The Moderating Role of Political Ideology on the Relationship Between Perceived Effectiveness and Public Acceptability of DACCS

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PSB3E-BT15: Bachelor Thesis

PSB3-BT_2324-2a_27

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July 05th, 2024

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Abstract

The problem of climate change is becoming more severe, and Negative Emissions Technologies and Practices (NETPs) are crucial for its mitigation. Public acceptability is essential for NETPs to be employed successfully. This paper aims to contribute to the understanding of key variables that influence the support for Direct Air Carbon Capture and Storage (DACCS) to aid the path for its large-scale implementation. This study explores the determinants for public acceptability of DACCS. Namely, how the perceived effectiveness of DACCS and an individual's political ideology influence public acceptability and the moderating effect of political ideology. We conducted a cross-sectional survey of a convenience sample ($N = 150$). The results show that perceived effectiveness has the most influence on acceptability, while political orientation does not play a role. Specifically, perceived effectiveness is positively related to the acceptability of DACCS, and political orientation did not have a significant effect, which challenges previous research suggesting that left and right-leaning individuals show different levels of acceptability to climate policies. Finally, we did not find an interaction effect, meaning that political ideology does not moderate the relationship between perceived effectiveness and acceptability of DACCS. These findings highlight the importance of perceiving the policy to be effective at its aim and fostering communication about new technologies to the general public to increase their acceptability.

Keywords: NETPs, DACCS, public acceptability, perceived effectiveness, political ideology

The Moderating Role of Political Ideology on the Relationship Between Perceived

Effectiveness and Public Acceptability of DACCS

The negative impacts of climate change and global warming are becoming increasingly observable across different aspects of our environment, society, and economy (Carleton & Hsiang, 2016; Parmesan & Yohe, 2003). An effective way to limit the impact of climate change would be to reduce the concentrations of greenhouse gas emissions in the air, with carbon dioxide (CO_2) accounting for most of them (Mikhaylov et al., 2020). Intergovernmental panels have focused on achieving net-zero emissions, which means greenhouse gas emissions released are equivalent to those removed from the atmosphere (Fankhauser et al., 2022; IPCC, 2022; Matemilola & Salami, 2020). Despite the mitigation measures that are currently in place, such as switching to renewable energy sources, negative emissions technologies and practices (NETPs) are increasingly needed to remove the remaining CO_2 from the atmosphere (IPCC, 2022).

This study focuses on one of the NETPs, namely Direct Air Carbon Capture and Storage (DACCS) (IPCC, 2022). In a general process, DACCS extracts the air and filters out CO_2, after which the filtered air without CO_2 is released back into the atmosphere. The collected CO_2 is then stored underground in liquid form (Lee et al., 2023; Meadowcroft, 2013). According to the IPCC report (2022), the advantages of DACCS are that the CO_2 removal is fast, the land needed for use is not substantial, and CO_2 can be stored permanently with low risk for leakage. On the other hand, its drawbacks include high cost and excessive energy use that comes with the possibility of emitting more CO_2 if the energy is produced by fossil fuels (Buck, 2016; IPCC, 2022). Due to its high potential for efficiently removing CO_2 from the atmosphere and long-term storage, DACCS technology is gaining attention from both scholars and policymakers (Erans et al., 2022; Meckling & Biber, 2021; Motlaghzadeh et al., 2023). However, as a new and emerging technology, there is still limited research and

understanding of its implications, specifically the extent to which it would receive the public's support.

Public Acceptability

Mitigating climate change involves not only technological solutions but also societal considerations. That makes it crucial to consider the public's support and acceptability of the technologies to accomplish the desired effect and for NETPs to be deployed globally (Lee et al., 2023). Policies that the public is unwilling to support or accept are more likely to face obstacles such as postponement (Ščasný et al., 2017). Therefore, examining this phenomenon in the context of DACCS is needed for its large-scale implementation.

