assumed to be in a position to make changes to the organization, to choose the company's business environment and to even partially shape it (Lewin et al. 2004). This can occur, for instance, by modifying a company's domains of operation, including its target market and its products and services. Scholars following the strategic choice perspective regard managerial perceptions and sensemaking as the basis for developing managerial action to address environmental changes and uncertainty (Sharma 2000; Weick et al. 2005).

An important point of the strategic choice perspective is that the decision-maker acts on his or her sensemaking and perceptions of business risks and opportunities, based on selectively accessed information, rather than on what could be (objectively) considered as the 'best' information available. Given that organizational decision-makers are facing time and cognitive constraints in assessing and evaluating information on environmental changes and resulting impacts on their company, models of rational decision-making (such as those in economics, cognitive science, biology and other fields) have therefore been qualified within business research (Simon 1991). The perceived importance of strategically responding (or adapting) to external changes is therefore – in many cases – not driven by 'absolute' risks, but by decision-makers' selective engagement with information which is mediated by perceptions of risks, vulnerabilities and/or opportunities available to the company (Pablo et al. 1996).

2.2 The role of information in decision-making on adaptation

Prior research has established the relationship between information used by a decision-maker, the assessment of risks, vulnerabilities and/or opportunities available to the company, and decision-making outcomes. Decision-making studies regard information (for instance, on a competitor's move) as a fundamental input into decision-making processes which influences an individual's interpretation and perception of a particular issue or situation (e.g., Ge and Helfert 2013; Huber 1991; Ungson et al. 1981). Of particular importance is, thereby, not the amount or volume of information available to a decision-maker, but the quality of the information source the decision-maker chooses to engage with. Prior studies researching the role of information in decision-making have demonstrated that better information quality leads to more accurate and effective interpretations of a particular issue or situation (Ge and Helfert 2013; Raghunathan 1999). Decision-makers' interpretations and perceptions of information are, in turn, an antecedent for determining which issues and situations are attended to (Thomas et al. 1993).

This paper builds on these theoretical insights developed for decision-making and adaptations within competitive environments and applies these insights to the context of adaptation to climate change. Reliance on available scientific information is particularly important in the context of managerial decision-making for climate change. Climate change impacts are generally difficult to comprehend by lay individuals as they are surrounded by much uncertainty in regards to their magnitude, timing and location (Peterson 2006). This uncertainty implies that managers need to understand what climate change means for their organization in order to be able to assess vulnerabilities and adaptation needs. The conceptual model for this study is summarised in Fig. 1 below, which puts forward that information on climate change is a fundamental input into decision-making processes guiding adaptation to the physical impacts of climate change, mediated by decision-makers' interpretations and perceptions of their company's vulnerability. The main hypothesis related to this model is:

H1: Executives who show a greater engagement with scientific information sources for decision-making perceive a greater need to adapt their organization to climate change. This relationship is mediated by how vulnerable executives perceive their company to be to the impacts of climate change.

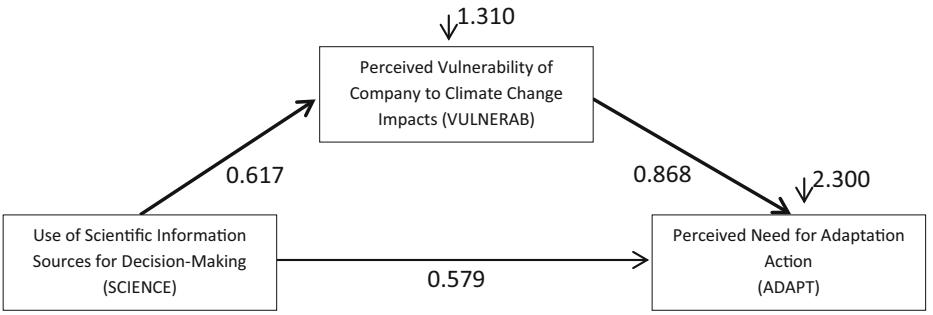

Fig. 1 Mediation model. Demographic variables of age (AGE), gender (GENDER) and tenure (TENURE), a variable asking respondents if they think that climate change is occurring (CC_OCCUR) and a variable indicating industry sector exposure to climate change (SECTOR) were included as covariates in the analysis with paths to VULNERAB and ADAPT (not depicted in Fig. 1). Effects observed are net of their impact. Unstandardized estimates are reported here. Significant pathways ($P \leq 0.01$) are highlighted as *thicker lines*

The question of whether decision-makers engage with scientific information sources for decision-making purposes seems particularly important given that studies on corporate decision-making have provided much support for the intuitive assumption that 'good' information leads to 'good' decision-making (O'Reilly 1982). This paper is thereby less concerned with the specific cognitive processes through which individuals select information in the first instance (i.e., variables influencing information search), but rather the outcomes of being exposed to specific information sources.

