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Unveiling Green Facades: Exploring the Confluence of Greenwashing and Fake News

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Unveiling Green Facades: Exploring the Confluence of Greenwashing and Fake News

Research Paper

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Abstract. In the global pursuit of sustainability, the role of private sector capital is pivotal, necessitating a shift in financial flows towards sustainable initiatives. However, the proliferation of greenwashing undermines trust among investors and consumers alike. The detection and mitigation of greenwashing demand robust automated systems. Nonetheless, this endeavor is challenging due to ambiguous definitions, limited availability of high-quality data, and the qualitative nature of sustainability claims. In contrast, the field of fake news detection, facing similar obstacles, has undergone substantial methodological evolution. Employing a systematic mapping approach, we link existing types of greenwashing and fake news, unveiling similarities and distinctions. Our findings contribute to the linking of these two fields by establishing the conceptual foundation to transfer methodological advancements, such as detection algorithms, from fake news literature to the realm of greenwashing. Furthermore, we outline promising research avenues in the domains of greenwashing, fake news and their intersection.
Keywords: Greenwashing, Fake News, Detection, Disinformation, Sustainable Finance

1 Introduction

Addressing climate change and advancing sustainability necessitates substantial investments both now and in the future, surpassing the financial capacity of the public sector alone (IPCC, 2022). Mobilizing private sector capital, involving investors and consumers, becomes essential for channeling sufficient financial resources toward sustainable initiatives (EU, 2018). Despite encouraging trends in both the capital market (ETFGI, 2022) and consumer segments (Simon-Kucher, 2022), the phenomenon of greenwashing emerges as a barrier to achieving these goals (Delmas and Burbano, 2011; Yang et al., 2020; EU, 2023). Given the early stages of greenwashing detection literature, this work aims to link the more advanced fake news research with the greenwashing literature. By providing a conceptual basis, we enable future research to transfer established findings, such as detection methods, from the realm of fake news to greenwashing.

Greenwashing, the deceptive practice of presenting an overly positive image of an organization's sustainability performance (Lyon and Montgomery, 2015), erodes trust among investors and consumers, hindering overall progress towards sustainability (Yang et al., 2020; H. Wang, Ma, and Bai, 2020; Gatti, Pizzetti, and Seele, 2021).

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Some (in)famous examples include the "save the towel movement" in the hotel industry (Orange and Cohen, 2010) or the Volkswagen emission controlling testing procedures in 2015 (Jung and Sharon, 2019). The detrimental consequences extend to potential stakeholders, consumers, and society at large, outweighing any short-term gains for existing stakeholders (Yang et al., 2020). While greenwashing is not a novel phenomenon (Lyon and Montgomery, 2015), its escalation in recent years poses a critical challenge (RepRisk, 2023). Particularly, in both Europe and the Americas, the banking and financial services sectors saw a 70% increase in the number of climate-related greenwashing incidents in 2023, compared to the year prior (RepRisk, 2023).

Addressing greenwashing and its widespread repercussions necessitates the development of automated detection systems (Oppong-Tawiah and Webster, 2023). However, this is a complex effort due to the absence of standardization, transparency, and accessible data (In and Schumacher, 2021; Gatti, Seele, and Rademacher, 2019). Presently, the main data sources are self-published data by businesses (e.g., sustainability reports, estimated emissions) or third-party ratings from data vendors (e.g., MSCI, LSEG). The qualitative nature of sustainability claims makes their objective assessment and detection of greenwashing even more difficult (Seele and Gatti, 2017). Therefore, there is a critical need to develop methods capable of navigating the absence of an objective ground truth and working with available data sources.

Furthermore, there are different types of greenwashing that also necessitate different detection methods. For instance, an algorithm designed to detect *empty green claims*, which are "statements that organizations are realistically unable to carry out" (Siano et al., 2017, p.28), is unlikely to effectively detect more subtle types of greenwashing such as visuals used for *misleading* (Cervellon and Shammas, 2013). An example for this behavior is a company adopting a green color palette for its corporate design without improving their actual sustainability efforts.

Nevertheless, researchers have started to develop concepts and methods for greenwashing detection. The methods found in literature tackle two different steps of the process. The initial step focuses on detecting claims associated with sustainability in different types of text (e.g., business reports, Twitter posts), a task already known for its complexity, as evidenced by the breadth of existing approaches (Luccioni and Palacios, 2019; Luccioni, Baylor, and Duchene, 2020; Leippold et al., 2022; Woloszyn, Kobti, and Schmitt, 2021; Bingler et al., 2022; Moodaley and Telukdarie, 2023; Stammbach et al., 2023).

The second step involves evaluating these claims for greenwashing practices, an area where research is still evolving. For instance, Makrenko, Makarenko, and Rubanov (2023) employ a partial least squares structural equation model to identify greenwashing in sustainability reports, while Oppong-Tawiah and Webster (2023) use linguistic cues to discern deceptive environmental statements in tweets. Notably, Oppong-Tawiah and Webster (2023)'s method circumvents the need for a ground truth, thereby advancing greenwashing detection literature where obtaining a reliable ground truth is burdensome or even impossible. Furthermore, Oppong-Tawiah and Webster (2023) also created the link between greenwashing and fake news. However, they do not discuss the various types of greenwashing (Siano et al., 2017) and their relation to the different types of fake news. Fake news, again being a broad term, usually covering different forms of

mis- and disinformation (Wardle and Derakhshan, 2017). Similar to the greenwashing phenomenon, there are however, a multitude of different types of fake news that can vary substantially, for example, in terms of veracity, intent, or medium. A *photo manipulation* (Tandoc, Lim, and Ling, 2018), for instance, is very different in all three of these dimensions from *citizen journalism* (Downie and Schudson, 2009). Given this multitude of different forms of fake news and greenwashing, a transfer of existing methods is not trivial and first needs a conceptual linkage that we aim to contribute with this study.

