## The Colour Green in Sustainability Reports: Greenwashing or Institutionalisation?

## Abstract

This study examines the use of the colour green in sustainability reports. We introduce a novel pixel-based measure that quantifies the level of green used across the standalone sustainability reports. We examined Fortune 500 firms from 2014 to 2023. This colour measure is then compared against each firm's level of environmental activities. Our preliminary findings, based on pooled data, suggest an overall negative relationship between the use of colour green and environmental performance. However, when controlling firms with a high level of green colour usage and a low level of environmental activity (the potential "green-washers"), the rest of the firms exhibit a positive alignment between their use of green and environmental activities.

We interpret these results through two theoretical lenses. First, drawing on marketing research, we propose that the level of green can serve as a tool for impression management, aiming at conveying strong environmental credentials to stakeholders; this is particularly evident among the identified "green-washer" group. Second, our findings suggest that, for most firms, green colour reflects a genuine organisational commitment to environmental sustainability, as these entities likely have more institutionalised underpinning their reports. By presenting a new and broadly applicable method for quantifying the use of green colour in large samples of corporate reports, this study opens avenues for future research for the visual presentation of stakeholder perception and provides implications for regurgitator practitioners.

Keywords: Sustainability; Visualisation; Greenwash

## **1.0 Introduction**

A growing awareness of environmental and social issues has led to a rapid growth in sustainability reporting over the last decade, with the vast majority (over 80%) of listed companies worldwide providing standalone sustainability reports or incorporating sustainability-related information into their annual reports (KPMG, 2020). The disclosure of sustainability information is associated with higher firm values (Cahan et al., 2016) and a reduced cost of capital (Dhaliwal et al., 2011) and has drawn the interest of investors, many of whom now insist upon the inclusion of sustainability data (Dunn, 2021). However, prior research has questioned the quality and usefulness of sustainability information (Hahn & Lülfs, 2014; Moneva et al., 2006). While some companies are genuinely committed to environmental sustainability, others have adopted sustainability, CSR and ESG as corporate strategies to improve stakeholder and consumer relations and deflect criticism of their less commendable activities (Haffar & Searcy, 2020; Kassinis & Panayiotou, 2018). Criticism around sustainability reports is growing, and research has highlighted how managers can use them as impression management tools (Brennan & Merkl-Davies, 2013; Cho et al., 2015; Cho & Patten, 2007; Hooghiemstra, 2000). Firms have been found to use a variety of impression management strategies in corporate reports, such as rhetoric (García-Sánchez et al., 2019; Merkl-Davies & Brennan, 2007) and images such as photographs (Boiral, 2013; García-Sánchez & Araújo-Bernardo, 2020a) or graphs (Cho et al., 2012). While some firms may be greenwashing, others may be genuinely committed to environmental sustainability. It is, therefore, difficult for report users to distinguish between what organisations communicate and what they are actually doing (Bellucci et al., 2019, 2021; Bini et al., 2017).

Our study focuses on the use of the colour green in sustainability reports. Colour as a means for managing impressions has been relatively under-examined in the accounting literature (Courtis, 2004), and considering the recent developments in sustainability reporting warrants further research attention. We follow a stream of marketing literature that highlights the importance of colour to human perceptions. Colour is a communicative tool, and the use of the colour green has been found to prime consumers about a brand's commitment to environmental principles, serving as an effective medium to convey sustainability initiatives (Barchiesi et al., 2018; Kassinis & Panayiotou, 2018). We introduce a novel measure of colour that is based on pixel counts in sustainability reports. As our measure is objective and can be used to analyse images and text in reports, it can be used on large samples, extending the prior literature, which has tended to focus on manual analyses of smaller samples.

We compare the level of green colour used in sustainability reports to the level of environmental activities by firms. We measure green colour using a novel method for counting the level of green in each pixel on each page of a sustainability report and use LSEG (former Refinitiv) scores to capture the levels of environmental activity. Preliminary results indicate a significant negative correlation, indicating a mismatch between the use of green colour and environmental activity. We break our results into different industries and control for factors such as firm age and financial performance. These results highlight a mismatch between corporate communication and action, consistent with greenwashing. However, after controlling firms with high green colouration and low environmental activity (the potential "greenwashers") from our sample, the remaining firms exhibited a positive alignment between their use of green and their environmental activities. We provide multiple avenues for future research, including further research into user perspectives on colour use and management decisions when producing sustainability reports.