Research on the public acceptability of DACCS has shown mixed results, characterised by moderate acceptance and no strong opposition or support. For example, one study found that the general acceptability of DACCS seems to be lower than that of more nature-based strategies (Wolske et al., 2019). Additionally, other research found that people accept DACCS at a moderate level and with no strong opposition compared to other NETs, such as afforestation, biochar and bioenergy with carbon capture and storage (BECCS) (Jobin & Siegrist, 2020; Wenger et al., 2021).

Although previous studies show that the public exhibits either neutral or moderate acceptance of DACCS on average, they do not provide much insight into the reasons why. Therefore, it is of great importance to gain a deeper understanding of the factors behind the phenomenon of public acceptability to aid the process of the implementation of new and emerging solutions. This paper aims to address the need for deeper understanding by investigating the determinants of public acceptability. The primary research question guiding this study is: What are the key factors influencing public acceptability of DACCS? To explore this question, the paper will examine two factors. Specifically, this paper focuses on the interaction between two variables, namely perceived effectiveness and political ideology,

which have shown great importance in predicting acceptability but have yet to be studied together in the context of DACCS.

Perceived Effectiveness of DACCS

Previous research has shown that people are more likely to accept a policy if they perceive that policy to be effective in what it is trying to accomplish (Dreyer & Walker, 2013; Eriksson et al., 2008; Gärling & Schuitema, 2007; Schade & Schlag, 2003). Perceived effectiveness can be conceptualised as an individual perception of the degree to which the objectives of a measure can be achieved (Schade & Schlag, 2003). In the context of this research, it refers to the subjective individual assessment of the degree to which DACCS is effective in limiting climate change and removing CO_2 from the atmosphere. Although experts mainly discuss the objective effectiveness of a measure or technology, such as the amount of CO_2 removed, it does not necessarily mean that the public perceives it in the same way, as they often lack familiarity with policies or their impact on the environment (Steg et al., 2006).

Various research and literature reviews showed there is a consistently strong correlation between perceived effectiveness and acceptability of environmental policies in different domains (e.g., transport and energy) (Ejelöv & Nilsson, 2020; Eppe et al., 2022; Steg et al., 2006). A meta-analysis of factors influencing public support for environmental policies found perceived effectiveness to be the second strongest determinant, and that relationship was particularly strong for policies directed at mitigating climate change (Bergquist et al., 2022).

Another research attempted to investigate the relationship between perceived effectiveness and public support of technological solutions such as the replacement of fossil fuels with nuclear energy and ocean fertilisation. They did not find a significant relationship for perceived effectiveness when also considering other variables (e.g., perceived

consequences, causes, etc.) (Rosentrater et al., 2012). However, the technological solutions they investigated were very diverse, and their perceived effectiveness scores varied (Rosentrater et al., 2012). Due to their approach, which included a broad range of factors, the relationship between perceived effectiveness and support in their research seems unclear. Therefore, as DACCS is relatively new, research is needed to clarify the way perceived effectiveness influences the acceptability of DACCS.

This leads to the secondary research question: How and to what extent does the perceived effectiveness of DACCS contribute to its public acceptability?

Hypothesis 1. Individuals who perceive DACCS as more effective will be more likely to accept the implementation of DACCS.

Political Ideology

There is a consistent finding in literature that there is a relationship between political ideology and support for environmental policies (Ejelöv & Nilsson, 2020; McCright et al., 2015; Tobler et al., 2012). Political ideology is defined as a subjective stance on the political left-right spectrum. While past studies suggest ideology plays an important role in the degree of acceptability of environmental policies, more research is needed to see how this applies to more nuanced strategies, such as DACCS. This paper explores whether and how this relationship changes, considering DACCS has both environmental drawbacks and benefits.