Given the early stage of greenwashing detection research, a pragmatic approach involves delving into related fields to identify possible solutions that can be further developed and adapted. Given the more evolved literature on fake news detection (Shu et al., 2017; Oshikawa, Qian, and W. Y. Wang, 2018; Zhou and Zafarani, 2020), our study focuses on establishing a connection between different types of greenwashing and fake news by examining the formal classification and conceptualization of both phenomena, leaving the actual transfer of detection methods for future work. Hence, we pose the following research question:

What types of greenwashing can be matched to established concepts from the fake news literature?

To address this question and consolidate the ongoing discourse, we conduct a literature-based analysis following the three-step approach of a systematic mapping study by Petersen, Vakkalanka, and Kuzniarz (2015). Systematic mapping studies differ from systematic reviews (see e.g. Webster and Watson (2002) and Brocke et al. (2009)) in various aspects (Petersen, Vakkalanka, and Kuzniarz, 2015; Kitchenham, Budgen, and Brereton, 2010): The research goal is more general, the search terms are derived from a whole topic area instead of specific topics, the search is less stringent and an assessment based on the quality of the underlying papers is typically not a requisite. The results of a mapping study is a collection of papers that are aggregated in different categorizations. In this study we aim to find different types of fake news and greenwashing in order to map them to each other. Our research goal is thus exploratory in nature and results in a categorization of these types and the corresponding articles. Therefore, we consider the use of the systematic mapping study method appropriate in this context.

We contribute to the greenwashing detection literature by offering a formal conceptualization of the interplay between fake news and greenwashing. We aim to systematize the deceiving techniques used and provide a clearer picture of when and where it occurs. This endeavor not only facilitates future research in selecting applicable fake news detection methods as a starting point for greenwashing detection but also provides the necessary conceptual foundation and rationale for doing so. Additionally, we contribute to the greenwashing and fake news literature by offering promising research avenues that warrant exploration in the future and by proposing *smearing* and *adversarial attack* as two new types of greenwashing.

2 Research Design

Our approach to map the greenwashing and fake news methods involves establishing a connection between these two phenomena through a comparative analysis of the different forms of misleading in both fields. To ensure rigor and transparency, we align

our analysis with the systematic mapping approach, and adopt the three-step procedure (planning, conducting, reporting) suggested by Petersen, Vakkalanka, and Kuzniarz (2015).

To address our overarching research question, we break it down into the following three standalone questions, to adopt a more systematic approach in the search phase of our study:

RQ1: What types of fake news are established in literature?
RQ2: What types of greenwashing are established in literature?
RQ3: Which types of greenwashing have a counterpart in fake news literature?

As indicated by these questions, we aim to find a representative list of types of fake news and greenwashing for subsequent comparison. Therefore, we need to conduct two separate searches, one for the fake news literature and one for the greenwashing literature, in preparation for the mapping. We focus our review on publications within the fields of information systems (IS), finance, business, and sustainability, with a specific emphasis on secondary and tertiary sources that cover multiple conceptualizations simultaneously. First, we refine our search topic by incorporating related terms for fake news, namely information disorder, disinformation, misinformation and malinformation (Wardle and Derakhshan, 2017). Although greenwashing is inherently specialized, it is occasionally referred to as greenwash in literature (Lyon and Montgomery, 2015). Next, we construct a search phrase that incorporates the topic-related terms along with the descriptors of typology, taxonomy, and categorization to guide our search towards the secondary and tertiary literature.

For our search strategy we initiated a search across reputable databases, including Web of Science, Scopus, AISeL, Emerald and Wiley. These databases are recognized for hosting high-quality research as well as the most recent publications in the related disciplines. Employing the search string "(fake news OR information disorder OR disinformation OR misinformation OR malinformation) AND (typolog* OR taxonom* OR categor*)" on titles, we focus exclusively on articles published post January 1, 2010, given the novelty of the topic in tandem with advancements in digital technologies fostering fake news. This initial search yielded 25 publications (as of November 11, 2023), with one duplicate. Conducting an initial screening based on titles, abstracts, and keywords, we retained nine papers covering various forms of single or multiple types of fake news. Subsequently, we expanded our database search using forward and backward search to further enrich our sample. This resulted in 19 articles that contribute to a comprehensive understanding and collection of fake news categories. Replicating this process for the greenwashing literature, utilizing the search string "(greenwash*) AND (typolog* OR taxonom* OR categor*)", we initially identified four articles post duplicate removal. Augmenting our findings through the forward and backward search expanded our data set to 16 articles.

Two independent researchers conducted the data extraction and classification process. After one researcher finalized a first version of the extraction and classification, the second researcher reviewed the results and a consensus meeting was held to clarify open discussion points. Fitting our research goals, we use topic-specific classification, starting with the overarching concepts of disinformation, misinformation, and malinformation (Wardle and Derakhshan, 2017; Ireton and Posetti, 2018; Oppong-Tawiah

and Webster, 2023). We populate these categories by adding corresponding types of fake news extracted from the reviewed literature. This step also includes consolidating possible differences in definitions or naming conventions. In the second step we extract the contents of the identified greenwashing literature, synthesise the information and draw comparisons between the types of greenwashing and fake news.

