Sustainability communication: how to communicate an inconvenient truth in the era of scientific mistrust

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Abstract

Purpose – This conceptual paper aims to explore the current state of sustainability communication research, focusing on the challenges of communicating inconvenient truths in an era of scientific mistrust. Therefore, this study aims to (1) examine the existing research landscape in sustainability communication, (2) identify unresolved problems and challenges, and (3) propose strategies for counteract misinformation through targeted communication.

Design/methodology/approach – For this, the authors conducted a critical literature review and analyzed the resulting sample ($n = 473$ journal articles) by means of qualitative content analysis to (1) evaluate existing communication approaches dealing with the communication of sustainability's inconvenient truth, (2) identify stakeholder groups involved in sustainability communication, (3) discuss limitations of current communication approaches and (4) present recommendations on (more) effective communication strategies to address the unresolved issues in sustainability communication.

Findings – The analysis reveals that when it comes to sustainability communication and its unresolved problems, literature refers to four key stakeholder groups: (1) science deniers; (2) adaptation skeptics; (3) whitewashers and (4) world saviors. Furthermore, the analysis provides valuable insights into the complex dynamics involved in communicating sustainability, emphasizes the need for tailored approaches to engage and address the concerns of each stakeholder group, and exposes limitations in current communication methods and approaches. Accordingly, the analysis highlights the necessity of developing new theories, models and methods specific to sustainability communication to tackle its unique challenges effectively.

Research limitations/implications – Like our society, communication sciences need a fundamental transformation to meet sustainability communication's new challenges induced by the necessary shift toward sustainable development.

Originality/value – This paper provides a comprehensive overview of the current state of sustainability communication in research, specifically addressing the challenges of effectively communicating unpleasant news in the context of scientific mistrust. It fills a gap in existing literature by examining the progress made in addressing these issues and identifying the emerging challenges that need to be addressed.

Keywords Sustainability communication, Inconvenient truth, Scientific misinformation, Media and communication science, Communication strategies

Paper type Literature review

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1. Introduction

Sustainability communication has already established itself as an interdisciplinary yet independent research area within communication studies. However, at least two conspicuous features can be identified in observing the development of the "Sustainability Communication" research area. *First,* the tendency to communicate only the so-called "sunshine perspective" of sustainability. This means conceptualizing sustainability as an alternative normative framework in our capitalist, market-oriented society while focusing only on its positive aspects, such as economic and technological progress, innovation, green jobs and renewable energies. However, the narrative of sustainability also contains a "rainy side" – i.e. the necessity for radical changes and turning away from current (economic) paradigms – making sustainability an "inconvenient truth" [1] to communicate. Indeed, this conception implies the narration of unpleasant, uncomfortable truths, which require sacrifices and renunciation on a personal level that can also be perceived as restrictions of personal freedom (Weder *et al.*, 2021, p. 3–4).

Second, a targeted misinformation campaign related to (anthropogenic) climate change is taking place to undermine scientific evidence, discredit scientists and spread doubts (McCright and Dunlap, 2017). Such a strategy was most recently evident in early November 2021. While heads of state and government met at the COP26 summit to consult on how to fight climate change, misleading claims and untruths about the climate – such as a "Grand Solar Minimum" will stop global warming or that renewable energy is unreliable – were spread on social media (BBC, 2021). This strategy of manufacturing uncertainty and spreading doubts complicates the aims and goals of sustainability communication and its communicators considerably since it undermines the public trust in evidence-based research findings (Weiss, 2017; van der Linden *et al.*, 2017) and – in turn – slows down evidence-based policy (Farrell *et al.*, 2019). This was confirmed, not least, in the Eurobarometer survey 2021: half of the respondents stated that they "can no longer trust scientists to tell the truth on controversial topics" (Eurobarometer, 2021, p. 9), such as climate change.

As a fundamental social science, communication science is a research area that should address these two problematics features. Hence, this paper aims to understand where we as a scientific discipline are in addressing these problems, i.e. (1) what is the *status quo* in research around communicating sustainability, (2) what are unresolved problems and challenges, and (3) how to counteract misinformation through (targeted) communication.

Consequently, we (1) identify and analyze existing approaches that deal with the question of how to communicate sustainability and its rainy side (more) effectively, (2) identify different stakeholder groups, (3) discuss limitations of related existing communication approaches and (4) present what the analyzed literature suggests as appropriate communication strategies to overcome sustainability communication's unresolved issues.

2. Sustainability communication

Generally speaking, sustainability communication refers to an understanding of the relationship between human beings and their environment. Its development as a research discipline was accompanied by an increasing requirement for responsible handling of humans' natural and social environment (Godemann and Michelsen, 2011, p. 3). Sustainability communication is understood as a process in which arguments, options for action and/or (contrasting) positions on social development are discussed forward-looking from an economic, ecological, social and cultural view. However, these perspectives are perceived and interpreted differently by individuals (Michelsen, 2009, p. 25). Thus, it is a social understanding process that deals with causes and (possible) solutions, refers to social discourses and seems essential for legitimizing arguments related to change toward sustainable development (Newig *et al.*, 2013). Therefore, sustainability communication aims

to critically evaluate this understanding of the human-environment relationship and introduce it into the social debate (Godemann and Michelsen, 2011, p. 6). Sustainability communication thus conceived takes place at all social levels: on the micro-level, as intra- and interpersonal communication, on the organizational, meso-level and at the whole-of-society macro-level.

However, what is "inconvenient" when communicating a concept aiming at meeting "[. . .] the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 15)?

2.1 The "inconvenient" side of sustainability

The "inconvenient" side of sustainability refers to the impossibility of maintaining our current capitalist and consumption-driven lifestyle while ensuring enough resources for future generations. The "inconvenient", "rainy" side of sustainability is therefore not a communicative construct but a real inconvenience, since achieving sustainability requires significant changes, including a shift away from Western notions of wealth, increased costs, job- and profit losses (especially for unsustainable industries) and the imperative for personal behavioral change, which in turn implies giving up privileges and comfortable habits. Indeed, high-socioeconomic status individuals and households have particularly problematic consumption patterns, contributing significantly more greenhouse gas emissions compared to lower-income individuals (Nielsen *et al.*, 2021). Studies have shown that the top 1% earners generate twice as much consumption-related CO2 emissions as the entire bottom 50% combined (Oswald *et al.*, 2020; Kartha *et al.*, 2020).

Implementing sustainability practices in businesses can have negative consequences on an industry level, as conflicts arise when environmental and social sustainability goals clash with economic objectives (Tura *et al.*, 2019). Investing in eco-friendly technologies, for example, to reduce environmental impact is often costly and carries risks due to uncertain returns on investment (Hall, 2002). Sustainable production involves higher costs, mainly due to eco-certification expenses (Hamilton and Zilberman, 2006), making these products more expensive than conventional alternatives. However, consumer willingness to pay higher prices is not always given, resulting in low market share for sustainable products (Luchs *et al.*, 2010). Thus, profit maximization becomes difficult. Adhering to sustainability standards may also require severing ties with long-term partners and suppliers who fail to meet new requirements, leading to revenue and job losses (Jackson and Young, 2016). In the context of Western capitalism, embracing sustainability measures can lead to cost increases that undermine industrial competitiveness (Wilkinson *et al.*, 2001).