According to previous research, left-leaning individuals show greater support for climate mitigation policies (e.g., increased CO_2 tax, expansion of public transport and restricting private car use) compared to right-leaning ones (Jagers et al., 2017). Additionally, they align their beliefs on climate change more closely with the established scientific consensus and show greater personal concern about global warming than right-leaning individuals (Borick & Rabe, 2010; Hamilton & Keim, 2009; Malka et al., 2009; McCright & Dunlap, 2011). Considering that left-leaning people are usually more pro-environmental than

right-leaning ones and generally show higher concern for climate change, it could be argued

that they would also be more accepting of DACCS (Clulow et al., 2021; Neumayer, 2004).

However, the environmental risks of DACCS (e.g., the risks of CO_2 leakage and large energy

use) could consequently drive left-leaning individuals to be against its implementation

(Clulow et al., 2021). Moreover, they prefer and are more supportive of renewable energy

sources than non-renewables (e.g., nuclear, biomass, fossil fuel energies) (Clulow et al.,

2021). Even though DACCS could possibly operate on renewable energy, its current

operation still mainly relies on fossil fuels, which might concern left-leaning individuals (Qiu

et al., 2022). Considering these arguments, it is possible that the role of political ideology on

acceptability for left people could extend to DACCS in two ways. On one hand, left-leaning

individuals might show greater acceptability due to higher environmental concern when the

technology's potential to mitigate climate change and reduce CO_2 emissions is considered

(Marcucci et al., 2017). On the other hand, the environmental risks of DACCS and its reliance

on fossil fuels might lower their acceptability (Clulow et al., 2021).

Compared to the individuals leaning left, those aligned with right-wing ideologies

show less concern about climate change and climate actions, such as financial contributions to

mitigation efforts (McCright et al., 2015). Moreover, a recent study found that right-leaning

individuals are more likely to support technologies such as nuclear energy, carbon capture and

storage (CCS), and fossil fuel deployment compared to renewables (Clulow et al., 2021). The

finding that right-leaning individuals favour CCS might be explained by its dependence on

fossil fuels, which the left is strongly against (Clulow et al., 2021). Additionally, the

observation that right-leaning people show higher acceptance of less environmentally friendly

policies is mainly seen in the fields of nuclear energy (Clulow et al., 2021; Pampel, 2011).

Considering that DACCS and nuclear energy both come with risks and share a similar

purpose, it is possible they can be compared, and that finding would extend to DACCS.

However, the impact of their environmental risks is different, which might make the comparison between them harder. For example, the risks of DACCS (e.g., high energy use, risk of leakage) do not have such a direct effect on individuals, while the risks of nuclear energy (e.g., accidents, nuclear waste disposal) have more disastrous consequences (Gambhir & Tavoni, 2019; Höffken & Ramana, 2023; Prăvălie & Bandoc, 2018). Therefore, it is possible that the findings from nuclear energy might not apply to DACCS. On the other hand, the political right might be more likely to accept DACCS than the left because they support the continuation of fossil fuel usage (Clulow et al., 2021). Additionally, the environmental risks of DACCS might not be an issue to them due to their lack of climate concern (McCright et al., 2015).

Considering strong arguments exist for both right-leaning and left-leaning individuals being more accepting of environmental policies and climate mitigation strategies, it is left to explore how this applies to DACCS. Therefore, the following research question is proposed: How do different political ideologies influence the public acceptability of DACCS?

Hypothesis 2a. Left-leaning individuals will show higher levels of acceptability of DACCS than right-leaning individuals.

Hypothesis 2b. Right-leaning individuals will show higher levels of acceptability of DACCS than left-leaning individuals.

Political Ideology as a Moderating Variable

When investigating the perceived effectiveness of DACCS, it is important to recognise that perceptions can be easily influenced by the group that people identify with. Social Identity Theory (SIT) suggests that attitudes, emotions, and behaviours are influenced by group memberships (Tajfel, 1974). In this context, SIT can explain how the attitudes and values associated with someone's political-ideological stance could influence the relationship

between perceived effectiveness and acceptability of DACCS. Therefore, this paper proposes that political ideology serves as a moderator.