3 Results

Our analysis aligns with the overarching conceptualization of disinformation, misinformation, and malinformation in contemporary literature (Wardle and Derakhshan, 2017; Ireton and Posetti, 2018; Oppong-Tawiah and Webster, 2023). In a bipartite distinction, the validity is characterized as true and false and the intention as good intention or harmful intention. True information denotes valid information devoid of harmful intent, whereas malinformation is typically accurate but disseminated with an intention to harm. Disinformation and misinformation entail false information, with harmful intent in the former and an absence of harmful intent in the latter. **Table 1** illustrates this 2x2 matrix.

Table 1. Information disorder matrix, based on Wardle and Derakhshan (2017)

	True	*False*
Good Intent	True information	Misinformation
Harmful Intent	Malinformation	Disinformation

Our categorization of various fake news examples into these three broader classifications of disinformation, informed by related literature (Oppong-Tawiah and Webster, 2023; Rahmanian, 2023; Zhou and Zafarani, 2020; Tandoc, Lim, and Ling, 2018; Meel and Vishwakarma, 2020), is presented in **Table 2** as a response to *RQ1*. Similarly, **Table 3** answers *RQ2* and shows the conceptualizations that we extracted from the greenwashing literature. Finally, **Figure 1** illustrates which types of greenwashing we were able to map to the existing fake news literature thus solving *RQ3*.

In the following, we describe the different conceptualizations of greenwashing and fake news to create a common understanding and to substantiate the mapping between the various types of greenwashing and fake news. For the sake of parsimony we only provide enough explanation to understand our rationale for the categorization and mapping. For more elaborate definitions and examples we encourage the reader to consult the literature cited in **Tables 2** and **3**.

3.1 Disinformation Conceptualizations

For the disinformation category we found two types of fake news that have counterparts in the greenwashing literature. *News fabrication* constitutes information that has no factual basis but is intentionally created to mislead and obfuscated to imitate legitimate sources (Rubin, Chen, and Conroy, 2015). Clearly corresponding types of greenwashing

Table 2. Aggregation of extant types of fake news and related literature. Names printed in bolt have corresponding types of greenwashing.

Information Disorder	*Fake News Types*	*Articles*
Disinformation	**News fabrication / Deceptive news/ False news**	Rubin, Chen, and Conroy (2015), Wardle and Derakhshan (2017), Tandoc, Lim, and Ling (2018), Ireton and Posetti (2018), Zhou and Zafarani (2020)
	Imposter content	Ireton and Posetti (2018)
	Hoax	Rubin, Chen, and Conroy (2015), Molina et al. (2021)
	Photo manipulation	Tandoc, Lim, and Ling (2018), Ireton and Posetti (2018)
	Opinion spam	Jindal and Liu (2008)
Misinformation	Conspiracy theory	Vicario et al. (2016), Ahmed et al. (2020)
	Satire/ Humorous fakes/ Parody	Rubin, Chen, and Conroy (2015), Allcott and Gentzkow (2017), Tandoc, Lim, and Ling (2018), Ireton and Posetti (2018), Molina et al. (2021)
	Pseudosience	Hansson (2017)
	Misreporting	Molina et al. (2021)
	Citizen journalism	Downie and Schudson (2009), Molina et al. (2021)
Malinformation	**Cherry-picking**	Asudeh et al. (2020)
	Rumor	Rojecki and Meraz (2016), Shin et al. (2018)
	Trolling	Bishop (2015), Shin et al. (2018)
	Clickbait/ False connection	Ireton and Posetti (2018), Meel and Vishwakarma (2020)
	Sensationalism	Molek-Kozakowska (2013), Molina et al. (2021)
	Hidden advertising/ Propaganda	Tandoc, Lim, and Ling (2018), Molina et al. (2021)

are *sin of fibbing* (TerraChoice, 2010) or *empty green claims and policies* (Ramus and Montiel, 2005) the only difference lies in the topic of sustainability in the case of greenwashing, while no such restriction is made in the case of fake news. Decoupling practices, such as *structure/activities decoupling* or *means/end decoupling*, as well as

cheap talk, sin of no proof and *implied superiority* can also be matched to this type of fake news if we assume a company to deliberately engage in these methods. They describe scenarios where claims about goals or activities are stated even though the company is in reality unable or unwilling to fulfill these claims (TerraChoice, 2010; Lyon and Montgomery, 2015).

For the rest of the disinformation category, we did not find any matching types of greenwashing in extant literature. *Imposter content* refers to content distributed under misuse of the name or logo of often reputable journalists or organizations without their consent (Ireton and Posetti, 2018). A related type from the greenwashing literature is *astroturf lobbying* (Lyon and Maxwell, 2004). In both instances, the apparent source of the information is altered to create more trust with the audience. The difference is that the source in the *astroturf lobbying* case is aware of what they are doing and often receive funding for it, whereas in the case of *imposter content*, the source is often not even aware that their reputation is impermissibly used.

Hoaxes are similar to less problematic issues such as practical jokes, but tend to be more serious and elaborate fabrications that can also be aimed at causing harm (Rubin, Chen, and Conroy, 2015).

Photo manipulation (Tandoc, Lim, and Ling, 2018) can be another strong form of disinformation. It is the intentional manipulation and alteration of visual media with the aim to deceive the audience. The advancements in generative artificial intelligence that greatly facilitate the creation of made up visuals makes this form of fake news one of the growing threats for information credibility in the future.