Embracing a sustainable lifestyle on a personal level would require changing our mobility, food, purchase and consumption habits. For example, always traveling by train instead of flying and therefore forgoing long-distance, overseas travels, since GHG for airplanes are four to seven times higher than the emissions for short- and long-distance travel by train (Umweltbundesamt, 2021). Concerning our dietary habits, the transition to a plant-based diet is considered a fundamental contribution toward sustainable development and climate change mitigation (Austgulen *et al.*, 2018), as the general food production system is associated with severe environmental impacts, with livestock products production being the most problematic one (Stoll-Kleemann and O'Riordan, 2015). Meat production is considered to be among the most energy-intensive and environmentally harmful foods (Dagevos and Voordouw, 2013).

These are just a few of countless examples that could have been mentioned to show why sustainability communication, in the sense of communication *of, about* and *for* sustainability [2] (Newig *et al.*, 2013), involves conveying inconvenient truths about the challenges and sacrifices associated with sustainability. It goes beyond portraying only the positive aspects

and encompasses the communication of renunciation, loss of privilege and changes in welfare. Such narratives are often disliked by recipients at various levels (individual, organizational, societal) and can be challenging to communicate effectively. However, these truths are not fictional stories or subjective interpretations but are rooted in scientifically validated data and findings.

2.2 The "truth of sustainability"

The reality of anthropogenic climate change is supported by a unanimous consensus among scientists (Powell, 2019). The latest IPCC report 2023 further confirms that global warming is primarily caused by human activities and has fatal consequences (IPCC, 2023). As humans are responsible for climate change, it is our responsibility to take action to mitigate its effects. The report consistently calls for a complete transformation of our first-world lifestyle, including changes in consumption patterns, the industrial sector and the economic system. The ultimate goal is to achieve near-zero greenhouse gas emissions worldwide by 2050.

Despite the consensus among (climate) scientists about the reality and causes of climate change, this consensus is not widely known among the public. Studies have shown that the perceived level of scientific agreement on human-caused climate change act as a critical "gateway belief" (Ding *et al.*, 2011; McCright *et al.*, 2013). Consequently, misconceptions about the scientific consensus can have significant consequences, leading to a lack of support for climate action (Aklin and Urpelainen, 2014; van der Linden *et al.*, 2014). This discrepancy between the scientific consensus and public perception can be attributed to several factors. Firstly, while there is agreement on the existence of climate change and the role of humanity in it, there is still debate about the appropriate actions to address these issues – and people tend to confuse these two issues (Parton and Morrison, 2011). Secondly, the media's tendency to provide a "false balance" by presenting opposing views with equal weight, even when one side lacks scientific evidence, contributes to confusion among the audience (Cook *et al.*, 2017). This false balance undermines public certainty about scientific issues (Kortenkamp and Basten, 2015). Thirdly, some industries with a vested interest in the sustainability debate exploit this discrepancy and misunderstanding by spreading doubts through their PR strategies, leading to further confusion and misinformation (Farrell *et al.*, 2019; McCright and Dunlap, 2017)

2.3 Strategic manufacture of uncertainty

The strategy of manufacturing uncertainty and doubt has been historically employed by the Western industrial system, e.g. the tobacco industry, to undermine scientific evidence (Oreskes and Conway, 2010) and is now used to create controversy around human-caused climate change (McCright and Dunlap, 2017). Fossil fuel advocacy groups often engage unqualified scientists to spread misleading messages, deliberately creating the impression that there is insufficient scientific evidence about climate change (Davidson, 2008; Jacques *et al.*, 2008; Moser, 2010). These tactics serve the interests of corporate and industry stakeholder who fear that climate change solutions may threaten their own interests (Farrell *et al.*, 2019; Diethelm and McKee, 2009). Rather than outright denying the phenomenon, these groups question the degree of certainty regarding the causes, consequences and severity of climate change, as well as the relationship between our first-world lifestyle and its impact. This communication strategy aims to cast doubt where there is none, framing the need for necessary measures as a matter of data interpretation (McCright and Dunlap, 2017.). By highlighting uncertainties, they argue against the necessity of changing the current industrial system, limiting GHG emissions, or restricting carbon-intensive practices, as the effect of such actions on climate change is portrayed as uncertain.

A well-informed public is essential for a functioning democracy, as decisions made on a societal level rely on accurate information (Kuklinski *et al.*, 2000). However, consistent misinformation can lead to suboptimal decision-making and hinder collective understanding and engagement (Lewandowsky *et al.*, 2017). To effectively address societal issues like climate change, it is crucial to tackle the problem of misinformation (West and Bergstrom, 2021). This involves correcting scientifically inaccurate content, exposing the production and dissemination of misinformation and confronting the institutional and political structures that enable its spread. Taking these actions is necessary to counter misinformation and ensure that accurate information prevails in public discourse (Farrell *et al.*, 2019).

As mentioned above, the field of communication sciences (should) play(s) a vital role in addressing the challenges of effectively communicating sustainability and its complex aspects. To understand the progress made in tackling these issues, we undertake the following tasks: (1) we identify and analyze existing approaches that deal with the question of how to communicate sustainability and its rainy side (more) effectively, (2) identify different stakeholder groups, (3) discuss limitations of related existing communication approach and (4) present communication strategies suggested by the analyzed literature to address the unresolved issues in sustainability communication. By conducting these tasks, we aim to (1) determine the current state of research in communicating sustainability, (2) identify unresolved problems and obstacles and (3) propose ways to counteract misinformation through targeted communication.

3. Literature review

To address our research objectives, we conducted a critical literature review. A critical literature review is a comprehensive and methodical analysis of published research and scientific articles related to a specific topic. It serves an important purpose in the scientific community by providing a thorough overview of the current knowledge on a particular issue (Hart, 2001). By synthesizing existing knowledge, these reviews help identify and examine problems, weaknesses, contradictions, or controversies within a specific research area (Baumeister and Leary, 1997). Additionally, they contribute to creating awareness of the current state of the field and shedding light on any gaps or biases that may exist (Jesson and Lacey, 2006). Accordingly, a critical literature review is an appropriate method to achieve our research goals.

For this, we searched for keyword combinations in two different databases – Google Scholar and EBSCOhost. In line with the research' aims, the following keyword-combinations were selected for the database search: "inconvenient truth AND communicat*"; "bad *or* negative news AND communicat*; "communicat* sustainability"; "communicat* climate change"; as well as "climate change AND scientific mistrust *or* denial"; and "climate change AND misinformation *or* disinformation *or* fake news".

The timeframe for the search was limited to the period 2013 to June 2021. 2013 was selected as a starting point since the Intergovernmental Panel on Climate Change (IPCC) first reported in 2013 on the certainty that climate change is a reality caused by humans (IPCC, 2013). While for EBSCOhost all hits were included in the sample, the search was limited to the first 15 hit pages for Google Scholar. This corresponded to the point where we reached sample saturation. Furthermore, only journal articles available as full text and/or open access were included in the sample. Table 1 shows the keyword search results based on the criteria just described.