Left-leaning individuals often identify with groups that favour environmentalism and highlight the importance of climate change mitigation (Neumayer, 2004). Additionally, they recognise the high risks associated with climate change (Van der Linden, 2015). Based on SIT, this shared environmental identity associated with left-leaning political ideology can strengthen the relationship between the perceived effectiveness and acceptability of DACCS. Since DACCS has the potential to be a crucial climate change mitigation strategy, left-leaning individuals might be more likely to accept it if they perceive it as effective. Their stance on climate urgency and the need for solutions could align with their belief in DACCS's potential effectiveness. On the other hand, right-leaning individuals generally have lower overall concern for climate-related issues (McCright & Dunlap, 2011). Their group identity does not prioritise the need for climate solutions, potentially leading to lower acceptability of DACCS even if perceived as effective. These shared group values could then result in a disinterest in the implementation of DACCS, therefore weakening this relationship.

Nevertheless, right-leaning individuals identify with groups that prioritise economic growth over environmentalism, which might influence their acceptability of climate policies (Chu & Yang, 2020; Jost et al., 2008). When evaluating the high costs of DACCS, they are likely to put a heightened focus on its perceived effectiveness to justify those expenses. This focus could strengthen the relationship between perceived effectiveness and acceptability. Despite their support for climate change solutions in general, left-leaning individuals may oppose large-scale implementation of DACCS due to its environmental drawbacks and reliance on fossil fuels (Qiu et al., 2022). Their higher concern for the environment, which is an important part of their group identity, may lead them to focus on DACCS's risks, such as high energy use and potential leakage, therefore weakening the relationship between

perceived effectiveness and acceptability. Additionally, they might fear that focusing on

DACCS could deter investment in renewable energies, which research showed they favour

(Anderson & Peters, 2016; Clulow et al., 2021).

Given these competing arguments, both left- and right-leaning individuals could either

strengthen or weaken the relationship between perceived effectiveness and acceptability. The

research question that arises is: How does political ideology moderate the relationship

between the perceived effectiveness of DACCS and public acceptability? The overall research

model is illustrated in Figure 1.

Hypothesis 3. Political Ideology moderates the relationship between the perceived

effectiveness and acceptability of DACCS.

Figure 1

Visual representation of the research model
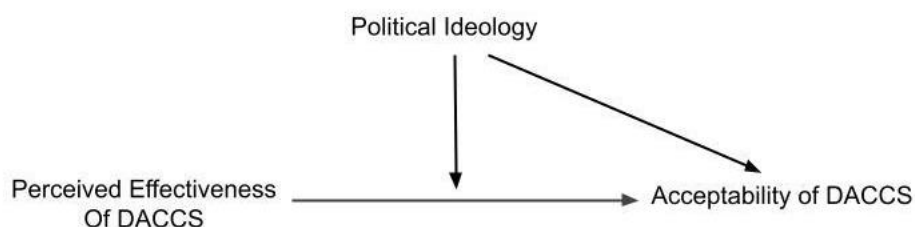
Methods

Participants

A priori power analysis was conducted in two different ways, depending on the study

design. The current paper used the software G-Power, based on Linear Multiple Regression,

which indicated that a minimum of 133 participants were required to achieve a small to

median effect size ($f^2 = .06$) and power of .80%. A total of 203 participants were recruited.

After quality checks, 150 participants were included in the sample (100 female, 46 male, 3

non-binary, 1 prefers not to say). The age range of participants was between 18 and 87 years

old ($M = 31.39$, $SD = 16.13$). Among them, 22 participants were Dutch, 61 were German, and 29 were British. The remaining 38 participants identified as other nationalities, such as Spanish, Bosnian, and Norwegian, among others. Participant exclusion occurred in several situations. Firstly, participants were not included in the sample when they did not give their consent at the beginning and end of the study. Secondly, participants who failed attention checks were excluded, which occurred 53 times, leaving us with a total of 150 participants.