Opinion spam is mainly found in online retailing in the form of fake reviews for products or brands (Jindal and Liu, 2008).

3.2 Misinformation Conceptualizations

We did not map any types of greenwashing to misinformation. In **Section 3.5** we go into more detail about the rational behind this decision. *Conspiracy theories* simplify reality with often obscure rationals. They intentionally leave room for uncertainty that allows their supporters to ignore evidence against their theories (Vicario et al., 2016).

Satire, humorous fakes and *parody* are types of misinformation that use humor and exaggerations as a means to transport information. This can lead to inaccurate statements or stories, however, the authors do not try to disguise as serious news outlets but are usually clear about their intent to entertain rather than to accurately inform (Rubin, Chen, and Conroy, 2015).

As the name suggests, *pseudoscience* describes a type of fake news that is closely connected to the realm of science. However, the information provided here is unreliable and not rooted in scientific principles. Although there is usually no intention to harm or deceive, followers often try to convince others of their views (Hansson, 2017).

Misreporting illustrates the archetype of misinformation. False information is spread unintentionally, often from otherwise reputable sources (Molina et al., 2021).

Citizen journalism is the reporting of news worthy events trough the lens of non-professionals. It often lags the rigor and stylistic form of professional journalism which can lead to incorrect or biased reporting (Downie and Schudson, 2009).

3.3 Malinformation Conceptualizations

For the malinformation category we found suitable types of greenwashing in extant literature for *Cherry-picking*, which refers to the deliberate passing on of information that is helpful to a particular position, while omitting facts that support opposing arguments (Asudeh et al., 2020). *Selective disclosure, sin of hidden trade-off, sin of vagueness, sin of irrelevance, sin of lesser of two evils* and *incomplete comparisons* are related types from the greenwashing literature. All of these methods have in common that critical information is kept from the recipients that would be necessary to form an unbiased opinion about the content (TerraChoice, 2010; Lyon and Montgomery, 2015).

For the remaining types, there are no greenwashing counterparts available in the existing literature. However, for *rumors* and *trolling* we propose two new types of greenwashing in **Section 3.5**.

Rumors have an unclear level of truthfulness when they start out but might turn out true, false, or, as it is often the case, somewhere in between. While rumors can also develop without intent, they can be spread deliberately with either the intent to harm an opposing side or to promote the spreaders' own interests (Rojecki and Meraz, 2016).

Trolling is mainly present online and describes offensive messages usually disseminated to provoke conflict in communities. The motivation behind it can be amusement for the "troll" or weakening of an opposing side or community (Bishop, 2015).

False connection or clickbait describes a disconnect between (often attention-grabbing) headlines or visuals and the actual content (Meel and Vishwakarma, 2020).

Sensationalism is used to manipulate audiences' opinion on a specific matter. It is often connected to alarming headlines to trigger human instincts. One-sided reporting, implied information and divisive information are typical characteristics of sensationalism (Molek-Kozakowska, 2013).

Hidden advertising describes the practice of producing seemingly informative and unbiased content with the hidden goal of advertising, e.g., a product or company. Even though the information is often true, it can be biased, and by disguising the actual source and masquerading as unbiased content, attempts are made to deceive the audience and create (unwarranted) trust (Tandoc, Lim, and Ling, 2018). *Propaganda* is similar to *hidden advertising*, however, here the motives are often political instead of financial (Molina et al., 2021).

3.4 Other Types of Greenwashing

Our analysis indicates that multiple forms of greenwashing can be attributed to a corresponding form of fake news, underlining the connection between these two deception types. Nevertheless, instances arise where a close connection is not apparent.

Misleading (Cervellon and Shammas, 2013; Matejek and Gössling, 2014; Siano et al., 2017) uses written text and visual communication to create a skewed image. While it may fit the *fabricated news* type, given its often strategic and persistently built narrative, we argue that it goes one step further and therefore falls in a category of its own.

The *Halo effect* (Russo, Metcalf, and Stephens, 1981; Lyon and Montgomery, 2015) describes how an audience can infer a positive overall image of a product or company based on individual communicated attributes. While this effect can of course also be

misused, e.g. through *cherry-picking*, it can also occur without malicious intent on the part of the company, as it is mainly based on a human behavioral bias. For types like *pooling* (Delmas and Burbano, 2011), *costly state falsification* (Hamilton and Zilberman, 2006), *sin of worshipping false labels* (TerraChoice, 2010), and *deceptive manipulation* (Siano et al., 2017), no matching types were identified in the fake news literature. Here, the main difference lies in the greater emphasis on underlying actions as opposed to mere communication. Investigating whether these deceptive methods manifest in other contexts from a fake news perspective requires further exploration.

3.5 Further Observations

While our analysis reveals connections between many types of greenwashing and fake news, distinctions between the two fields surface. Notably, a primary difference involves the higher dependence on underlying actions and often more future-oriented claims in greenwashing instances compared to types usually regarded in the fake news literature. For example, a *decoupling* claim, such as promising to reduce emissions to zero, may be made sincerely and with good intent. However, if the company fails to fulfill this commitment, the claim transforms into greenwashing. In such cases, the determination of intent becomes crucial, distinguishing between disinformation (i.e., intent-driven false news) and misinformation (i.e., unintentional misreporting). However, given the competences and resources of especially large companies that should enable them to prevent most unwanted mishaps (Watkins and Bazerman, 2003), we would argue to lean towards assuming intent rather than unawareness, when in doubt. This also explains the lack of greenwashing types from the misinformation category in our mapping.