As shown in Table 1, $n = 826$ journal articles were found that matched the search criteria. In a second step, duplications were excluded. After that, the abstracts of the remaining journal articles were read, thus removing from the sample those papers that, despite keywords, did not provide information on how existing approaches deal with the

communication of inconvenient truth nor how scientific misinformation can be counteracted through communication. After data cleaning, the sample included $n = 473$ journal articles. These were read in-depth and analyzed by means of content analysis following an inductive approach (Mayring, 2014). This kind of content analysis enables a methodical, regulative and theory-driven examination of the content, allowing for the direct creation of categories from the study material while maintaining the data's original meaning. The results of the content analysis are presented in the next section.

4. Stakeholder types and counteracting strategies

The qualitative content analysis revealed that when it comes to the question of how to communicate sustainability and its rainy side (more) effectively and address its unresolved issues, literature mainly refers to four stakeholder groups: (1) science deniers; (2) adaptation skeptics; (3) whitewashers; and (4) world saviors (Table 2) [3].

Using qualitative content analysis, we identified the distinctive characteristics of each stakeholder type and examined the drawbacks of current communication approaches employed by or targeted toward them. Additionally, we could identify proposed communication strategies to address these limitations and effectively engage stakeholders in sustainability communication. In the subsequent subsections, we will provide a more comprehensive discussion and presentation of these findings.

4.1 Science deniers

The first stakeholder type revealed by the content analysis is science deniers. Through the inductive approach, we identified their distinct characteristics, prevalent debunking strategies, limitations and gather suggestions from the sustainability communication literature on how to effectively address or counteract their arguments through communication (see Table 3).

Science deniers pose a significant challenge to the scientific community as they undermine scientific milestones, propagate misinformation that contradicts established scientific knowledge and selectively accept evidence only if it aligns with their preconceived beliefs, often at odds with the scientific consensus (Schmid and Betsch, 2019). Consequently, science deniers exhibit a motivation to reject scientific findings, driven by their desired outcomes rather than evidence-based reasoning (Hornsey and Fielding, 2017; Lewandowsky and Oberauer, 2021). In response, scientists have undertaken extensive research to comprehend their cognitive and communication processes, aiming to counteract the targeted dissemination of misinformation by debunking and disproving their misconceptions and wrong facts (Lewandowsky and Oberauer, 2016; Cook *et al.*, 2017; van der Linden *et al.*, 2017; Schmid and Betsch, 2019).

	Google scholar	EBSCOhost
*Inconvenient truth AND communicat**	67	9
*Bad or negative news AND communic**	85	34
Communicate sustainability	92	86
Communicate climate change	77	41
Climate change AND scientific mistrust or denial	112	24
Climate change AND misinformation or disinformation or fake news	102	97
	535	291

Source(s): Authors' own creation

Table 1. Journal articles in databases – keyword matches

Text passage	Category	Main category
They believe global warming is not happening, human-caused, or a threat, and most endorse conspiracy theories (e.g. "global warming is a hoax")	Not believing in global warming	*Science Deniers*
They reject the reality of climate change	Rejecting reality of climate change	
Although the majority of people take these robust results of scientific inquiry for granted, science deniers publicly oppose these results	Rejecting scientific results	
Finally, several respondents doubted the reliability of climate science (e.g. "unscientific theory")	Doubting reliability of scientific results	
They argued that nobody needed to worry about global warming, for it was all nothing but "junk science"	Denying science	
They think human-caused global warming is happening [. . .] but impacts are still distant in time and space and not a serious risk	Doubts about climate impacts	*Adaptation Skeptics*
They are less supportive of government action to reduce climate change	No support for adaptation/ mitigation measures	
people believe that it is prudent to "wait and see" whether a potential environmental risk will actually cause harm	Doubts about consequences of climate change	
They are uncertain about the causes and consequences of climate change means potentially costly actions to address the risks should be deferred	Defer costly adaptation/ mitigation actions	
When science conflicts with "common sense" people are unlikely to favor or adopt policies consistent with science	No support for science-driven policies	
Emerging green market brings many opportunities in different fields	Positive effects of sustainable turn	*Whitewashers*
Properly designed environmental standards can trigger innovations that lower the total cost of a product	Lower production costs for environmental-friendly products	
Sustainable development is a far more inclusive guide for happiness when compared with isolated concepts such as income, employment and economic freedom	Sustainable development as guide for happiness	
Creating green jobs has come to be seen as a possible solution for creating new jobs, while the green economy has come to be seen as a solution to climate change, environmental degradation and poverty growth	Green jobs and economy as solutions to climate change	
[. . .] tendency to communicate only the [. . .] "sunshine perspective" of sustainability —i.e. to tell a story that focuses only on the positive aspects and impacts of sustainability	Focus only on positive side of a sustainable turn	

Table 2.
(*continued*) Four stakeholder types

Text passage	Category	Main category
They are convinced global warming is happening, human-caused, an urgent threat and strongly support climate policies	Urgency of anthropogenic climate change	*World Saviors*
They are already highly engaged, seek to motivate activism and eager to know what individual and collective actions they can take to help reduce global warming	Need for action to reduce global warming	
They are willing to abstain from longer car or plane journeys. They are willing to give up certain living conveniences to do something about climate change	Accept restricting measures	
Individuals that commits crimes of economic sabotage in defense of the environment or to direct changes in environmental policy	Defending the environment at any cost	

Source(s): Authors' own creation

Table 2.

Science deniers Text passage	Category	Main category
Science deniers publicly oppose scientific results and spread misinformation	SD oppose science	*Characteristics of SD*
Science deniers [. . .] spread misinformation	SD spread misinformation	
Creating the appearance of scientific uncertainty about issues for which the solution may threaten these interests is therefore critical to this [. . .] infrastructure	Create doubts and uncertainty is essential for SD	
[. . .] people do not adopt the scientific process, weighing up the evidence before reaching a conclusion	SD do not recognize scientific evidence	
[. . .] they often operate like cognitive lawyers, engaging in a biased and selective search for information, with a view to reinforcing their preexisting attitude. In this process of motivated reasoning, evidence is sampled and critiqued selectively in order to reinforce what one wants to believe	SD search for information that reinforce their attitude	
Science deniers accept evidence only if it confirms their prior beliefs – that usually contradict the scientific consensus	SD accept scientific evidence only if it matches their belief	
In particular, these segments were less likely to believe climate science	SD do not believe in climate science	
Denialism is typically driven by ideology, politics, or religious belief	Reasons for denialism	
Public attitudes about climate change can be successfully "inoculated" against misinformation by exposing people to a dose of refuted arguments before they hear them	Public inoculation	*Debunking strategies*
Neutralize potential misinformation before it is encoded, a technique colloquially known as "prebunking"	Prebunking	
We [. . .] propose a coordinated set of strategies across four interconnected areas: public inoculation, legal strategies, political mechanisms and financial transparency	Set of debunking strategies	
Technique rebuttal (uncovering the techniques of science denial). [. . .] Unmasking these techniques will educate the audience about why arguments of denial are appealing but incorrect	Uncover techniques	
The public should be inoculated against the sources of scientific misinformation as well, by drawing more explicit attention to exactly who is behind these messages	Uncover source	
[. . .] drawing more explicit attention to exactly who is behind these messages — that is, the financial contributions and economic motivations behind the bad-faith information they will encounter	Uncover economic interests	
Advocates for science can respond to misinformation by supporting the scientific standpoint with scientific facts, that is, topic rebuttal	Topic rebuttal	
[. . .] corrections are effective only when at least two conditions are met: first, they must not directly challenge people's worldviews [. . .]	Rectify without questioning SD worldviews	

