Companies´ Adaptation to Global Climate Change: Empirical Identification of Drivers and Barriers to the Implementation of Protective Measures against Natural Hazards

Simon König
TU Dortmund University
Hartmut Holzmueller
TU Dortmund University

Acknowledgements:
This study is a part of a more comprehensive interdisciplinary research project, which is financed by the European Regional Development Fund (ERDF) and the State of North Rhine-Westphalia, Germany.

Cite as:
König Simon, Holzmueller Hartmut (2021), Companies´ Adaptation to Global Climate Change: Empirical Identification of Drivers and Barriers to the Implementation of Protective Measures against Natural Hazards. *Proceedings of the European Marketing Academy*, 50th, (94520)

Paper from the 50th Annual EMAC Conference, Madrid, May 25-28, 2021

Companies´ Adaptation to Global Climate Change: Empirical Identification of Drivers and Barriers to the Implementation of Protective Measures against Natural Hazards

To mitigate the growing risk of natural disasters climate change adaptation (CCA) is an essential challenge for companies worldwide. Nevertheless, the majority of firms are not well prepared for dealing with natural hazards. For governmental institutions, trade associations, and investors it is an important marketing task to raise the awareness and sensitivity of boards of directors for these new risks in order to improve resilience and guarantee a stable performance of industries. Our study contributes to a better understanding of organizational mechanisms with regard to corporate reactions to natural hazards. Based on 24 case studies (29 guided in-depth interviews with managers responsible for operations) of midsized companies we identified the core barriers and drivers of CCA. Overall, we identified more barriers to CCA than drivers. The findings are used as input to suggest marketing programs, which target companies in order to stimulate protective measures against natural hazards.

Keywords: Climate change adaptation, drivers and barriers, local governments

Track: Public Sector and Non-Profit Marketing

1. Relevance

Climate change is one of the biggest challenges companies worldwide are facing in their operations in the decades to come. Companies across the world already feel the consequences of the anthropogenic climate change. Severe weather events like extreme precipitation, heavy windstorms and droughts are increasing in frequency and severity. For companies affected by those events it oftentimes leads to detrimental consequences and sometimes even existential risks. Although implementation of protective measures against the expected severe weather events mitigates their impacts at least partially (IPCC, 2014) not many companies have realized them leaving these companies fully exposed to the possible ramifications of such events. This process of adjusting to the growing risk of natural disasters and implementing protective measures is labelled climate change adaptation (CCA).

2. Conceptual Background

Companies identify and evaluate climate related risks within their risk management process the same way they handle conventional risks (ISO, 2018). If the probability of occurrence or the expected damages seem to be very high, then the company should implement protective measures like reducing vulnerability or taking out insurance to mitigate the risk. With an increase in frequency and severity of natural disasters due to climate change the probability of occurrence and the expected damages are rising, which is why CCA is gaining importance. Furthermore, dynamic capabilities play an important role in climate change adaptation. Dynamic capabilities are a company´s ability to adapt their resources to external changes (Treece, Pisano, and Shuen, 1997). With the rapidly increasing risk of natural disasters caused by climate change, dynamic capabilities are crucial to successful CCA.

The existing literature regarding climate change adaptation is mostly concentrating on either barriers (e.g. Eisenack et al., 2014) or drivers (e.g. Sadiq & Graham, 2016) with a majority of studies analyzing barriers. In addition, it often focuses on either one specific, most of the time very vulnerable, sector like housing (e.g. Berkhout, Hertin, and Gann, 2006), on different levels of government (e.g. Ford, Berrang-Ford, and Paterson, 2011) or on society as a whole (e.g. Adger et al., 2009). There are only a handful of studies that simultaneously focus

on drivers and barriers to CCA (e.g. Simonet & Leseur, 2019), but none of these studies focus on companies. This paper is closing this research gap by simultaneously analyzing the core drivers and barriers to climate change adaptation in midsized companies, which hinder or facilitate the implementation of protective measures against the growing risks of severe weather events. Furthermore, the results are not limited to a specific sector, they pertain to a broad variety of industries.

3. Research Goals

The main objective of this paper is to identify the core drivers and barriers concerning the implementation of adjustments to and protective measures against increasing and more severe natural hazards caused by climate change. Concentrating on both drivers and barriers is very important in order to identify commonalities and interactions between those two. Assuming that the opposite of an identified barrier is automatically a driver for climate change adaptation and vice versa is deficient. Another goal is to find out whether the amount of barriers is outweighing the amount of drivers or if it is the other way around. Based on the results we are able to give recommendations to local governments and authorities how to use the identified drivers and barriers to CCA for marketing programs sensitizing companies to the dangers and consequences of climate change and stimulating adaptation actions. The knowledge about barriers and drivers of CCA supports responsible executives when facilitating the implementation of protective measures against the growing risks of severe weather events and thus reduces the risk of interruptions or shut downs.