Types of Greenwashing / Fake News	News Fabrication / Deceptive News / False news	Imposter content	Cherry-picking	Trolling	Rumor
Sin of fibbing/ Empty green claims and policies	X				
Structure/ Activities decoupling	X				
Means/ End decoupling	X				
Cheap talk	X				
Sin of no proof	X				
Implied superiority	X				
Astroturf lobbying		X			
Selective disclosure			X		
Sin of hidden trade-off			X		
Sin of vagueness			X		
Sin of irrelevance			X		
Sin of lesser of two evils			X		
Incomplete comparisons			X		
Smearing				X	
Adversarial attack					X

Figure 1. Mapping between types of fake news and greenwashing based on existing literature

Recognizing that real-world claims often fall between complete falsity and absolute truth (Meel and Vishwakarma, 2020) and that discerning the intent behind a claim or

Table 3. Aggregation of extant types of greenwashing and related literature. Names in bold have corresponding types of fake news. Newly proposed types of greenwashing are labeled with *.

Greenwashing Type	*Articles*
Sin of fibbing/ Empty green claims and policies	Ramus and Montiel (2005), TerraChoice (2010)
Structure/ Activities decoupling	Meyer and Rowan (1977), Lyon and Montgomery (2015), Siano et al. (2017)
Means/ End decoupling	Bromley and Powell (2012), Lyon and Montgomery (2015), Siano et al. (2017)
Cheap talk/ Sin of no proof/ Implied superiority	Snyder (1989), Farrell and Rabin (1996), TerraChoice (2010), Lyon and Montgomery (2015), Siano et al. (2017)
Astroturf lobbying	Lyon and Maxwell (2004), Lyon and Montgomery (2015)
Selective disclosure/ Sin of hidden trade-off/ Sin of vagueness/ Sin of irrelevance	TerraChoice (2010), Lyon and Maxwell (2011), Lyon and Montgomery (2015), Siano et al. (2017)
Incomplete comparisons	Shimp (1978), Lyon and Montgomery (2015), Siano et al. (2017)
Sin of lesser of two evils	TerraChoice (2010), Siano et al. (2017)
Misleading	Cervellon and Shammas (2013), Matejek and Gössling (2014), Siano et al. (2017)
Halo effect	Russo, Metcalf, and Stephens (1981), Lyon and Montgomery (2015), Siano et al. (2017)
Pooling	Delmas and Burbano (2011), Lyon and Montgomery (2015)
Costly state falsification	Hamilton and Zilberman (2006), Siano et al. (2017)
Sin of worshipping false labels	TerraChoice (2010), Siano et al. (2017)
Deceptive manipulation	Siano et al. (2017)
Smearing	*
Adversarial attack	*

action is often challenging, especially for external observers (Zhou and Zafarani, 2020), it is clear that the extracted types do not necessarily have definite boundaries neither need to be mutually exclusive in reality. For example, a claim that is untrue and issued with intent to harm or deceive is usually declared as *fabricated news*, however, if the intent is determined as insufficient, one might instead label it as *misreporting*. Furthermore, a

rumor might also be labeled as *fabricated news* or both, depending on the level of truth that it inherits. These ambiguities present opportunity for future research in the fake news literature. A more unified taxonomy along with clear definitions and naming of the various types is needed. Furthermore, the practical problem of identifying intent remains an open question to be addressed. Future research might look at practices in criminal law (Fletcher, 2019; Dam, 2013), where there exist a similar problem to decide between intent and negligence, to find solutions for this conundrum.

Figure1 shows that most types of greenwashing can be categorized into only three types of fake news. We argue that this is mainly due to the focus of the greenwashing literature currently being on corporate communications, whereas the fake news literature covers a broader spectrum, including, for example, the political and individual spheres. We contend that given the high reputational risk associated with the spread of fake news and greenwashing, companies could be limiting themselves to methods where they can defend themselves by claiming to not have disseminated any lies (i.e., *cherry-picking* and *astroturf-lobbying*) or by denying intent (i.e., *fabricated news*).

Similarly, literature predominantly examines companies enhancing their own image to appear greener, however, instances also exist where an opposing side is denigrated to achieve a similar objective (Samoilenko and Cook, 2023). Expanding the focus beyond corporations as the primary practitioners of greenwashing presents another promising research avenue. When regarding *trolling* and *smearing* from the fake news types some examples come to mind that we call *smearing* and *adversarial attack*. A prominent example for *smearing* is Elon Musk twittering on May 18, 2022 that "ESG is a scam." and that "It has been weaponized by phony social justice warriors." after Tesla was removed from the S&P 500 ESG index (Kerber and Jin, 2022). This behavior is very similar, for example, to former President Donald Trump's fake news trolling campaigns on Twitter (Cillizza, 2018). The *adversarial attack* shows, for example, in proponents of combustion engines who give bad press to electric vehicles by calculating their total emissions less favorably than generally accepted (Lienert, 2021). Since we were not able to find these forms of deception in existing greenwashing literature, we did not list any exemplary sources for these cases in **Table 3**. Notably, in both examples it is not an organization engaging in the greenwashing behavior but third parties (albeit with varying degrees of association) that carry out the greenwashing. We are convinced that more examples and forms of greenwashing can be found by future studies by further exploring the connection between the fake news and greenwashing literature.