Research Design and Procedure

This study was approved by the Ethical Committee of the Faculty of Behavioural and Social Sciences at the University of Groningen (EC-BSS). The data collection was conducted over a week, beginning on the 17th of May 2024 and ending on the 27th of May 2024. Participants were recruited through convenience sampling, which involved inviting individuals from the researchers' social networks and social media circles to participate in an online survey administered through Qualtrics survey software. This was done by sharing the link to the online questionnaire, available in English, Dutch, or German. Furthermore, participation in the study was completely voluntary for every participant. The study was designed to be a cross-sectional design. The survey was online and took between 10 and 15 minutes to complete.

The survey included questions regarding demographics, familiarity with DACCS, and values, including political orientation, environmental values of their political group, environmental identity, and perceptions of climate change. Additionally, it incorporated information on DACCS technology, administered on two different levels. DACCS was introduced either in a basic manner, providing an infographic about the workings of the technology (low knowledge condition) or providing the infographic and additionally providing a list of advantages and disadvantages of the technology (high knowledge condition).

The survey continued with multiple questions regarding the risk and benefit perception of DACCS, followed by the perceived effectiveness of DACCS. Finally, participants answered questions about the acceptability of DACCS. A debriefing was provided at the end of the questionnaire, informing the participants that they had been assigned to one of the two knowledge conditions, either having received only basic knowledge or basic knowledge and a list of pros and cons. Lastly, the contact details of the research team and a box for general comments were presented, giving the participant the opportunity to contact the research team with any further questions or concerns. The questionnaire items relevant to this paper can be found in the Appendix.

Measures

Attention Check

An attention check was added to the questionnaire to assess participants' attention to the content: "Please select 'disagree' as your answer" (1 = *strongly disagree*, 6 = *strongly agree*).

Independent variables

The current paper focuses on perceived effectiveness and political orientation as independent variables. Political orientation was measured using a six-point Likert scale, ranging from 1 (left-wing) to 6 (right-wing). The following statement regarding political orientation was adapted from research conducted by Jagers et al. (2017): "It is sometimes said that political opinions can be placed on a left-right scale. This is also known in some countries, like the US, as a liberal-conservative scale. Please indicate your general political opinions on the scale from left-wing (1) to right-wing (6)" ($M = 2.47$, $SD = 0.92$).

Perceived effectiveness was measured by three statements as follows: "I think DACCS would be effective in mitigating climate change"; "I think DACCS would be effective to limit global warming." and "I think DACCS would be effective in removing CO_2 from the

atmosphere." Participants indicated to what extent they agreed with the statements on a six-point Likert scale from strongly disagree (1) to strongly agree (6). (Cronbach´s alpha = 0.84; $M = 4.0$, $SD = 0.82$).

Acceptability of DACCS' was measured using four statements. The statements included "I find the use of DACCS technology acceptable", "I find it acceptable to implement DACCS technology in my country", "I find it acceptable to use DACCS technology in order to reach global climate goals", "I find it acceptable to use more DACCS technology in my country than is used now". Again, these statements were rated on a six-point Likert scale, ranging from strongly disagree (1) to strongly agree (6) (Cronbach´s alpha = 0.93; $M = 4.28$, $SD = 0.85$).

Results

Assumption Checks

Based on the assumptions of multiple linear regression, we checked linearity, normality of residuals, multicollinearity, and homogeneity of variance. To check for normality, the distribution of residuals was examined with a visual inspection of the Q-Q plot, which revealed that they were normally distributed. Therefore, this assumption was met. For linearity, a scatterplot of the residuals against the predictor variables indicated a linear relationship. The assumption of multicollinearity was checked by examining Variance Inflation Factors (VIFs), and all the values were below 10, indicating that this assumption was also met.