3 Methods

Based on the theoretical foundations reviewed above, we designed a survey to examine executives' engagement with scientific material as information sources on climate change. We aim to re-administer this survey over time to track corporate action on climate change and to provide greater theoretical insights into underlying reasons for executives' perceptions of adaptation needs. The survey instrument was developed by the lead investigators and further refined based on expert advice, input from researchers across the social and natural sciences and a pre-test conducted in November 2012. Data collection took place between February and June 2013. Participants were recruited from executive decision-makers in Australia's top 500 publicly-listed corporations on the Australian Stock Exchange (ASX-500). We selected these companies as our population of interest because they have substantial assets. We chose participants in executive positions (e.g., CEOs/Managing Directors), because these roles typically involve high-level leadership, involvement in decisions about strategy, and responsibility for managing the corporation.

The survey questions examined to what extent executives used scientific information, the perceived vulnerability of their company to climate change impact, and a measure of the perceived need for adaptation action. We labelled the constructs SCIENCE, VULNERAB and ADAPT, respectively (please refer to Table 1 for the key constructs examined). We also collected data for the demographic variables of age (AGE), gender (GENDER) and tenure with the company (TENURE), and included a question asking respondents if they think that climate change is occurring (CC_OCCUR). In addition, we assigned each case a variable indicating the industry sector (SECTOR) of each respondent's organization according to the S&P Global Industry Classification Standard (GICS), which is also used as industry classification standard by the ASX. For the final analysis, we used the GICS information to create a dummy variable of whether an organization belongs to a sector highly exposed to climate change impacts (yes/1; no/0). Based on evidence presented in the literature (e.g., Wilbanks et al. 2007), we coded energy, food, insurance, materials, real estate, transportation and utilities as highly exposed sectors. This dummy variable does certainly not account for finer variations in exposure among industries, and is rather intended as a general control variable than a detailed assessment of exposure.

The survey was undertaken using a CATI (Computer-Assisted Telephone Interview) facility and was administered by fully trained and supervised CATI research interviewers. The participant recruitment process included an initial telephone call to establish each respondent's willingness to participate in the survey and to schedule a suitable interview time if the participant was not available immediately. Follow-up calls were placed where required (e.g., in cases where the respondent could not be reached or was unavailable). Attempts to re-recruit participants were undertaken in cases such as a leadership change. 125 executives across 125

Table 1 Questions assessing the key constructs

Construct	Questions	Coding	Mean (s.d.)
Use of scientific information sources for decision-making (SCIENCE) (α=0.713)	- How frequently, on average, do you obtain information from the IPCC for decision-making on climate change? - How frequently, on average, do you obtain information from reviews (e.g., Stern/ Garnaut) for decision-making on climate change? - How frequently, on average, do you obtain information from scientific reports (e.g., the CSRIO Adaptation Reports) for decision-making on climate change? - How frequently, on average, do you obtain information from scientific journals (e.g., Science, Nature) for decision-making on climate change?	Seven-point scale (never/1 - daily/7)	1.38 (0.43)
Perceived vulnerability (VULNERAB) (α=0.935)	Please rate how impactful the following projected consequences of climate change will be for your business? - Increases in average temperature - More frequent heat waves - Changes in rainfall patterns - Increased area affected by droughts - More frequent and larger storms or cyclones - Sea level rise - Increased area impacted by storm surge - Increased area impacted by flooding	Six-point scale (No impact expected/1 - Very strong impact expected/6)	3.40 (1.26)
Perceived need for adaptation action (ADAPT) (α=0.901)	Please rate how important you perceive the following adaptation responses to be for your business? - Divestments of highly climate-affected product lines or business units - Relocation of vulnerable assets to less affected areas - Adjustment of timing of production to account for climate change impacts	Eleven-point scale (Not important at all/1—Highly important/11)	5.93 (2.00)