Table 3.
Science deniers

(*continued*)

Science deniers Text passage	Category	Main category
Inoculation [. . .] succeeds when the patient is not already sick	Inoculation only effective before exposure	*Limitations of existing approaches*
Backfire effects are most likely to be found among audiences whose prior beliefs or political ideologies are threatened by the advocate. For example, attempts to correct misconceptions about vaccination in an audience with low confidence in the safety of vaccination can ironically reinforce the misconception	Backfire effects	
Misinformation often continues to influence people's thinking even after they receive and accept a correction – this is known as the "continued influence effect"	Rectification is never fully effective	
[. . .] a mere provision of facts has been criticized as insufficient to reduce the influence of misinformation because [. . .] it lacks the important explanation of why the misinformation is wrong	Information transfer is not enough	
It is not enough simply to communicate to the public over and again the scientific consensus on human-caused climate change	Repetition of scientific truths is not enough	
[. . .] narratives can also perpetuate misinformation and inaccuracies about science or about scientists themselves	Storytelling can reinforce SD's arguments	
Researchers have begun to tease apart factors that influence the cultural cognitive process of interpreting scientific information, noting the importance of individuals' religiosity; political affiliation; beliefs about the role scientists should play in policy-making; beliefs about the relative independence of science from economic and political interests; levels of trust in venues that disseminate science information (such as news media, government, science TV); and geographical context	Response depends on various factors	
Narratives have the ability to introduce novel information, defamiliarize existing information and provide models for new behavior often without the same level of cognitive resistance facing other types of persuasion	Storytelling	*Suggested communication strategies*
[. . .] framing as a technique for tailoring climate change communication to engage diverse publics	Framing	
Metaphors 'as a bridge between experience and scientific concepts' are essential to understanding climate change	Metaphors	
In order for climate science information to be fully absorbed by audiences, it must be actively communicated with appropriate language, metaphor and analogy; combined with narrative storytelling; made vivid through visual imagery and experiential scenarios; balanced with scientific information; and delivered by trusted messengers in group settings	Set of communication strategies	
[. . .] situating climate change in terms of an individual's present locality will render the issue more salient and more likely to promote emotional and cognitive engagement with the issue	Link to local issues	
stakeholder orientation has to be seen as part of sustainability [. . .] attempts to formulate a unified narrative are unlikely to yield a solution to climate change communication dilemmas	Stakeholder orientation	

Source(s): Authors' own creation

Table 3.

In this regard, research has primarily focused on the concept of "public inoculation", which aims to protect individuals from scientific misinformation before they encounter it (Farrell *et al.*, 2019). This (communicative) strategy draws parallels with the preventive approach in public health, where vaccinations are used to prevent infections. Accordingly, to "prevent" science deniers is necessary to provide the public with an "attitudinal inoculation" by exposing them to debunked arguments about climate change before they encounter false information (van der Linden *et al.*, 2017; Cook *et al.*, 2017). Understanding the communication techniques employed by science deniers, which create the illusion of strong arguments where none exist, can be beneficial in this process (Schmid and Betsch, 2019). This involves educating the public about why denial arguments may appear convincing but are ultimately false (Schmid *et al.*, 2018). Additionally, it is crucial to uncover the sources of scientific denialism by explicitly identifying the individuals and organizations behind these messages

and highlighting their financial interests and motivations. However, as in medicine, inoculation is only effective if the individual has not yet been infected (Farrell *et al.*, 2019).

An alternative approach is to correct misinformation once people believe it (van der Linden *et al.*, 2017; Ecker *et al.*, 2017; Cook *et al.*, 2017). However, rectifying targeted misinformation and fake news is extremely difficult and never fully effective. Moreover, when rectification challenges people's worldview, people still rely on information they know is wrong. Accordingly, it is crucial to communicate the correction without directly challenging recipients' existing beliefs and to provide alternative explanations for the issue (Lewandowsky *et al.*, 2017). However, simply conveying scientific data and facts in a way that is understandable to the general public is insufficient to effectively refute and counteract the arguments of science deniers (Lewandowsky *et al.*, 2012). Indeed, a one-way communication from the scientific community to the audience – i.e. communication *of* sustainability – is inadequate to achieve the desired effects (e.g. Badullovich *et al.*, 2020; Pearce *et al.*, 2015). Thus, repeatedly communicating the scientific consensus on anthropogenic climate change to the public is not a comprehensive solution.

Storytelling is suggested as a helpful strategy here to enhance understanding and persuasion in communication scientific information since narratives are inherently persuasive (Dahlstrom, 2014). Previous studies have shown the successful use of storytelling to influence resistant audiences on various scientific subjects, including vaccinations, HIV/AIDS and environmental issues (Brodie *et al.*, 2003; Vaughan *et al.*, 2000; Dahlstrom, 2010). However, storytelling as a way of communication on an emotional rather than rational level involves the risk of maintaining science-related misinformation and inexactness since accepted familiar narratives are difficult to rebut even with scientifically proven data (Barriga *et al.*, 2010). Accordingly, the use of storytelling in this context requires careful and skillful implementation to avoid undermining the accuracy and credibility of the conveyed information (Katz, 2013), which could inadvertently strengthen the arguments of science deniers.

A third approach is to counteract denial arguments in public discussions (Schmid and Betsch, 2019; Schmid *et al.*, 2018). However, the use of storytelling in this context should be approached cautiously, as empirical guidance on effectively communicating and responding to science deniers in public discussions is limited (Schmid and Betsch, 2019). Persuasion psychology suggests here that persuasion attempts depend on three variables: the characteristics of the sender (i.e. the communicator's credibility and likability) (Pornpitakpan, 2004); (2) of the receiver (i.e. the personal need for knowledge) (Cacioppo *et al.*, 1983; Friestad and Wright, 1994); and the message's structure and content (i.e. the type of communicated evidence or the message bias) (Hornikx, 2005). While using frames, metaphors, storytelling and focusing on local issues rather than global problems are important, effective communication with science deniers must also occur stakeholder specific (Badullovich *et al.*, 2020; van der Linden *et al.*, 2014). Recognizing and addressing so-called stakeholder-specific causal variables, such as attitudes, personality, habits, context, emotions and cognition, is crucial as they can support or inhibit behavioral change (Moser, 2014; Pearce *et al.*, 2015). Therefore, effective communication with science deniers requires an understanding of and differentiation among these stakeholder-specific variables and their integration into the communication process.