Correlations

Simple correlations between the key variables were computed. Acceptability was positively correlated with perceived effectiveness ($r = .53$, $p < .001$), indicating that higher perceived effectiveness was associated with greater acceptability. Political ideology was not significantly correlated with acceptability ($r = -.10$, $p = .109$). However, perceived

effectiveness was significantly and negatively correlated with political ideology ($r = -.20$, $p =$ .009), suggesting that right-leaning individuals are more likely to perceive DACCS as ineffective.

Main analysis and Hypothesis testing

A hierarchical regression analysis was conducted to examine the effects of perceived effectiveness and political ideology on acceptability. The analysis was performed in three steps.

First, we tested the first hypothesis, that is, the perceived effectiveness of DACCS is a significant predictor of acceptability. In the first model, the centered variable of perceived effectiveness was included as the independent variable. We found this model significant $F(1, 145) = 56.43$, $p < .001$, $R^2 = .28$. Perceived effectiveness was significantly related to the acceptability of DACCS ($B = 0.55$, $p < .001$, 95% CI [0.410, 0.696]). These results are in line with Hypothesis 1 of this paper, which states that individuals who perceive DACCS as more effective will be more accepting of its implementation.

In the next model, the second hypothesis was tested, which stated that political ideology significantly influences the acceptability of DACCS. Therefore, the variable of political ideology was added as a predictor. This model was also overall significant $F(2,144) = 28.02$, $p < .001$. However, it did not account for any additional variance in acceptability. Political ideology did not have a statistically significant effect on acceptability ($B = .004$, $p = .981$, 95% CI [-0.347, 0.356]). Regarding descriptives, left-wing participants ($n = 127$) had a mean score of 4.32 ($SD = 0.80$). In contrast, right-wing participants ($n = 20$) had a mean score of 4.06 ($SD = 1.10$). These results contradict Hypothesis 2, which proposed that left and right individuals will show different levels of acceptability to the implementation of DACCS.

The third model tested the last hypothesis, which proposed that the relationship between perceived effectiveness and acceptability of DACCS will be influenced by political

ideology. This step of the analysis included an interaction variable between perceived

effectiveness and political ideology to examine if such an effect exists. The model was overall

significant $F(3,146) = 18.57$, $p < .001$, but it did not account for additional explained variance.

The interaction between perceived effectiveness and political ideology was not significant (B

$= 0.03$, $p = .867$, 95% CI$[-0.313, 0.370]$), indicating that political ideology does not moderate

the relationship between perceived effectiveness and acceptability. Therefore, Hypothesis 3 is

rejected.

Discussion

The purpose of this research paper was to explore how the perceived effectiveness of

DACCS and an individual's position on the left-right political scale affect their degree of

acceptability towards this technology. The overarching aim was to investigate whether

political ideology moderates the relationship between perceived effectiveness and public

acceptability of DACCS. Three hypotheses were proposed to address these research

questions. The first hypothesis assumed a positive relationship between perceived

effectiveness and acceptability. The second hypothesis proposed that political orientation

influences acceptability. We proposed to test a competing model due to strong arguments for

both left and right-leaning ideologies potentially being more acceptable to DACCS.

Therefore, it suggested that there might be a significant difference in acceptability rates

between right-wing and left-wing individuals. The last hypothesis assumed a moderating

effect of political orientation, and due to convincing arguments on both sides, it was left open

to explore whether the relationship would be stronger or weaker for left and right-leaning

individuals.