The remainder of this paper is structured as follows: Section 2 provides an overview of the literature for two competing theoretical views of how colour is related to sustainability reporting. The first relates to impression management, focusing on the use of colour as a medium for managing impressions, and the second relates to how colour reflects the institutionalisation of environmental practice. Section 3 outlines the research method, outlining the test hypotheses and controls. Section 4 presents the findings. Section 5 discusses the findings in light of the impression management literature. Section 6 concludes, highlighting the contribution of the paper and avenues for future research. Section 7 contains references and Section 8 appendices, respectively.

## 2.0 Literature Review

The study is informed by two competing theoretical lenses: impression management theory and institutional theory. These theoretical foundations provide contrasting perspectives on the relationship between the use of the colour green in CSR reporting and a firm's environmental performance. Impression management theory suggests that firms strategically use symbolic actions, such as using the colour green, to shape stakeholders' perceptions and create a favourable image, often without substantive changes in their actual environmental practices.

From an accountability perspective, corporate sustainability reports are intended to communicate credible information about a firm's environmental performance (KPMG, 2020). Yet, critics argue that managers may employ visualisation as "greenwashing" to appear more sustainable than they genuinely are (Delmas & Burbano, 2011). In particular, the colour green is closely associated with environmental friendliness and sustainability, which can influence stakeholder perceptions of a firm (Labrecque & Milne, 2012). Through a marketing lens, colours have been shown to evoke specific consumer attitudes about products (Bottomley & Doyle, 2006), potentially extending to a firm's perceived environmental stewardship. In this context, green may serve as a visual tool to project an environmentally responsible image, even if the firm's environmental performance does not align with this portrayal. This perspective aligns with the concept of "greenwashing," where firms exaggerate or misrepresent their sustainability image over their substantial efforts (Laufer, 2003).

In contrast, institutional theory posits that firms adopt certain practices, such as the use of green symbolism, in response to external pressures and the need to conform to societal expectations and norms (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). According to this view, the use of the colour green in corporate reporting may reflect a firm's genuine commitment to environmental principles as it seeks to align itself with institutionalised sustainability and environmental responsibility. This perspective suggests that firms with

stronger environmental performance are more likely to use green colour as a means of demonstrating their adherence to institutionalised practices (Berrone et al., 2013).

### 2.1 Sustainability reporting and the growth of greenwashing

Organisations are increasingly challenged to be more transparent about their impact on the environment and society (Unerman & Chapman, 2014). This has led to a rapid growth in sustainability and corporate social responsibility reporting and practice, with some organisations seeing these developments as an opportunity to enhance public perception of their ethical stance on social, environmental, and humanitarian issues (Carroll, 2021; Rim & Ferguson, 2020). Unlike annual reporting, sustainability reporting is still largely voluntary, and such reports are subject to management discretion (Adams & Abhayawansa, 2022). Even though such reports are likely to become mandatory in the future and are already in certain jurisdictions, the focus of mandates tends to be on disclosure rather than presentation. Sustainability reports can be used to manage stakeholder impressions (Brennan & Merkl-Davies, 2013; Cho et al., 2015; Cho & Patten, 2007; Hooghiemstra, 2000). Managers have been found to select positive information and exclude or downplay negative information in sustainability reports (Bingler et al., 2023; Boiral, 2013; De Villiers & van Staden, 2011; Diouf & Boiral, 2017). This type of behaviour has led to increasing concerns around greenwashing (Delmas & Burbano, 2011; Lyon & Montgomery, 2015; Marquis et al., 2016; Moodaley & Telukdarie, 2023). Research has shown that consumers are increasingly cynical about the sustainability claims made by organisations (Ioannou et al., 2022; Policarpo et al., 2023). In addition, consumers have been found to react more angrily to greenwashing firms than to firms who take no action to improve their environmental performance (Lyon & Maxwell, 2011).

Greenwashing has been defined in various ways in the literature (de Freitas Netto et al., 2020). In the corporate reporting context, greenwashing usually relates to a form of selective disclosure and/or presentation used by firms to create a false impression of eco-credentials and transparency (Delmas & Burbano, 2011; Moodaley & Telukdarie, 2023). Greenwashing is not only an unethical practice undermining corporate accountability, but it also presents a significant economic and environmental challenge. ESG investing is valued at \$30 trillion, representing 25% of global assets under management (Bloomberg, 2024). Well-intentioned stakeholders may believe that they are making a positive impact on the environment and society with their investment and purchasing choices, unaware of the fact that their decisions may be based on inaccurate information. Another consequence of greenwashing is that organisations are genuinely committed to sustainability and have taken actions to promote environmental and social concerns, which may be viewed with suspicion (De Villiers et al., 2023). In this context, it becomes difficult for stakeholders to understand whether sustainability information is just corporate rhetoric or reflects genuine actions firms take to promote sustainability (Bellucci et al., 2019, 2021; Bini et al., 2017).