4.2 Adaptation skeptics

The second type identified through content analysis is adaptation skeptics. Skepticism should not be confused with science denial (Dunlap, 2013) since, basically, skepticism about scientific claims is a fundamental element of science itself (Ziman, 1996). However, this skepticism must be based on scientific ethos, i.e. using and questioning scientific data to update previous beliefs – regardless of the outcome (Schmid and Betsch, 2019). However, colloquially skeptics are rarely understood as remarkably self-aware and critical thinking

people. Instead, the word is used synonymously for doubters, i.e. a person prone to doubts but without denying science. In this context, adaptation skeptics are individuals who do not deny science or anthropogenic climate change but harbor doubts, particularly regarding adaptation measures. These doubts often arise due to the influence of lobbying activities by influential public relations (PR) companies and the subsequent politicization of the sustainability debate (Farrell *et al.*, 2019; McCright and Dunlap, 2017).

Besides their characteristics, the content analysis reveals the challenges and limitations of current approaches in addressing adaptation skeptics communicatively, in countering scientific disinformation, as well as some suggestion on how to advance sustainability communication in relation to this specific stakeholder group (see Table 4). Accordingly, any

Adaptation skeptics Text passage	Category	Main category
They haven't yet made up their minds: Is global warming happening? Is it human-caused? Is it serious?	Uncertainty about global warming	*Characteristics of AS*
[. . .] markets should be unconstrained and so are motivated to deny risks that imply restriction of market freedoms	Economy first	
They used the argument that the science is uncertain to avoid adapting strong measures to reduce greenhouse gas emissions (a scientific-scepticism frame)	Creating doubts	
[. . .] misinformation that is intended to confuse the public and/or block science-based policy change	Stop science-based policy change	
[. . .] drive the [. . .] political conversation [. . .] to develop and promulgate ideological viewpoints and policies that are favorable to political and/or industry interests	Support political and economic interests	
[. . .] alarmed about the economic and political costs of enacting climate change policy	Alarmed about measure's costs	
play a central role by providing key counter-claims to challenge climate science and obstructing climate policy	Obstruct climate policy	
global warming policies would do more harm than good	Climate policy measures are harmful	
Strong negative affect associated with the concrete, immediate costs and sacrifices and the absence of feelings of worry about possible abstract and distant consequences of global warming in the absence of such actions drive ecologically damaging consumption decisions and actions	Worries about costs and sacrifice rather than on global warming's consequences	
these individuals pursue their own self-interest they exacerbate the environmental externality as a byproduct of private consumption	Economic (self-) interests more relevant than environmental protection	
Those with significant interest in maintaining the fossil-fuel intensive status quo [. . .] suggest that a wait-and-see stance in the most responsible course of action	Wait and see attitude	

(*continued*)

Table 4.
Adaptation skeptics

Adaptation skeptics Text passage	Category	Main category
individuals' responses are highly influenced by previous responses from other group members [. . .] judgment consensus emerges as a consequence of the desire to avoid negative evaluation by other group members	People rely on the judgment of the social group they belong to	*Limitations of existing approaches*
effective communication of probabilistic events may be more difficult to learn in larger groups due to decreased social facilitation in larger groups	Communication of risks works better in smaller groups	
[. . .] challenges surrounding the communication of phenomena that can never be directly experienced because of the particular scale at which humans have evolved to perceive reality. [. . .] Accurate values and explanations do little to provide an intuitive sense of something as large as climate change. [. . .] When attempting to understand such ideas, audiences must take some relevant aspect of experience from human scale and mentally extrapolate it past possible experience to arrive a general perception of the phenomenon in question, a perception on which they will the base their decision making. Unfortunately, research suggests that the farther the perception is from human scale, the less accurate it is likely to be	Climate change beyond "human scale"	
Higher levels of perceived risk increase protection motivation. Conversely, a low risk perception may lull people into a false sense of security and, as a result, cause them to overlook the risk as a threat that should be heeded	Risk perception leads behavior	
Strong emotional appeals are more likely to invoke-self-protection and inaction rather than an active response	Strong emotions lead to self-protection	

Table 4. (*continued*)

Adaptation skeptics Text passage	Category	Main category
Risk-reduction actions are greater for risks that present a direct personal threat. [. . .] direct experience and personal involvement induce individuals to think about their attitudes	Create personal link	*Suggested communication strategies*
Not speaking in code/jargon: rather than "anthropogenic," you could say "human-caused." Instead of "spatial" and "temporal," try "space" and "time."	No scientific jargon	
In an era of eroding public confidence, however, top down forms of [. . .] communication will not suffice	No top down communication	
[. . .] a new or different model of communication [. . .] is needed, one that emphasizes openness, transparency and dialogue	New modes of communication	
People are especially likely to engage in bottom-up processing	Bottom up	
the notion of empowerment, meaning the importance of providing information to the public so they can make informed decisions [. . .] the importance of individual and collective empowerment through a horizontal process of information exchange	Empowerment	
Reframe adaptation in ways that make it consistent with already familiar decision-making	Re-framing of adaptation	

Source(s): Authors' own creation

Table 4.

attempt to communicate with and counteract scientific disinformation directed to adaptation skeptics is complicated because organized propagators of doubt link scientific misinformation and their ideological partisan arguments to real economic and political problems–such as energy independence, nationalism, or deregulation, thus addressing adaptation skeptics' concerns directly. Their key strategy is finding the right way of performing targeted and effective communication so that a (supposedly abstract) risk – in this case, economic losses or personal restrictions – can be transferred into people's personal "worry budget" (Huh *et al.*, 2016).

This is exactly the starting point to communicate with adaptation skeptics – i.e. establishing a personal connection to environmental issues. It is important to emphasize the personal concerns regarding the environmental impact of climate change and prioritize them over concerns related to industries or the financial system. Creating this personal link can facilitate behavioral change and replace other priorities in their personal "worry budget" (Mabon, 2020). However, establishing such a connection can be challenging, as individuals may rely on the judgment of their social groups (Festinger, 1954), particularly when they are politically aligned. Furthermore, communication with adaptation skeptics is complicated by the difficulty of conveying phenomena that individuals cannot directly experience (Dahlstrom and Ritland, 2012) In science, however, phenomena and processes are studied which are far away from the human cognitive scale – as in the case of (anthropogenic) climate change. This leads skeptics to adopt a "wait-and-see" attitude, questioning whether the predicted damages and the need for mitigation and adaptation measures are genuine (Sterman, 2011).

We can draw from communication science literature some suggestions on how to communicate with adaptation skeptics under such circumstances. Top-down communication forms fall short here, especially when public trust in science communications and communicators is waning. Instead, communication strategies should prioritize openness, transparency and a dialogue-oriented approach (Lofstedt, 2013). Openness should involve acknowledging the complexity of climate change's causes and the uncertainty surrounding its (long-term) impact. By disclosing this complexity, skeptics can be convinced of the transparency, truthfulness and sincerity of scientific communicators and their arguments (Pearce *et al.*, 2015). Transparency is also crucial in terms of clearly stating the funding sources for the research being presented (Farrell *et al.*, 2019). These strategies aim to build trust and credibility in the communication process.