4 Discussion

Our findings have several implications for researchers and practitioners in the field of Information Systems (IS). The primary motivation behind this study was to establish a conceptual foundation that facilitates the transfer of methodologies from fake news detection to greenwashing detection. By leveraging existing reviews (e.g., Shah and Ganatra (2022)) and approaches targeting specific types of fake news (e.g., Rubin, Chen, and Conroy (2015)), our mapping now enables this methodological transfer. Conducting a literature review that categorizes existing fake news detection approaches based on

the type of fake news they aim to detect would further enhance this transferability to greenwashing detection.

Promising technologies for these applications include Natural Language Processing for analyzing text-based communications and Computer Vision for image-based content. The recent advancements in Transformers, such as GPT-4, show significant promise in handling a wide variety of fake news and greenwashing types. Additionally, given the diverse nature of greenwashing and its communication channels, a comprehensive research avenue would be to integrate multiple methods and data sources. This could include analyzing corporate reports, social media activity, and advertisements at the same time to create a more holistic assessment of a company's greenwashing tendencies. Following these research avenue can further enhance the contribution of the IS field towards more transparent and sustainable economy in the future.

Beyond detection, our study has implications for the conceptual frameworks of fake news and greenwashing. Although various taxonomies and categorizations exist for both fields, there is no widely agreed-upon comprehensive overview. Considering their close relationship, it would be beneficial to include greenwashing within fake news taxonomies. Both fields are continuously evolving, with new forms of deception emerging. For instance, AI-generated hallucinations could be considered a new type of fake news. Future research should continuously explore new forms of fake news and greenwashing, developing a more comprehensive and conclusive framework to categorize these diverse phenomena.

5 Conclusion

This study bridges the gap between greenwashing and fake news literature by providing a conceptual mapping between different types of fake news and greenwashing. This linkage facilitates the transfer of existing detection methodologies from fake news to greenwashing. Our systematic mapping demonstrates that many types of greenwashing can be linked to fake news, allowing the adaptation of techniques such as Natural Language Processing (NLP) and Computer Vision used in fake news detection to identify deceptive sustainability communications. Furthermore, we show that both the fake news and greenwashing literature needs to be extended continuously since new types of both phenomenons keep emerging.

Greenwashing presents a significant challenge,in sustainable finance. It undermines the ability of investors and consumers to discern and support companies genuinely committed to sustainability initiatives. Yet, the identification of greenwashing instances remains a formidable challenge and often still requires labor-intensive manual investigation. Improving and finding new ways for greenwashing detection thus leads to more transparency and accountability in the market.

References

Ahmed, Wasim et al. (2020). "COVID-19 and the 5G conspiracy theory: Social network analysis of twitter data". In: *Journal of Medical Internet Research* 22 (5).

Allcott, Hunt and Matthew Gentzkow (2017). "Social media and fake news in the 2016 election". In: *Journal of Economic Perspectives* 31 (2), pp. 211–236.

Asudeh, Abolfazl et al. (2020). "On detecting cherry-picked trendlines". In: *Proceedings of the VLDB Endowment*. Vol. 13. VLDB Endowment, pp. 939–952.

Bingler, Julia Anna et al. (2022). "Cheap talk and cherry-picking: What ClimateBert has to say on corporate climate risk disclosures". In: *Finance Research Letters* 47.

Bishop, Jonathan (2015). "The psychology of trolling and lurking: The role of defriending and gamification for increasing participation in online communities using seductive narratives". In: IGI Global, pp. 162–179.

Brocke, Jan Vom et al. (2009). "Reconstructing the Giant: On the Importance of Rigour in Documenting the Literature Search Process". In: *ECIS 2009 Proceedings*.

Bromley, Patricia and Walter W. Powell (2012). "From Smoke and Mirrors to Walking the Talk: Decoupling in the Contemporary World". In: *Academy of Management Annals* 6 (1), pp. 483–530.

Cervellon, Marie-Cécile and Lara Shammas (2013). "The Value of Sustainable Luxury in Mature Markets: A Customer-Based Approach". In: *Source: The Journal of Corporate Citizenship* (52), pp. 90–101.

Cillizza, Chris (2018). *Donald Trump, Internet troll*. URL: https://edition.cnn.com/2018/11/28/politics/donald-trump-internet-troll/index.html (visited on 11/16/2023).

Dam, Cees Van (2013). "225Intention and Negligence". In: *European Tort Law*. Oxford University Press. ISBN: 9780199672264.

Delmas, Magali A. and Vanessa Cuerel Burbano (2011). "The drivers of greenwashing". In: *California Management Review* 54 (1), pp. 64–87.

Downie, Leonard and Michael Schudson (2009). "The Reconstruction of American Journalism". In: *Columbia Journalism Review*.

ETFGI (2022). *Report on Global ESG ETF Inflows*. URL: https://etfgi.com/news/press-releases/2022/12/etfgi-reports-esg-etfs-listed-globally-gathered-us826-billion-net (visited on 11/16/2023).

EU (2018). *Final Report 2018 by the High-Level Expert Group on Sustainable Finance - Financing a sustainable European economy*.

— (2023). *Proposal for a directive of the European Parliament and of the Council on substantiation and communication of explicit environmental claims (Green Claims Directive)*. URL: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2023%3A0166%3AFIN.

Farrell, Joseph and Matthew Rabin (1996). "Cheap Talk". In: *Journal of Economic Perspectives* 10, pp. 103–118.

Fletcher, George P. (2019). "175C7Intention vs. Negligence". In: *The Grammar of Criminal Law: Volume Two: International Criminal Law*. Oxford University Press. ISBN: 9780190903572.

Gatti, Lucia, Marta Pizzetti, and Peter Seele (2021). "Green lies and their effect on intention to invest". In: *Journal of Business Research* 127, pp. 228–240.