FIGURE I. A Typology of Firms based on Environmental Performance and Communication



Delmas and Burbano (2011) present a typology of firms based on their communication and environmental performance, shown in Figure 1. Their quadrant is helpful for our research as it categorises into those who communicate in line with their activities (vocal green firms and silent brown firms) and those who do not (greenwashing firms and silent green firms). Of the firms that do not conform to the expected relationship between communication and action, greenwashing firms reflect impression management. In contrast, silent green firms reflect organisations of sustainability that may not promote their activities in their reports. Our paper aims to explore this phenomenon by considering two potential explanations for the use of colour in sustainability reports: first, to manage impressions (through greenwashing); and second, as a reflection of an organisation's commitment to environmental sustainability. Our approach follows Bingler et al. (2023), who consider the relationship between 'Cheap Talk' (a narrative form of greenwashing) and climate-related risk disclosures.

### 2.2 Impression management

The concept of "impression management" originates from social psychology and describes the strategic process through which individuals manage and control the image they present to others to create specific impressions in their minds, intentionally or not (Goffman, 1959; Hooghiemstra, 2000). Impression management strategies may be used as a reaction to legitimacy threats. Legitimacy theory suggests that corporate reporting practices are used to shape perceptions about an organisation's legitimacy. This theory is grounded in the idea that firms engage in a social contract with society, and their survival depends on operating within social norms (Merkl-Davies & Brennan, 2007). In sustainability reporting, companies may configure their reports to project an ideal image of the firm, often using optimistic narrative rhetoric and images that present a desirable view of the firm's activities (Solomon et al., 2013). Less sustainable companies might employ these strategies for symbolic legitimacy, reporting superficial, nonnumerical information to create a favourable impression. In contrast, more sustainable companies may use such images to more effectively convey information about their real impacts and achievements (García-Sánchez & Araújo-Bernardo, 2020). The two impression management strategies most commonly used are enhancement

(highlighting good performance) and obfuscation (concealing poor performance) (Merkl-Davies & Brennan, 2011).

Corporate communicators use impression management strategies to cultivate a desired image for a firm by drawing attention to tangible and symbolic attributes (for example, logos, colours, text, visuals, and websites) that influence perceptions about a company or a brand (Campelo et al., 2011; Melewar et al., 2017; Parguel et al., 2015). Impression management is thus linked to image orientation and further amplifies environmental friendliness as part of the visual design of messages or media artefacts (Barchiesi et al., 2018; Kassinis & Panayiotou, 2018). Websites, for example, allow companies and brands to position themselves as environmentally sustainable by controlling visual, verbal, and technological elements (Connolly-Ahern & Broadway, 2007)) and providing extensive information beyond traditional media like informing consumers about product ingredients and product benefits, sustainability reporting, and manufacturing practices (Kahraman & Kazançoğlu, 2019; Talbot & Boiral, 2018).

Previous literature highlights the use of 'visual rhetoric' in corporate reports, which is a marketing notion of using images and colour to persuade someone to do something or influence their opinion in a certain direction. Cho et al. (2012) and Kanbaty et al. (2020) show how visuals such as charts and graphs can be manipulated to focus on good news stories, and Boiral (2013) comments on how annual reports can be perceived as 'photo albums' of idyllic images, designed to either detract audience attention away from real activities (for less sustainable companies) or to highlight actual achievements in sustainability (for more sustainable companies). Photos have been found to be the most powerful rhetorical tool for persuasion (Chong et al., 2023; Davison, 2014) and have been used in sustainability reports to evoke positive emotions (Kanbaty et al., 2024). García-Sánchez and Araújo-Bernardo (2020) show how the size of images and the strategic use of colour can also influence the effectiveness of other visual rhetoric choices, as visual rhetoric comprises several elements. They measure colours on a page on a scale of 0 to 6, with 6 being the 'main' colour and others secondary colours. Invernizzi et al. (2022) find evidence that the experience of 'easy information processing' when reading corporate reports (based on the number of images used) is associated with a perception of less hypocrisy.