Effective communication with adaptation skeptics involves key features such as engaging them in the process and considering their perspectives. Instead of imposing measures from the top-down, involving them in a (perceived) bottom-up communicative process creates a sense of empowerment and increases their willingness to support and sustain the proposed measures (Mitchell *et al.*, 2016). Furthermore, the concept of adaptation should be exemplified by concrete (achievable) measures to make it more tangible to the audience. By doing so, the term "adaptation" can be (re-)framed to align with familiar decision-making processes, responsible planning and existing management approaches, thereby addressing potential uncertainty among recipients. Referring to past experiences or similar situations where successful adaptation strategies were implemented creates a sense of familiarity and continuity. Additionally, framing the communication using language that resonates with the recipients' values, such as precaution, responsibility, fairness and transparency, enhances the effectiveness of the message (Moser, 2014).

4.3 Whitewashers

The qualitative content analysis identified a third stakeholder type referred to as "whitewashers" concerning communicating sustainability and its rainy side (more) effectively and addressing its unresolved issues. Unlike the previous stakeholder types, the whitewasher group is not the target audience of sustainability communication but individuals who actively engage in sustainability communication themselves, i.e. communicators *of*, *about* and *for* sustainability. Due to their role, they face and pose different issues and challenges in relation to the research questions than the other stakeholder groups discussed in this paper.

Whitewashers are individuals who fully accept and support the scientific findings related to sustainability but emphasize and communicate only its positive side, while downplaying and omitting less desirable aspects. While it is understandable that promoting the positive aspects can be more appealing and effective in encouraging change, there are potential drawbacks to this approach. By exclusively focusing on the positive side of sustainability, whitewashers may inadvertently disregard the concerns and doubts of adaptation skeptics. This can create a sense of dismissal or neglect, leading to the reinforcement of their skepticism and mistrust towards science and its communicators.

Our content analysis revealed, on the one side, the limitations and mistakes of current communication strategies of the so-called "whitewashers" while identifying, on the other hand, some suggestions about how sustainability communication could better succeed in inducing behavioral change without denying or omitting the "rainy" side of the sustainable turn (see Table 5).

The tendency to communicate sustainability as positive story can be attributed to the framing of sustainability issues – such as global warming or anthropogenic climate change – as crisis and thus communicated through crisis communication strategies. Indeed, in crisis

Whitewashers Text passage	Category	Main category
the range of groups and people who have adopted sustainability as this sunny, positive "common future" frame has become incredibly wide	Adoption of the sunshine perspective	*Characteristics of WW*
[. . .] the tendency to communicate only the so-called "sunshine perspective" of sustainability in the public sphere—i.e. to tell a story that focuses only on the positive aspects and impacts of sustainability, such as the creation of new green jobs, the (economic) benefits of renewable energies and the technological and economic progress coming with the turn towards sustainable development	Focus on sunshine perspective	
"rainy side" [. . .] This perspective seems to be rather unappealing mainly on an individual level because it cuts down the narrative of individuality and personal freedom	Negative side of sustainability is unappealing	
[. . .] stave off neoliberal delusions of "green recovery" currently bandied about by global North politicians	Propagators of "green recovery"	
[. . .] emphasizing the positive aspect of crisis situations; that is, considering such occurrences [. . .] as an opportunity for positive changes	Ignoring the negative side	
The rhetoric of renewal emphasizes on the future and recovery. [. . .] communicating positive emotions such as relief, when the damage in some way remained contained	Focus on positive emotions	*Limitations of existing approaches*
Increased use of "crisis" to characterize climate change and/or increasing instances of climate change being mentioned in proximity to related crises [. . .]	Climate change as "crisis"	
Stakeholders have no reason to be inspired by model behavior if they cannot see a positive outcome	Focus on positive outcome to engage stakeholder	
Highlighting the positive: [. . .] messages are far more effective when you describe what you can do instead of what you can't do	Highlight the positive	
[. . .] a return to "normal life" under financial capitalism and climate destabilization is not desirable nor represents just or viable future	Return to "normal" is not possible	
Among scientific papers, titles with positive, more interesting framing receive higher Altmetric scores	Positive bias in research	
[. . .] climate anxiety was neither positively nor negatively correlated with behavior [. . .] this reflects a state of tension between the motivating and paralyzing effects	Missing link to behavioral change	
breaking the bad news softly	Soften bad news	
[. . .] communication strategies advised are determined by individual response and not decided unilaterally [by the communicator]	Individual response determines communication strategy	
What listeners hear depends not on what speakers say, but on listeners' subjective and social context on what has been said	Response is individual	
There is no empirical research on which type of communication (e.g. emotional or rational [. . .]) is best suited for [. . .] sustainability	Lack of empirical research	
Emotional responses tend to be restricted to situations when expertise is low	Limitation of emotional communication	

(*continued*)

Table 5.
Whitewashers

Whitewashers Text passage	Category	Main category
[. . .] explicit messages state their conclusion, making it less likely for the message to be misunderstood. The advantage of explicit messages is that audiences who are unfamiliar with sustainability can also understand the message	Use explicit message	*Suggested communication strategies*
a denotative meaning expresses a definition of a word that is determined and agreed by a community and has limited room for misinterpretation	Use denotative messages to avoid misinterpretation	
the delivery of substantive messages (i.e. reasoned messages) [. . .] encourages the recipients [. . .] to mindfully consider the arguments and meaning of the message and to realign their beliefs and attitudes accordingly [. . .] leading to desired changes in behavior	Use reasoned messages	
Although the importance of rational sustainability communication [. . .] emotional elements are still more important	Use emotions	
[. . .] prefer emotional sustainability messages that appeal to their feelings [. . .] because the sense of relief from moral guilt by making an environmentally sound choice is greater	Use emotions to evoke relief	
The contextualization of messages, by making them personal, ensures perceived behavioral control, which improves [. . .] recipients' response	Contextualization and personal link	

Table 5.

Source(s): Authors' own creation

communication, there is a focus on highlighting positive aspects (Heath and O'Hair, 2009; Coombs and Holladay, 2010) and the return to normalcy after overcoming the crisis. This approach helps to communicate and justify unpleasant measures that may involve personal limitations and sacrifices. It also facilitates the support for corrective actions as they are seen as a means to restore normalcy quickly (Vermeer *et al.*, 2020; Paicu and Franco, 2016; Coombs, 2014). This strategy aligns with the approach taken by whitewashers who ignore the "rainy side" by putting the positive post-crisis time in the foreground, while downplaying the negative aspects or challenges.

Therefore, when it comes to whitewashers, there is a pressing need for clear and transparent communication that includes the "rainy side", the inconvenient aspects of sustainability. However, finding an effective communication strategy to address these issues is challenging within the field of sustainability communication itself. Even in other communication disciplines that deal with the communication of negative news, such as health [4] or business communication [5], it is difficult to find applicable approaches, techniques and models for sustainability communication. This is because negative news is typically communicated in face-to-face, interpersonal settings, whereas sustainability communication needs to occur on a macro level. Based on this understanding, effective sustainability communication necessitates integrating both the interpersonal approach used in face-to-face interactions and the macro-level communication required for broader dissemination. However, such an integrated approach has not yet been developed in the field of sustainability communication.