The results supported the first hypothesis about the main effect of perceived

effectiveness. Participants who perceived DACCS to be effective in reducing CO_2 emissions,

mitigating climate change and limiting global warming were more likely to support its

implementation. The finding that higher perceived effectiveness was associated with higher acceptability of DACCS is in line with previous literature suggesting that people are more likely to accept a policy if they believe it is going to be effective (Dreyer & Walker, 2013; Eriksson et al., 2008; Gärling & Schuitema, 2007; Schade & Schlag, 2003). This finding further suggests that perceived effectiveness is important not only for climate policy support in general but also for the acceptability of technological solutions, specifically DACCS in our case. Even though our findings support this hypothesis, it is important to note that perceived effectiveness is not the only factor influencing the acceptability of DACCS. Other determinants, such as perceived fairness, which research has shown to strongly predict acceptability and has been frequently studied alongside perceived effectiveness, need to be considered (Bergquist et al., 2022; Clayton, 2018; Dreyer & Walker, 2013; Eriksson et al., 2008; Jagers et al., 2017). When investigating perceived fairness and perceived effectiveness together, several studies found perceived fairness to be a stronger determinant of policy acceptance (Bergquist et al., 2022; Clayton, 2018; Eppe et al., 2022). Future research could explore if that applies to DACCS and if this variable can contribute to an even deeper understanding of the role of perceived effectiveness.

However, our findings did not support the two hypotheses regarding the second research question. Contrary to prior research showing a clear difference in support or acceptance rates of climate policies between left and right-leaning individuals, no significant difference was observed in this study, which is surprising (Ejelöv & Nilsson, 2020; McCright et al., 2015; Tobler et al., 2012). One potential reason political ideology may not predict the acceptability of DACCS is that it is a new and unfamiliar technology. Unlike established climate policies, such as nuclear energy, which research on ideology has focused on due to its controversial nature, DACCS may not have yet become a polarised issue (Clulow et al., 2021; Pampel, 2011). Therefore, people across the political spectrum may not have fully formed

their opinions and stances about it. Without those clear opinions, the common ideological divide that exists with other environmental policies might not be present with DACCS.

Finally, the findings do not support the third hypothesis, as political ideology did not moderate the relationship between perceived effectiveness and acceptability. This may suggest that political ideology influences acceptability only for specific environmental policies and technological solutions. For example, previous research has focused mainly on pricing and tax policies and more polarising solutions such as nuclear energy (Clulow et al., 2021; Jagers et al., 2017). Left-leaning individuals are generally more supportive of pricing and tax policies aimed at reducing emissions (Jagers et al., 2017; McCright et al., 2015). These policies are simpler and more familiar, and their pro-environmental stance aligns directly with such measures (Borick & Rabe, 2010; Hamilton & Keim, 2009; Malka et al., 2009; McCright & Dunlap, 2011). However, DACCS is more complex. Left-leaning individuals might accept DACCS for its potential to fight climate change but worry about its reliance on fossil fuels (Clulow et al., 2021). On the other hand, right-leaning individuals might support DACCS because they support the continuation of fossil fuel usage but are less concerned about its environmental risks (Clulow et al., 2021). This complexity might explain the lack of significant results.

Limitations and Directions for Future Research

The main limitation of this study is related to the characteristics of the sampling method. Firstly, convenience sampling was used to gather the participants, which restricts the generalizability of the findings. Moreover, due to all the researchers being psychology students with similar ideological viewpoints whose social circles mostly share those values, it was challenging to find a wide variety of participants with diverse opinions. Therefore, the number of left-leaning participants was around six times greater than right-leaning ones in our study. There might not have been enough data from the right-wing group to observe an effect

due to low statistical power, and the probability of Type-II error is increased. Future research should consider this when examining these results. Furthermore, the scale for political orientation in the questionnaire was purposefully constructed to include six options. Thus, the participants could not choose the centre option but had to categorise themselves into either left or right. Considering many people do not fully identify with either political ideology, future research may benefit from allowing participants to choose a centre or a moderate option to explore how these findings differ for people who consider themselves to be in the centre of a political ideology scale.