Table 1 (continued)

Construct	Questions	Coding	Mean (s.d.)
	- Diversification of income across less climate-affected product lines or sectors - Adjustments to supplier base to minimise climate impacts - Application for government funding or subsidies - Climate resilient (e.g., drought or flood resilient) products - Alteration of production processes to account for climate change impacts - Firm-internal research into climate impacts - Firm-internal climate change education campaigns - Climate-proofing of infrastructure (e.g., new building standards, retrofitting) - Uptake of insurance - Disaster preparedness programs - Water management practices - Energy management practices		
Control variables	Questions	Coding	Descriptive Statistics (n=125)
Age	What is your age?	18–29 yrs (1) 30–39 yrs (2) 40–49 yrs (3) 50–59 yrs (4) 60–69 yrs (5)	18–29 yrs; 4.8 % 30–39 yrs; 33.6 % 40–49 yrs; 34.4 % 50–59 yrs; 23.2 % 60–69 yrs; 4.0 %
Gender	What is your gender?	Female (1) Male (0)	Female: 20.8 % Male: 79.2 %
Tenure	How many years have you been with your organization?	0–6 yrs (1) 7–13 yrs (2) 14–20 yrs (3) 21–27 yrs (4) >28 yrs (5)	0–6 yrs: 67.2 % 7–13 yrs: 20.0 % 14–20 yrs: 5.6 % 21–27 yrs: 4.8 % >28 yrs: 2.4 %
CC_occur	In your opinion, is human-induced greenhouse warming now occurring?	Yes (1) No (0)	Yes: 81.6 % No: 18.4 %
Sector	*Note*: This variable was not included in the survey and assigned based on the S&P Global Industry Classification Standard (GICS) of each respondent's organization.	Exposed sector (1); Other sector (0), please see text for details	Exposed sector: 66.4 % Other: 33.6 %

companies agreed to participate in the study, constituting a response rate of 25 %. Survey participants were compared to non-participants using demographic variables (industry sector, gender, age, tenure, where available). No statistically significant differences were found. In our sample, 81.6 % of respondents answered "yes" when asked if they think that climate change is occurring, compared to 66 % in the Australian general population (The Climate Institute 2013). No incentives for participation were offered other than the option to receive a copy of the aggregate results.

4 Analysis

Before conducting the analysis, we established that the data met the basic criteria for a mediation argument (Baron and Kenny 1986), which was further supported by a Sobel test ($z=2.29$, $p<.05$) (Preacher and Leonardelli 2015). In order to validate the model in Fig. 1, we used path analysis. We modelled executives' perceptions of the vulnerability of their company as a mediating factor, assuming that scientific information is not just directly translated into the perceived need to undertake adaptation actions, but that decision-makers make judgements regarding their company's vulnerability based on the information available, which in turn influences the identified adaptation need. Five control variables (AGE, GENDER, TENURE, CC_OCCUR and SECTOR) were included as covariates within the analysis with paths to VULNERAB and ADAPT to ensure effects found were not due to their influence. All results reported are therefore net of the influence of these variables.

The path analysis was conducted using the SPSS AMOS software package (version 21) and a maximum likelihood (ML) estimation method. In SPSS AMOS, all causal relationships are tested simultaneously. Variables were coded such that higher values indicate greater levels of that variable (for instance, greater perceived vulnerability, greater perceived need for adaptation action). The goodness-of-fit measures in the study fell within recommended ranges for good model fit, with Chi-square/df=14.998/13=1.153, $p=0.308$, comparative fit index (CFI)=0.981, goodness-of-fit index (GFI)=0.971, adjusted goodness-of-fit index (AGFI)=0.921, normed fit index (NFI)=0.890 and root mean square error of approximation (RMSEA)=0.035 (Bentler 1990; Bentler and Bonett 1980; Byrne 2010; Hu and Bentler 1999; Kline 2011). In addition, we conducted tests to check for common method variance (Podsakoff et al. 2003), including Harman's ex-post one-factor test and a common latent factor analysis in SPSS AMOS. The tests provided confidence that common method bias is not a major concern in this study; however, the results should be interpreted keeping in mind that they come from self-report surveys.