4. Research Method

To identify the core drivers and barriers to CCA we analyzed 24 cases (besides location checks also 29 qualitative in-depth interviews with operation managers) of German midsized companies. Table 1 lists the analyzed cases. The interviews typically started with a short briefing on the research project followed by a discussion of several weather events and their importance to the company. The weather events discussed were heavy precipitation, floods, windstorms, hurricanes, thunderstorms, heat waves, droughts, cold, snowfall and any

further natural hazards the interviewees mentioned themselves. Moreover, we asked for already implemented protective measures, past experiences and future expected impacts of these weather events. In addition, we inspected the location and facilities on site after the interviews. In a next step, we transcribed the interviews and used qualitative content analysis by Mayring (2015) for the data analysis. Thus, it was possible to identify the barriers and drivers of climate change adaptation.

# Case	Field of Operation	# Employees	Age of Respondent	Position of Respondent
1	Packaging goods	120	35-50	CEO
2	Construction company	175	20-35	Purchasing
3			35-50	CEO
4	Metal processing	130	35-50	HR and Accounting
5	Engineering plastics	200	35-50	Purchasing
6	Engineering plastics	500	35-50	CEO
7	Safety Engineering	220	20-35	Sales
8			50-65	Purchasing & Logistics
9	Engineering Plastics	300	20-35	Controlling
10	Construction company	200	35-50	Accounting
11	Adhesives and abrasives	63	35-50	CEO
12			20-35	Controlling
13	Paper printing	50	35-50	CEO
14	Metal processing	120	50-65	CEO
15	Software development	120	35-50	CEO
16			35-50	Administration
17	Metal processing	1250	50-65	Facility management
18	Welding machines	184	50-65	CEO
19	Drive engineering	140	35-50	CEO
20	Psychiatric hospital	900	35-50	Quality management
21	Construction equipment	700	35-50	CEO
22	Energy provider	180	35-50	Operational safety
23	Energy provider	50	20-35	Technical management
24			35-50	CEO
25	Power engineering	1450	35-50	Chief Compliance Officer
26	Appliance	590	50-65	Operating technology
27	Construction company	20	50-65	CEO
28	Metal processing	26	35-50	CEO
29	Energy provider	25	50-65	CEO

Table 1. List of interviewees

5. Results

The results of the analysis show that the number of identified barriers is greater than the number of drivers for climate change adaptation. The same is true for the frequency by which the interviewees mention drivers and barriers. In total, we identified nine categories of adaptation barriers, which were articulated by the interviewees. For the drivers of CCA we found eight categories. In the following sections, we present and discuss this categorization. The order of the discussed categories reflects the observed importance. The labelling of the categories tries to catch the comprehensive meaning of all text passages falling in the respective category and is therefore to a certain extent subjective. Table 2 lists the identified categories.

Barriers to CCA	Drivers of CCA
1. Sense of false security sentiment	1. Prior negative experience
2. Low risk awareness	2. Expected negative impact on operations
3. Lack of experience	3. General risk awareness
4. Lack of information	4. High-expected probability of occurrence
5. Ignorance of risks	5. External recommendations
6. Underestimation of the probability of occurrence	6. Organizational capabilities
7. Region or topographic location	7. Low implementation costs
8. Implementation problems	8. Risky topographic location
9. Social comparison	

Table 2. Identified categories

5.1 Barriers to climate change adaptation

The most often observed barrier to climate change adaptation is a sense of false security sentiments. The respondents believe that their company is already adequately protected against the impacts of natural disasters. Therefore, no further protection is necessary. The respondents rely on previously implemented protective measures without checking if these are still sufficient. Furthermore, existing natural hazard insurance contracts discourage many companies from shielding their buildings from bad weather in an anticipatory way. In some cases, the respondents indicate that they rely on the local authorities to fix any damages caused by natural hazards, which reinforces their sense of false security sentiments.

The second prominent barrier to CCA is a low risk awareness. Interviewees underestimate the risk for the company that a natural disaster brings and integrating safety measures deem to be unnecessary. Even if the firm might be hit by such an event in the future, the respondents assume the expected consequences to be so minor and thus no anticipatory measures are needed. Moreover, some respondents obviously downplay the impacts that a bad weather event can have.