The literature analysis suggests that when the goal of communication is to induce behavioral change, insights from marketing communication can be applied to enhance the effectiveness of sustainability communication. Accordingly, to achieve the desired outcome, persuasive messages should be clear, explicit and unambiguous, conveying a specific meaning to avoid confusion (Villarino and Font, 2015). Moreover, the content of these messages should not solely rely on logical arguments but also incorporate emotional appeals and social norms to establish a personal connection with the recipients (Wehrli *et al.*, 2014). By appealing to emotions, such messages can elicit a sense of relief from moral guilt and motivate behavioral

change. Contextualizing the message within the recipient's personal experiences enhances the perceived control over their behavior, leading to a greater likelihood of taking action and generating favorable responses (Villarino and Font, 2015; Stanford, 2014).

However, the application of persuasive communication methods and techniques poses challenges due to the risk of recipients feeling patronized or manipulated, resulting in a defensive response that hinders behavioral change (Becker-Olsen *et al.*, 2006; Brøn and Vionim, 2001). Although these techniques can be used to promote specific behaviors, the connection between communicating "inconvenient truths" and inducing behavioral change remains overlooked. This is because the effectiveness of communication depends on individual variables and perception patterns, making it difficult to apply these techniques on a societal level – as sustainability communication would require.

4.4 World saviors

The last type identified in the content analysis is referred to as "world saviors". Similar to whitewashers, this group consists of communicators rather than the intended recipients of sustainability communication. World saviors strongly believe in science and the necessity of restrictive and sometimes unpleasant measures. They are characterized by an extreme, normative, idealistic and critical attitude, wherein "critical" refers to their ability to pass "judgment on social realities" they deem "undesirable, unjust, or inverted" (Larrain, 1996, p. 62). World saviors are unwilling to engage in respectful debates that acknowledge and respect differing perspectives. They assert their opinions and demands without considering the consequences, often justifying their idealistic and sometimes angry attitude based on the perceived relevance and urgency of their cause.

Again, besides their specific characteristics, the content analysis identified limitations of their common communication strategies, as well as some suggestions for improvement about how world saviors can communicate their significant concerns without causing or reinforcing denial, refusal, or skepticism (see Table 6).

"World saviors" often employ anger as a persuasive tactic in their communication strategies. This is based on Lazarus' (1991) theory that anger, among other emotions, is associated with motivational action tendencies. Accordingly, angry individuals are more likely to take action to remove obstacles or regain control of a problem, making messages that evoke anger potentially effective in driving attitudinal and behavioral changes in recipients (Turner, 2007). However, the success of anger appeals is not guaranteed. It works best when the target audience is already inclined to the advocated attitude and strongly believes in its efficacy. Additionally, anger can arise when messages touch on issues that affect personal goals (*ibid.*). In the case of adaptation skeptics, the communication style of world saviors, which involves making demands and promoting radical measures without considering the consequences, can elicit anger due to a sense of being overpowered and not having their concerns taken seriously. This can trigger a protective response in adaptation skeptics, leading to resistance and inhibiting behavioral change (Brennan and Binney, 2010).

The use of strong emotional appeals to drive behavioral change is not a new concept in communication and social sciences, particularly in the field of social marketing. Social marketing often aims to promote behaviors that are socially important but may not align with individual motivations, such as tax compliance (Perez-Truglia and Troiano, 2018), energy conservation (Yoeli *et al.*, 2013), or sanitation issues (Bateman and Engel, 2018). Therefore, it is understandable that world saviors utilize emotional appeals in their communication strategies to convey their perspective and attempt to convince science deniers and adaptation skeptics. This approach could also be valuable in communicating the challenges and drawbacks associated with sustainability, commonly referred to as the "rainy side" of sustainability.

World saviors Text passage	Category	Main category
[. . .] championing issues like the preservation of ecosystems against industrial developments	Advocate for environmental preservation	*Characteristics of WS*
Climate change affects mental health by triggering emotional distress, with some individuals deeply affected by grief, loss and frustration	Climate change triggers emotional distress	
[. . .] protest are often theatrical and disruptive forms of nonviolent protest and civil disobedience	Theatrical protest and civil disobedience	
[They] believe that government's failure to act swiftly to curtail environmental harms is itself criminal	Governmental non-action is criminal	
These movements challenge the boundary between state and society, they promote the creation of certain values and identities rather than material interests, and they often engage in methods and tactics which are more 'radical' than those of other civil society groups	Mora radical than other civil society groups	
[. . .] often do not respect the opinions of those who are opposed to them [and] see issues in black and white and are resistant to opinions and facts that do not fit their world view	Refute opposite opinions	
[. . .] anger is a potentially political emotion through which protesters ascribe guilt to power-holders, accusing them of abusing their positions of power	Use of anger to attribute guilt	
There is also an increasing [. . .] trend in high profile aggressive and violent action by some "extremist" environmental activism groups	"Extremist" activism	
Messages invoking guilt were likely to invoke self-protection rather than encourage action	Problems of using guilt appeals	*Limitations of existing approaches*
While all negative emotions are unpleasant, their degree of activation differs. [. . .] less activating emotions lead to disengagement from a perceived threat, while more activating emotions predict behavioral attempts to lessen the threat, either by approaching or avoiding the situation	Effect of negative emotions depending on activation degree	
The danger-alerting capacity of fear is embraced "internally", but rejected as an effective emotion in mobilization	Fear not effective for mobilization	
Anger is a powerful driver of activism but can also cause activist burnout and internal conflicts, and thereby contribute to movement decline	Problems of using anger appeals	
Negative emotions appeals are demonstrated to be the antithesis of useful when attempting to motivate compliance	Negative emotional appeals don't motivate compliance	
Shame appeals were generally thought of in a negative light and as an ineffective method for motivating people to do the right thing	Problems of using shame appeals	
some highly emotionally charged messages resulted in emotional trauma leading to "escape" from the message rather than engagement with, and intention to act as a result of, the message. Self-protection was most likely to be evoked in situations with the most empathy and close relationship with the issue at hand	Problems of highly emotional messages	
moralizing climate change can motivate individuals while at the same time defensively lead them to avoid solving the problem	Problems with moralization	

Table 6.
World saviors

(*continued*)

World saviors Text passage	Category	Main category
Selling compliance to the unwilling requires some innovative packaging	New ways of communicating compliance	*Suggested communication strategies*
[. . .] encourage compliance by using message appeals (in this context not simply message framing) to link the socially desired behavior to something that is of value to the individual. These appeals must be packaged or presented in a way that enables the individual to see the direct benefit (value) of their action	Link behavior to personal value	
empathy, as an outcome of negative emotions such as fear, increases the likelihood of helping others	Evoke empathy	
Moral motivation includes the motivation to engage in social action based on personal values and/or collective ideologies	Appeal to moral motivation	
During moral panics, a social problem comes to be (re) defined as something that needs to be dealt with before it is too late	Evoke "moral panic"	

Source(s): Authors' own creation

Table 6.

Indeed, social marketing acknowledges the need for innovative communication strategies when promoting compliance among reluctant recipients (Brennan and Binney, 2010). In order to encourage desired behaviors, message appeals are used to connect socially desirable actions with personal value. Negative appeals such as fear, guilt and shame are often employed to achieve the intended effect or behavior. However, the excessive use of these negative appeals has been criticized for eliciting self-protective behavior and inaction rather than active engagement (*ibid.*). Guilt appeals, in particular, can be problematic when they lead to feelings of shame, as shame tends to result in negative responses and inactivity (Cotte *et al.*, 2005). To address this, guilt appeals should aim to evoke empathy, which can lead to a more positive response from recipients, ultimately driving behavioral change (Stürmer *et al.*, 2005; Taute and McQuitty, 2004).