### 2.3 Colour as reflective of the institutionalisation

An alternative explanation for using colour in sustainability reports is that it reflects the underlying institutionalisation stainability within organisations and the number of pressures organisations face. There may be other reasons for a difference between reporting and action that do not relate to greenwashing (Bingler et al., 2023). Institutional theory provides insights into how organisations adapt to pressures in their environments, thereby becoming more similar to one another over time through isomorphism (DiMaggio & Powell, 1983). There are three types of isomorphism: mimetic, coercive and normative. (1) Mimetic isomorphism is the process of mimicking the practices of other organisations, particularly those deemed more successful, often driven by the need to remain competitive or the desire to enhance reputation. (2) Coercive isomorphism refers to an organisation coming to external pressures, which can be formal (such as regulations) or more informal (such as society expectations) to

align with prevailing norms. (3) Normative isomorphism occurs when organisations institutionalise norms, values, or beliefs that are common within their professional or social context. These three types of isomorphic force can operate together. In the context of our paper, firms may initially resort to mimetic isomorphism as a reaction to uncertainty, copying the sustainability reports of leaders in the field. They may later be coerced by society's expectation to produce such reports or be subject to mandates. Then, normative isomorphism can emerge over time as shared reporting norms become institutionalised in the field (De Villiers & Alexander, 2014). The use of green colours in sustainability reports could, therefore, be reflective of underlying pressures and norms, and the institutionalised practices within organisations' colour green, rather than being used as greenwash, could just be reflective of norms and practices of all reporting organisations.

### 2.4 The colour green

Colour plays a critical role in shaping information perceptions. Choosing the right colour significantly influences the effectiveness of information delivery, as colour is a stimulus affecting human behaviour (Cheskin, 1957). Colour is a perception-dependent quality that exists in the minds of observers; it is not an inherent property of objects (Galileo, 1623). Colour is perceived by human eyes as wavelengths of light, with colour theory from Newton's colour wheel (Newton & Hemming, 1704). Colour perception and imagery involve brain activity beyond the visual cortex, suggesting that prior knowledge and social associations also shape how we perceive colours (Kosslyn & Thompson, 2003). Colours can convey specific meanings, enabling companies to communicate their sustainability efforts and performance through visual means.

The colour green, symbolism, harmony, and health reinforce the perception of ecofriendliness and commitment to sustainability and help to craft a 'green' identity. Consumers associate green with environmental friendliness (Lim et al., 2020). This marketing strategy, known as "shades of greenness", varies the intensity of environmental messaging through the use of visual design elements (Ahern et al., 2013; Segev et al., 2016). The extent of environmental information conveyed through such messaging defines a brand's greenness and associated environmental friendliness (Gephart et al., 2011; Leonidou et al., 2011; Segev et al., 2016). These messages often create a green façade, implying environmental responsibility without providing specific details on how the product benefits the environment or what the environmental practices of the company are (Baum, 2012). This strategy can influence consumer choices and perceptions, making it a powerful tool in sustainable marketing strategies (Seelig, 2023; Seelig et al., 2021). This has led to consumers purchasing products perceived as environmentally safe despite a lack of evidence that these products offer long-term solutions to growing environmental challenges (Dunaway, 2015; Kniazeva & Belk, 2007). For example, skincare brands have crafted a façade of eco-consciousness with nature-evoking colours and images, alongside claims of being green, natural, organic, and sustainable in their product labelling (Bom et al., 2019; Meister et al., 2006). This shaping of public perception through aesthetic cues and impression management can imply an ecoconscious image, impacting how consumers view a brand's products and services regarding environmental safety (Seelig, 2023). Colours are key in 'emotional branding,' with

companies using specific colours to evoke desired emotions (Aslam, 2006). In terms of accounting and finance studies concerning colour use, Courtis (2004) found that increased colour use (colour variety) was associated with both increased and decreased profitability (enhancing and downplaying the messages, respectively). Delong and Goncu-Berk (2012) found that green was the colour most associated with CSR. While previous research has focused on photographs, graph choice, narrative choice and disclosures, we investigate the use of the colour green, which can be used across all of the options above. Other studies considering colour in the accounting literature have used human judgements of colour (for example, García-Sánchez and Araújo-Bernardo (2020) consider the use of primary and secondary colours per page. In contrast, we provide a more objective measure that has the potential to be used on larger samples. Considering the two potential theoretical explanations for the relationship between the use of the colour green in sustainability reports and the actual environmental activities of firms?