5 Results

The results of our analysis are summarised in Fig. 1 and Table 2. As can be seen in this table, the reported use of scientific information sources for decision-making had a significant positive relationship with perceived vulnerability of a company to climate change ($b=0.617$, $p=0.010$), and perceived vulnerability had a significant positive relationship with perceived need for adaptation action ($b=0.868$, $P=0.000$). The relationship between reported use of scientific information sources for decision-making and perceived need for adaptation was positive but not significant at $p<0.05$ in our sample ($b=0.579$, $p=0.076$). Note that

Table 2 Model coefficients

	Consequent							
	Vulnerab				Adapt			
Antecedent	Coeff.	S.E.	C.R.	p	Coeff.	S.E.	C.R.	p
Science	0.617	0.240	2.572	0.010	0.579	0.326	1.775	0.076
Vulnerab	–	–	–	–	0.868	0.119	7.283	0.000
Age	−0.269	0.121	−2.221	0.026	−0.324	0.164	−1.979	0.048
Gender	0.223	0.266	0.838	0.402	−0.155	0.354	−0.438	0.661
Tenure	0.170	0.113	1.511	0.131	−0.028	0.151	−0.187	0.852
CC_occur	0.712	0.265	2.687	0.007	0.122	0.362	0.337	0.736
Sector	0.038	0.217	0.380	0.704	−0.117	0.288	−0.407	0.684
	R^2=0.152				R^2=0.403			

Values provided are unstandardized estimates

unstandardized coefficients (b) are reported here which describe the extent to which a one-unit change in the predictor will influence differences observed in the related factor. Correlations among constructs are reported in Table 3.

Overall, the findings support the hypothesized relationship that executives who show a greater engagement with scientific information sources for decision-making perceive a greater need to adapt their organization to climate change, and that this relationship is mediated by how vulnerable executives perceive their company to be to the impacts of climate change. Together, use of scientific information sources for decision-making and perceived vulnerability of a company to climate change can explain 40.3 % of variance in the perceived need for adaptation action (R^2=0.403). Vulnerability was considered higher if the respondent believed that climate change was occurring. This path was significant and points to the importance of views on climate change as a driver of perceived vulnerability. In addition, older participants reported a lower perceived vulnerability and a lower perceived need for action (both paths were also significant), which can likely be attributed to a greater level of environmental concern among younger people also reported in previous research (Hamilton 2011).

Table 3 Correlation matrix

	1	2	3	4	5	6	7	8
1 Science	-							
2 Vulnerab	0.265**	-						
3 Adapt	0.282**	0.615**	-					
4 Age	−0.075	−0.209*	−0.276**	–				
5 Gender	0.053	0.165	0.123	−0.329**	-			
6 Tenure	−0.048	0.027	−0.053	0.350**	−0.109	-		
7 CC_occur	0.179*	0.271**	0.202*	−0.060	0.142	−0.049	-	
8 SECTOR	0.108	0.008	−0.013	0.035	−0.053	−0.137	−0.076	-

**Correlation is significant at the 0.01 level (2-tailed); *. Correlation is significant at the 0.05 level (2-tailed)
Means and standard deviations are reported in Table 1. Sample size=125

Data examined in this article assume causality based on theoretical underpinnings in the business management field. We acknowledge that it is plausible that executives from certain companies (for instance, those from sectors in which climate change is seen as a greater threat) are generally more concerned about vulnerability and may tend to seek scientifically-based information to support their decision-making. We included a measure of industry sector exposure to climate change (SECTOR) as covariate in the analysis to account for the likelihood that executives in sectors generally more at risk from climate change are more concerned about vulnerability, but SECTOR was not found to have a significant effect. In addition, we tested an iteration of the model in SPSS AMOS with VULNERAB as the independent variable, SCIENCE as mediator and ADAPT as the dependent variable for an alternative causal explanation (the model also included the five control variables outlined above as covariates and paths from these covariates to SCIENCE and ADAPT). This model had poor model fit: Chi-square/df=25.908/13=1.993, p=0.017, and RMSEA=0.09, which is above the recommended cut-off value of 0.06 or 0.08 in studies with a less rigorous approach (Hu and Bentler 1999). Fit indices for this model are outside recommended ranges, including CFI=0.879, AGFI=0.866 and NFI=0.808.