Furthermore, lack of experience is a barrier to climate change adaptation. If the operation manager or the company have not experienced an episode related to natural hazards in the past, then most of the time there is no preventive adaptation taking place. Even if the company had to handle such an event in the past, this does not necessarily translate into a higher concern for CCA. If the natural disaster did not damage the company´s properties, then the willingness to adapt decreases. We also observed downplaying past cases of damage by people in charge.

Lack of information is also a frequent barrier to climate change adaptation. If the operation manager is not really well informed and/or has not spent time on the issue, then no adaptation measures are taken. Lack of information leads to three typical consequences. (a) The respondent is not able to determine the probability of a hazardous event, (b) the interviewee does not know about existing and applicable adaptation measures, and (c) most commonly, the respondent shows a lack information regarding the possible impacts of natural disasters.

The ignorance of risks is also a barrier to climate change adaptation. If the interviewee is psychologically blocking the risks of natural disasters, then this leads to no concern for the implementation of protective measures. Quite a few respondents admit that they have not thought about certain hazards, which is why they have not taken adaptive actions. In addition, interviewees report that it would be more appropriate and cost saving to react situationally instead of using preventive measures. Some respondents also stress the detrimental impacts certain events have on society as a whole, implying that in this case the consequences for their company would be negligible.

Another barrier to CCA that we identified is underestimation of the probability of occurrence. If managers assess the probability of occurrence of certain hazardous weather events as very unlikely, then typically the company is not carrying out adaptive measures. Downplaying the probability of occurrence of natural hazards by the operation managers as such is also noticeable.

The region or topographic location of the company is also a relevant barrier to CCA. On the one hand, the interviewees are convinced that, because of the area the firm is located the risk of natural disasters is minimal. Managers perceive certain events as unthinkable in their region and therefore no precautions have to be taken. On the other hand, the respondents frequently point out that the specific on-site topographical conditions, like no rivers nearby, are not leading to increased vulnerability and so no adaptation seems necessary or urgent.

Even if the interviewed managers are well aware, acknowledge the climatic hazard, and willing to implement protective measures, there can still be implementation problems preventing them from taking adaptation measures. If the available adaptation options are very expensive or complex, then the companies prefer to take the risk instead. Moreover, some respondents believe that adaptation to specific natural hazards is impossible. In addition, there are even legal requirements that keep firms from carrying out protective measures, for example, an entry at ground level is mandatory in Germany to receive a building permit although this increases the risk of water intrusion into the building.

The ninth and final identified barrier to CCA is social comparison. Some respondents detract from their own company and focus more on other firms or sectors that would have bigger repercussions caused by certain natural hazards. The interviewed managers use a direct comparison with other companies and their lack of protective measures as an excuse to neglect climate change adaptation in their own company.

5.2 Drivers of climate change adaptation

A core driver of adaptation to the growing risks of natural disasters is prior negative experience in a direct or indirect way. Has a company directly experienced the impacts of a natural hazard and the company had to suffer damages, then the firm typically does not just repair these damages but also implements further protective measures. In addition, indirect experiences by colleagues, neighboring firms, or in the private surroundings encourage CCA. Furthermore, climate related past episodes within the supply chain of companies increase the sensitivity with regard to weather hazards in the company.

The expected negative impact on operations is also an important driver for implementing protective measures against increasing and more severe weather hazards. If the respondents expect impacts of natural hazards that are threatening the existence of the entire business, then the company is more likely taking anticipating measures. Moreover, certain business

units that managers perceive as very vulnerable regarding specific weather hazards are more likely protected.

Further drivers for adaptation to natural hazards are general risk awareness and a high-expected probability of occurrence. If the manager reports a high general risk awareness, then his or her company is more likely to implement protective measures. In a same vain, when a respondent indicates that a certain natural hazard is very likely to impacts the company, then most of the time protective measures are taken. Some interviewees even predict a 100% probability for certain weather episodes and are convinced that it is only a matter of time until the company is hit.

External recommendations also contribute to the implementation of protective measures against the growing risk of natural disasters. These recommendations originate from different sources. On the one hand, insurance companies stimulate the adaptive measures in order to anticipate damage. On the other hand, the respondents frequently point out that work or operations safety requirements are a reason for the implementation of protective measures. This refers especially to impacts of high temperature. In addition, some managers point out that they received recommendations from partners in the supply chain to reduce their climatic vulnerability.