The use of negative appeals, if communicated effectively to trigger appropriate emotions, can be a valuable approach in sustainability communication, particularly when aiming to promote compliance with uncomfortable measures. However, *how* these messages and measures are communicated is crucial for achieving their desired outcomes. If the message comes across as excessively moralizing, recipients may feel judged, leading to self-protective behavior and a decreased willingness to take action (Brennan and Binney, 2010).

Addressing the challenge of finding the proper emotional appeal, stimulating the desired emotion and avoiding moralization is an ongoing unresolved issue in sustainability communication. New models and strategies need to be developed to effectively tackle this challenge and meet the complexities of communicating the inconvenient truth of sustainability.

5. Discussion

As a crucial discipline in society, communication is responsible for addressing contemporary issues and contributing to responsible societal development. Through our critical literature review and content analysis, we aimed to provide a comprehensive overview of existing approaches concerning three key aspects: (1) effectively communicating the inconvenient truth of sustainability in an era of scientific mistrust, (2) identifying and addressing unresolved problems and challenges and (3) suggest further communication strategies to optimize sustainability communication while counteracting misinformation through (targeted) communication. Our findings reveal numerous suggestions and current approaches that can enhance sustainability communication, including fostering dialogue and stakeholder engagement, employing framing and storytelling techniques, using different

emotional appeals to connect with audiences and promoting transparency and openness when discussing uncertainty and complex, challenging topics. These findings provide valuable insights for enhancing sustainability communication efforts.

Nonetheless, the literature review also highlights unresolved issues in existing sustainability communication concepts and methods. It emphasizes that a "one size fits all" approach is inadequate for this field. Standardization, which may be successful in other areas such as PR and marketing, does not yield the same results in sustainability communication. The review indicates that recipients' responses vary greatly depending on different variables such as background, attitudes, knowledge, education, beliefs and personal traits. What may motivate and engage one person could lead to self-protection and rejection in others. Therefore, stakeholder orientation and a differentiated communication strategy should be considered a *condition sine qua non* for (effective) sustainability communication. This in turn would imply the necessity to integrate, complement and adapt an interpersonal communication approach on a macro level. Currently, there is a lack of established knowledge and research on this specific approach. Therefore, further investigation and research are required to explore and understand the implications and potential of integrating interpersonal communication strategies into sustainability communication on a macro level.

In addition – as described above – the turn toward sustainable development means and implies *de facto* also negative (personal) impacts, such as renunciations, restrictions and cost increases. Thus, communicating restricting and unpleasant measures as temporary and short-term necessities with the promise of a positive output – often the return to "normalcy" – does not correspond to the (whole) truth. To enhance transparency and trust, it is crucial to incorporate *honesty* as a fundamental element in sustainability communication. By openly addressing both the positive and negative aspects of sustainability, communicators can establish credibility and foster trust among recipients.

In conclusion, the presented analysis offers the opportunity to formulate some implications for (1) theory and research, (2) teaching and education and (3) practice. The findings indicate that current communication approaches are insufficient for effectively communicating the inconvenient truth of sustainability in an era of scientific mistrust. This highlights the need for a transformative shift in communication science to address the challenges and unresolved issues in sustainability communication. New transdisciplinary research is required to analyze these problems, develop innovative solutions and explore alternative approaches. The analysis presented in this study serves as a valuable starting point for future research and theory development in sustainability communication, guiding scholars towards exploring new avenues and interdisciplinary perspectives.

Second, there is a need for a reevaluation of education in the field of sustainability communication, particularly in terms of preparing future sustainability (communication) scientists. This involves integrating sustainability concepts into media and communication studies curricula, as well as incorporating communication aspects and theories into sustainability science curricula (Karmasin and Voci, 2021; Voci and Karmasin, 2021). By promoting this mutual integration, the level of professionalism in sustainability communication can be significantly enhanced. Such an approach would greatly contribute to the development of new and effective modes, theories and techniques for sustainability communication. Recognizing that how information from sustainability science is communicated is as important as the content itself, this educational transformation would support the research and practice of impactful sustainability communication. In summary, the integration of sustainability concepts and communication principles in the education of various professionals, including politicians, journalists, educators, scientists and communication professionals, would have significant practical implications. It would equip them with innovative and effective approaches to engage in communication *for* sustainability. By addressing the inconvenient truth and fostering societal transformation

towards sustainable development, this educational shift would contribute to the further development of the sustainability field and enhance *sustainability literacy*.

Notes

1. With this expression, we refer to the documentary film directed by Davis Guggenheim in 2006, "An Inconvenient Truth".
2. Newig *et al.* (2013) differentiate between the communication *of*, *about*, and *for* sustainability. Communication of sustainability (CoS) indicates a mono-directional communication process, where experts – such as scientists, educators, journalists – provide information about sustainability-related issues to inform and educate the general public. Communication about sustainability (CaS) stands for a communicative process, where information, opinions, and interpretations on sustainability and its related issues are exchanged and discussed horizontally, instead, to establish a discursive debate on sustainability and create a common understanding of it. In contrast, communication for sustainability (CfS) focuses on the normative aspect of sustainable development. Here communication is not just about providing sustainability-related information and/or raising awareness. Instead, the aim of CfS is to initiate and facilitate social change towards sustainable development.
3. It must be specified here that this categorization takes, of course, into consideration previous research in the context of audience segmentation and climate change (e.g. Leiserowitz *et al.* (2021) "Global Warming's Six Americans", Metag *et al.* (2017) "Global Warming's five Germanys"; or Morrison *et al.* (2013, 2018) "Six Australians", as well as research by Haltinner and Sarathchandra, 2021; Lamb *et al.*, 2020; Chryst *et al.*, 2018; Haltinner and Sarathchandra, 2018; Capstick and Pidgeon, 2014) – as they were part of the critical literature review sample. However, the stakeholder's characteristics of previous research were rearranged and reassembled in line with the research aims and to answer the research questions.
4. For obvious reasons, health communication has to focus on how to communicate bad news best (e.g. Rossmann and Hastall, 2019; Gillotti, 2014). The priority here is to bring bad news to patients as effectively and gently as possible (e.g. Samal, 2019) and, where possible, communicate with an optimistic future scenario, i.e. the perspective of healing (Beukeboom, 2019). However, the communication of such news mainly takes place in a doctor-patient setting, i.e. in the context of interpersonal communication. Therefore, practitioners' techniques from this health communication section are inapplicable to sustainability communication since it occurs mainly on a societal level.
5. The focus here is on communicating bad news effectively and efficiently, mainly concerning dismissal and/or economic losses within a company. Previous research has dealt with this question to mitigate the recipients' reaction and improve the acceptance of its consequences. The aim is to achieve a total acceptance or resignation that does not trigger further action (e.g. Elliott *et al.*, 2018; Bies, 2013). Thus, this approach seems useless for sustainability communication, which on the contrary, aims to steer behavior toward sustainability.

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