6 Discussion

The results presented in this article have implications for communicating climate science and for designing adaptation policies. Executives have access to a growing body of scientific information on climate change. However, a challenge for science will be to communicate the impacts of climate change into the business landscape in order to engage executive decision-makers. A particular difficulty for executives will be to detect causal impacts of climate change on their corporations on short (business-relevant) temporal and spatial scales. Climate change still tends to be treated alongside a myriad of other corporate social responsibility issues competing for corporate attention. Any investment in climate adaptation brings a disparity between short-term investment (along with impacts on company competitiveness) and potentially avoiding any long-term adverse impacts of climate change.

Communication of climate science to a business audience can be strengthened by drawing direct linkages between climate change and business outcomes, and by translating information which is generated and used by a mostly scientific community in a way that it is accessible to a lay business audience. Science communicators need to understand how audiences process information and the type of information they require in order to design effective messages about complex science (Priest 2014). Business executives need information that establishes how different climate change outcomes affect organizational inputs, supply chains and business infrastructure, yet this type of information is rarely published in business journals or included in business curricula (Patenaude 2011). There are few resources (e.g., non-academic reports) available to assist executives evaluate adaptation challenges. Executives who have access to business-relevant data are more likely to be engaged with climate science; in contrast, this study found engagement to be very low. After all, a wealth of information is of little interest and value to executives unless it can be used for competitive advantage (Ferguson et al. 2005).

Furthermore, the results presented in this article have implications for integrating information and communication strategies into adaptation policies. Emerging efforts have largely taken the form of national ‘top-down’ plans with few considerations of how to translate

national plans into industry-level and corporate-level adaptation strategies. Communicating climate science to a lay business audience can serve as a complementary engagement strategy within the development of national plans, thus providing information on risk and opportunities to actors who generally have a large degree of adaptive capacity (Wilbanks et al. 2007). Some promising initiatives are already underway. The European Union, for instance, has provided funding for applied research and launched the European Climate Adaptation Platform (Climate-ADAPT) as an information portal. Individual countries such as Germany and the United Kingdom are moving forward with country-specific risk assessments and reports. Australia has established communication channels between science and industry through avenues such as the Commonwealth Scientific Research Organisation (CSIRO) (Moss et al. 2013), although the Federal government has recently reduced funding in this area. While many of these information services and portals are not directly targeted at businesses, there are opportunities here for greater engagement with the corporate sector.

7 Avenues for future research

Further research is needed on a number of issues. First, a longitudinal design administering the survey over time, possibly also with different samples, can provide additional supporting evidence for the causal relationships found in this study. Future research could also examine policy decision-makers and their perceived adaptation needs. Research could also consider the relative importance of popular information sources in influencing corporate decision-makers' perceptions of the importance of climate change, and provide more detailed insights into organizational learning processes on climate change. For instance, decision-makers have ready access to non-specialist sources of information such as newspapers, TV news or opinion leaders inside and outside the workplace. Yet little is known about whether or how these sources shape executives' decision-making processes on the topic of climate change.

Future research is also required to understand how organizations learn about issues and challenges outside the 'traditional' business environment, including climate change and natural resource decline. Future research could trace how perceived importance is translated into actual implementation of adaptation outcomes over time. Perceptions that a company is vulnerable to external changes are not a surrogate for adaptation action and success, but such perceptions have their own power to influence decision-making intentions. Data sets are not yet readily available on adaptation outcomes as many firms in the private sector have only started to engage with the implications of the physical impacts of climate change on their operations. An important research contribution to understanding how risk perceptions are translated into organizational actions will be to investigate how companies translate perceived vulnerabilities and intentions to act into actual outcomes. This work will need to consider constraints such as the availability of funding or technical expertise within the company.

Future studies can ask: What drives the information search of decision-makers (including corporate or political decision-makers) on topics such as climate change (e.g., personal curiosity, affinity to science, availability of time and resources, beliefs held within personal networks), and how is information translated into actionable outcomes? How do decision-makers filter amongst various information sources? How is the perceived need for adaptation translated into organizational action? It may be that any attempts at implementing adaptation actions are overshadowed by accompanying considerations of cost and industry

competitiveness. Our findings indicate that opportunities exist to engage the business sector with scientific information on climate change and thus encourage adaptation action.

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