Organizational capabilities of a company are also a driver for CCA. If companies engage in general risk management, e.g. by establishing a respective department, the increasing hazards through climate change are more often recognized and appropriate protective measures are implemented. Moreover, the financial situation of a company plays an important role in the implementation of protective measures. Higher financial strength leads to more sensibility with regard to CCA.

If cost-effective adaption options are available that protect the company from natural hazards, which are easy to implement as well, then the companies are more prone to carrying out anticipatory measures. It is also reported that investments in focal production processes lead to CCA as side effects.

Finally, a risky topographic location drives the implementation of protective measures against natural hazards. If the company shows a high level of vulnerability regarding certain weather events due to their surrounding topography, then this increases the company´s willingness to adapt. The same is true for the influence of regional conditions.

6. Implications and Conclusion

The results confirm that companies still have to overcome major barriers to CCA. However, there are also strong drivers that lead to increased climate change adaptation efforts in companies. In this study, we identified drivers and barriers that are typical for midsized companies in general and not limited to a specific industry. This allows for a more widespread approach of efforts by local authorities and governmental institutions to promote CCA. Although the amount of identified barriers outweighs the amount of drivers for climate change adaptation, the difference is not as big as the existing literature indicates. It seems that the topic of CCA is gaining more attention from companies than in past years. Furthermore, our research provides evidence that there are several common grounds for barriers and drivers for CCA (e.g. lack of experience and prior negative experience).

Implications for local governmental authorities, trade associations as well as investors, which strive for more CCA, can be drawn. In order to reduce barriers and enhance drivers the aforementioned aspects should be used. Information and training campaigns seem to be key in this process. Showing the companies the imminent and still increasing threat of natural hazards and reducing misjudgments of the risks and probability of occurrence of those events is essential. Furthermore, respective marketers should address operation managers (false) sense of security. Confronting the target group with past climate related episodes and the resulting impacts are marketing approaches that might work well. Moreover, cooperation with insurance companies to incentivize adaptation action or showing the companies inexpensive and easy to implement adaptation options could also help to increase the sensitivity in companies.

Our findings provide evidence that in most companies CCA is not a central part of the risk management process, even though natural hazards are increasing in probability and severity. If one or more of the identified barriers to CCA are present in a company, then this leads to a deficient identification and/or evaluation of climate related risks within the risk management process. Furthermore, our results indicate that the dynamic capabilities of a company facilitate the implementation of protective measures against natural hazards, but future research should further investigate this relationship.

References

Adger, W.N., Dessai, S., Goulden, M., Hulme, M., Lorenzoni, I., Nelson, D.R., Naess, L.O., Wolf, J., & Wreford, A. (2009). Are there social limits to adaptation to climate change?. *Climatic Change,* 93, 335-354.

Berkhout, F., Hertin, J., & Gann, D.M. (2006). Learning to Adapt: Organisational Adaptation to Climate Change Impacts. *Climatic Change,* 78, 135-156.

Eisenack, K., Moser, S.C., Hoffmann, E., Klein, R.J.T., Oberlack, C., Pechan, A., Rotter, M., & Termeer, C.J.A.M. (2014). Explaining and overcoming barriers to climate change adaptation. *Natural Climate Change,* 4, 867-872.

Ford, J.D., Berrang-Ford, L., & Paterson, J. (2011). A systematic review of observed climate change adaptation in developed nations. *Climatic Change,* 106, 327-336.

ISO (2018). *ISO 31000:2018 Risk Management – Guidelines.* Geneva: International Organization for Standardization (ISO).

IPCC (2014). *Climate Change 2014: Impacts, Adaptation, and Vulnerability, 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., Girma B., Kissel E.S., Levy A.N., MacCracken S., Mastrandrea P.R., & White L.L. (eds.). Cambridge, New York: Cambridge University Press.

Mayring P. (2015). *Qualitative Inhaltsanalyse – Grundlagen und Techniken* (12. Aufl.) [Qualitative Content Analysis – Fundamentals and Techniques (12. Ed.)]. Weinheim: Beltz. (in German).

Sadiq, A.-A., & Graham, J.D. (2016). Exploring the Predictors of Organizational Preparedness for Natural Disasters. *Risk Analysis,* 36(5), 1040-1053.

Simonet, G., & Leseur, A. (2019). Barriers and Drivers to Adaptation to Climate Change – a Field Study of Ten French Local Authorities. *Climatic Change,* 155, 621-637.

Treece, D.J., Pisano, G., & Shuen, A. (1997). Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, 18(7), 509-533.