Gatti, Lucia, Peter Seele, and Lars Rademacher (2019). "Grey zone in – greenwash out. A review of greenwashing research and implications for the voluntary-mandatory transition of CSR". In: *International Journal of Corporate Social Responsibility* 4 (1).

Hamilton, Stephen F. and David Zilberman (2006). "Green markets, eco-certification, and equilibrium fraud". In: *Journal of Environmental Economics and Management* 52 (3), pp. 627–644.

Hansson, Sven Ove (2017). "Science denial as a form of pseudoscience". In: *Studies in History and Philosophy of Science Part A* 63, pp. 39–47.

In, Soh Young and Kim Schumacher (2021). "Carbonwashing: A New Type of Carbon Data-related ESG Greenwashing". Working Paper. URL: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3901278 (visited on 11/01/2023).

IPCC (2022). *Sixth Assessment Report - Mitigation of Climate Change*. URL: https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf (visited on 11/01/2023).

Ireton, Cherilyn and Julie Posetti (2018). *Journalism, 'fake news' & disinformation : handbook for journalism education and training*. UNESCO.

Jindal, Nitin and Bing Liu (2008). *Opinion Spam and Analysis*.

Jung, Jae C. and Elizabeth Sharon (2019). "The Volkswagen emissions scandal and its aftermath". In: *Global Business and Organizational Excellence* 38 (4), pp. 6–15.

Kerber, Ross and Hyunjoo Jin (2022). *Tesla cut from S&P 500 ESG Index, and Elon Musk tweets his fury*. URL: https://www.reuters.com/business/sustainable-business/tesla-removed-sp-500-esg-index-autopilot-discrimination-concerns-2022-05-18/ (visited on 11/16/2023).

Kitchenham, Barbara A, David Budgen, and O Pearl Brereton (2010). "The value of mapping studies-A participant-observer case study". In: *14th International Conference on Evaluation and Assessment in Software Engineering*.

Leippold, Markus et al. (2022). "ClimateBert: A pretrained language model for climate-related text". In.

Lienert, Paul (2021). *When do electric vehicles become cleaner than gasoline cars?* URL: https://www.reuters.com/business/autos-transportation/when-do-electric-vehicles-become-cleaner-than-gasoline-cars-2021-06-29/ (visited on 11/16/2023).

Luccioni, Alexandra, Emily Baylor, and Nicolas Duchene (2020). "Analyzing Sustainability Reports Using Natural Language Processing". In: *Tackling Climate Change with Machine Learning workshop at NeurIPS 2020*.

Luccioni, Alexandra and Hector Palacios (2019). "Using Natural Language Processing to Analyze Financial Climate Disclosures". In: *Proceedings of the 36th International Conference on Machine Learning, Long Beach, California*. European Language Resources Association (ELRA).

Lyon, Thomas P. and John W. Maxwell (2004). “Astroturf: Interest group lobbying and corporate strategy”. In: *Journal of Economics and Management Strategy* 13 (4), pp. 561–597.

— (2011). “Greenwash: Corporate environmental disclosure under threat of audit”. In: *Journal of Economics and Management Strategy* 20 (1), pp. 3–41.

Lyon, Thomas P. and A. Wren Montgomery (2015). “The Means and End of Greenwash”. In: *Organization and Environment* 28 (2), pp. 223–249.

Makrenko, Inna, Serhiy Makarenko, and Pavlo Rubanov (2023). “Greenwashing Detection and Impact on Responsible Business and Investment: Case of Ukrainian Companies (Agriculture Leaders)”. In: *Springer Proceedings in Business and Economics*. Springer Nature, pp. 129–145.

Matejek, Sabine and Tobias Gössling (2014). “Beyond Legitimacy: A Case Study in BP’s "Green Lashing"”. In: *Journal of Business Ethics* 120 (4), pp. 571–584.

Meel, Priyanka and Dinesh Kumar Vishwakarma (2020). “Fake news, rumor, information pollution in social media and web: A contemporary survey of state-of-the-arts, challenges and opportunities”. In: *Expert Systems with Applications* 153.

Meyer, John W and Brian Rowan (1977). “Institutionalized Organizations: Formal Structure as Myth and Ceremony”. In: *The American Journal of Sociology* 83 (2), pp. 340–363.

Molek-Kozakowska, Katarzyna (2013). “Towards a pragma-linguistic framework for the study of sensationalism in news headlines”. In: *Discourse and Communication* 7 (2), pp. 173–197.

Molina, Maria D. et al. (2021). ““Fake News” Is Not Simply False Information: A Concept Explication and Taxonomy of Online Content”. In: *American Behavioral Scientist* 65 (2), pp. 180–212.

Moodaley, Wayne and Arnesh Telukdarie (2023). “A Conceptual Framework for Subdomain Specific Pre-Training of Large Language Models for Green Claim Detection”. In: *European Journal of Sustainable Development* 12 (4), p. 319.

Oppong-Tawiah, Divinus and Jane Webster (2023). “Corporate Sustainability Communication as ‘Fake News’: Firms’ Greenwashing on Twitter”. In: *Sustainability Switzerland* 15 (8).

Orange, Erica and Aaron M. Cohen (2010). “From Eco-Friendly to Eco-Intelligent”. In: *The Futurist*, p. 28.

Oshikawa, Ray, Jing Qian, and William Yang Wang (2018). “A Survey on Natural Language Processing for Fake News Detection”. In: *Proceedings of the 12th Language Resources and Evaluation Conference*.