A methodological limitation of this study concerns the amount of information given to participants about DACCS. Despite having high and low knowledge conditions, neither may have provided enough detail for participants to make informed decisions about its effectiveness or acceptance. Since DACCS is a new and unfamiliar technology, many participants found the information too vague, especially in the low knowledge condition, which only included a brief description. Some participants commented that they did not have enough information to form a proper opinion and would have liked an "I do not know" option instead of being forced to choose an answer they do not fully agree with.

It is also important to note that no causal relationships can be drawn from this study because it was not experimental. Without manipulation and control over variables, we cannot say with certainty that the observed findings represent the truth. Future research should employ experimental designs to explore causality and better understand the underlying factors driving the acceptability of DACCS.

Practical Implications

This research theoretically contributed to the understanding of determinants of public acceptability in the context of technological solutions and emerging strategies such as

DACCS. It particularly highlights the importance of how people perceive the effectiveness of DACCS for climate change mitigation, CO_2 removal and the potential to limit climate change.

A practical implication could suggest that the effectiveness of a solution or strategy should be clearly communicated to the public, as it may contribute to their choice to show more support. Therefore, effectiveness should be emphasised to the public by presenting how a technology such as DACCS can contribute to solving the problem of climate change. Involving the public in this discussion can show them how their support can positively contribute to such a large issue.

Additionally, this study's findings highlight that even though political ideology is a strong predictor of acceptability for familiar and more straightforward solutions, it might not be for new and emerging ones, as opinions about them might not be polarised yet. That being the case, there is an opportunity to present DACCS to the public. A recommendation for policymakers is to increase public acceptability of new and emerging solutions by developing communication strategies aimed at raising awareness and involvement. That way, the public can participate in the discussion and have a say in the decision-making process. That might help reduce people's uncertainty about DACCS and ensure they can form a constructive opinion.

Conclusion

In conclusion, the results of this study further emphasise the nuance that surrounds the ways individual factors and policy-specific characteristics predict acceptability. Overall, it highlights the role of perceived effectiveness in shaping attitudes and opinions about DACCS and how it can contribute to its successful large-scale implementation, which is crucial for meeting climate mitigation goals. Moreover, this research suggests that the effect of political ideology might not be relevant in the context of DACCS. Future research should clarify the relationship between political ideology and acceptability in a more representative sample.

Finally, this study emphasises how policymakers can implement communication strategies to raise awareness and acceptability of DACCS by actively involving the public in discussions.

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Appendix

Measures

Political orientation

It is sometimes said that political opinions can be placed on a left-right scale. This is also known in some countries, like the US, as a liberal-conservative scale. Please indicate your general political opinions on the scale from Left-wing (1) to Right-wing (6).

	1 Left Wing	2	3	4	5	6 Right Wing
Where would you place yourself on such a left-right scale?	o	o	o	o	o	o

Perceived effectiveness of DACCS

Based on the information above, we are interested in how you perceive the effectiveness of DACCS. Please read the statements below carefully and evaluate them on a 6-point scale from strongly disagree (1) to strongly agree (6).

	1 strongly disagree	2 disagree	3 somewhat disagree	4 somewhat agree	5 agree	6 strongly agree
I think DACCS would be effective to limit global warming.	o	o	o	o	o	o
I think DACCS would be effective in removing CO2 from the atmosphere.	o	o	o	o	o	o
I think DACCS would be effective in mitigating climate change.	o	o	o	o	o	o

Acceptability of DACCS

We are interested in your opinion on how acceptable it is to implement DACCS.

Please read the statements below carefully and evaluate them on a 6-point scale from strongly

disagree (1) to strongly agree (6).

	1 strongly disagree	2 disagree	3 somewhat disagree	4 somewhat agree	5 agree	6 strongly agree
I find the use of DACCS technology acceptable.	o	o	o	o	o	o
I find it acceptable to implement DACCS technology in my country.	o	o	o	o	o	o
I find it acceptable to use DACCS technology in order to reach global climate goals.	o	o	o	o	o	o
I find it acceptable to use more DACCS technology in my country than is used now.	o	o	o	o	o	o