Petersen, Kai, Sairam Vakkalanka, and Ludwik Kuzniarz (2015). “Guidelines for conducting systematic mapping studies in software engineering: An update”. In: *Information and Software Technology* 64, pp. 1–18.

Rahmanian, Emad (2023). “Fake news: a classification proposal and a future research agenda”. In: *Spanish Journal of Marketing* 27 (1), pp. 60–78.

Ramus, Catherine A. and Ivan Montiel (2005). “When are corporate environmental policies a form of greenwashing?” In: *Business and Society* 44 (4), pp. 377–414.

RepRisk (2023). *On the rise: navigating the wave of greenwashing and social washing*. URL: https://www.reprisk.com/news-research/reports/

on-the-rise-navigating-the-wave-of-greenwashing-and-social-washing (visited on 11/02/2023).

Rojecki, Andrew and Sharon Meraz (2016). "Rumors and factitious informational blends: The role of the web in speculative politics". In: *New Media and Society* 18 (1), pp. 25–43.

Rubin, Victoria L., Yimin Chen, and Niall J. Conroy (2015). "Deception detection for news: Three types of fakes". In: *Proceedings of the Association for Information Science and Technology* 52 (1), pp. 1–4.

Russo, J Edward, Barbara L Metcalf, and Debra Stephens (1981). "Identifying Misleading Advertising". In: *Journal of Consumer Research* 8 (2), pp. 119–131.

Samoilenko, Sergei A. and John Cook (2023). "Developing an Ad Hominem typology for classifying climate misinformation". In: *Climate Policy*.

Seele, Peter and Lucia Gatti (2017). "Greenwashing Revisited: In Search of a Typology and Accusation-Based Definition Incorporating Legitimacy Strategies". In: *Business Strategy and the Environment* 26 (2), pp. 239–252.

Shah, Minal Nirav and Amit Ganatra (Dec. 2022). "A systematic literature review and existing challenges toward fake news detection models". In: *Social Network Analysis and Mining* 12 (1). ISSN: 18695469. DOI: 10.1007/s13278-022-00995-5.

Shimp, Terence A (1978). "Do incomplete comparisons mislead". In: *Journal of Advertising Research* 18 (6), pp. 21–27.

Shin, Jieun et al. (2018). "The diffusion of misinformation on social media: Temporal pattern, message, and source". In: *Computers in Human Behavior* 83, pp. 278–287.

Shu, Kai et al. (2017). "Fake News Detection on Social Media: A Data Mining Perspective". In: *ACM SIGKDD Explorations Newsletter* 19 (1), pp. 22–36.

Siano, Alfonso et al. (2017). ""More than words": Expanding the taxonomy of greenwashing after the Volkswagen scandal". In: *Journal of Business Research* 71, pp. 27–37.

Simon-Kucher (2022). *Sustainability Study 2022*. URL: https://www.simon-kucher.com/en/who-we-are/newsroom/sustainability-study-2022 (visited on 11/16/2023).

Snyder, Rita (1989). "Misleading Characteristics of Implied-Superiority Claims". In: *Journal of Advertising* 18 (4), pp. 54–61.

Stammbach, Dominik et al. (2023). "Environmental Claim Detection". In: *Proceedings of the 61st Annual Meeting of the Association for Computational Linguistics*. Vol. 2. Short Papers, pp. 1051–1066.

Tandoc, Edson C., Zheng Wei Lim, and Richard Ling (2018). "Defining "Fake News": A typology of scholarly definitions". In: *Digital Journalism* 6 (2), pp. 137–153.

TerraChoice (2010). *The Sins of Greenwashing: Home and familiy edition*. URL: https://www.twosides.info/wp-content/uploads/2018/05/Terrachoice_The_Sins_of_Greenwashing_-_Home_and_Family_Edition_2010.pdf (visited on 11/10/2023).

Vicario, Michela Del et al. (2016). "The spreading of misinformation online". In: *Proceedings of the National Academy of Sciences of the United States of America* 113 (3), pp. 554–559.

Wang, Hong, Baolong Ma, and Rubing Bai (2020). "The spillover effect of greenwashing behaviours: an experimental approach". In: *Marketing Intelligence and Planning* 38 (3), pp. 283–295.

Wardle, Claire and Hossein Derakhshan (2017). *Information Disorder: Toward an interdisciplinary framework for research and policy making*. URL: https://edoc.coe.int/en/media/7495-information-disorder-toward-an-interdisciplinary-framework-for-research-and-policy-making.html (visited on 11/25/2023).

Watkins, Michael and Max Bazerman (2003). "Predictable Surprises: The Disasters You Should Have Seen Coming". In: *Harvard Business Review* 81 (3), pp. 72–85.

Webster, Jane and Richard T Watson (2002). "Analyzing the Past to Prepare for the Future: Writing a Literature Review". In: *MIS Quarterly* 26 (2), pp. xiii–xxiii.

Woloszyn, Vinicius, Joseph Kobti, and Vera Schmitt (2021). "Towards Automatic Green Claim Detection". In: *ACM International Conference Proceeding Series*. Association for Computing Machinery, pp. 28–34.

Yang, Zhi et al. (2020). "Greenwashing behaviours: Causes, taxonomy and consequences based on a systematic literature review". In: *Journal of Business Economics and Management* 21 (5), pp. 1486–1507.

Zhou, Xinyi and Reza Zafarani (2020). "A Survey of Fake News: Fundamental Theories, Detection Methods, and Opportunities". In: *ACM Computing Surveys* 53 (5).