## 3.0 Data and Variables of Interest

### 3.1 Data collection

To address our research question, we compare colour (communication) and ESG (environmental performance) data for Fortune Global 500 companies. We focused on the Fortune Global 500 companies because these companies are the world's largest companies by revenue. Prior research has found a positive association between the size of a company and sustainability reporting in terms of engagement (Schreck & Raithel, 2018) and rating (Drempetic et al., 2020). Our analysis was conducted on standalone sustainability reports in English released by Fortune Global 500 companies between 2014 and 2023. This generated a sample size of 1834 sustainability reports.

### 3.2 Level of green: Measurement using pixels

Millions of pixels are used when generating an image. Each pixel comprises subpixels that emit a red, green or blue (RGB) colour, displaying at different intensities. The maximum intensity value for any colour is 255. For computer screens, which start with a black background, composite images are made by blending red, green and blue intensities across comparable pixels (Burt & Perrett, 1995). We used Python to scan the sustainability reports systematically. For each page of the report, we extracted the intensity values of red, green, and blue for every pixel. We calculated the difference between the green, blue and red intensities, dividing this by 255 (the maximum intensity value) and normalised to achieve a final score between 0 and 1, where 0 indicates minimal green intensity, and 1 indicates the highest level of green intensity. To ensure consistency with measures from other databases, we aggregate the average green scores across all pages, aligning the data with firm-year levels for comprehensive analysis.

### 3.3 ESG and environmental score: Activity measurement

The ESG environmental measure we use in this study is derived from the LSEG database provided by the London Stock Exchange Group (LSEG). This database, previously known as Refinitiv and Thomson Reuters ASSET4 (Dobrick et al., 2023), offers comprehensive ratings of firms' ESG performance. These ratings are generated by analysts who gather raw data from a variety of sources, including annual reports, media outlets, and NGO websites (Roulet & Touboul, 2015). LSEG provides three pillar scores that encompass environmental, social, and governance dimensions. These ESG performance scores range from 0 to 100, with higher values indicating superior performance. The LSEG score has been widely employed in research to measure substantive ESG activities (Yu et al., 2020). For this study, we use both the ESG score and the environmental score (a subset of the ESG score) as an indicator of substantial environmental activities.

### 3.4 Model

# **3.4.1** Part 1: Effect of environmental activities on the use of green in sustainability reports

To examine the relationship between environmental activities and the use of green colour in the sustainability report in line with impression management theory, we estimate the following model:

$$\begin{aligned} Green_{i,t} &= \alpha + \beta_{1}LnScore_{i,t} + \beta_{2}Env\_Industry_{i,t} + \beta_{3}Multi\_Nation_{i,t} \\ &+ \beta_{4}US\_Listed_{i,t} + \beta_{5}Ln\_Assets_{i,t} + \beta_{6}Lev_{i,t} \\ &+ \beta_{7}CapitalIntensity_{i,t} + \beta_{8}ROA_{i,t} \\ &+ \beta_{9}Green\_Logo_{i,t} + \varepsilon_{i,t} \end{aligned}$$
(1)

The *Green* and *InEnv\_Score* are defined in Section 3.2 and 3.3. If firms' environmental activities are consistent with the use of green in their sustainability reports, we expect a positive coefficient of interest,  $\beta_E$ .

We include controls for environmentally sensitive industries (*Env\_Industry*) in our analysis, as prior research indicates that these industries are subject to negative public perception and exhibit a higher propensity for greenwashing practices (Cho & Patten, 2007; Emma & Jennifer, 2021). To define environmentally sensitive industries, we employ a binary variable identifying firms operating in sectors such as oil exploration, paper production, chemicals and allied products, petroleum refining, metals, mining, and utilities. For Fortune 500 firms, which include U.S. and international companies, we apply the industry classification systems specific to each firm's country of origin when the U.S. Standard Industrial Classification (SIC) is not applicable.

We also control for multinational firms (*Multi-Nation*), as these companies are often subject to scrutiny from global stakeholders, diverse regulatory standards, and cultural differences (Ali et al., 2017; Dhaliwal et al., 2012). Additionally, the literature suggests that

firms with higher operational complexity are more likely to employ visualisation techniques in their reporting (Christensen et al., 2024).

The control for U.S.-listed firms (*US\_Listed*) is included because the United States has historically been characterised by less stringent sustainability reporting regulations compared to other regions (Kolk, 2016). However, recent trends indicate a movement toward stricter sustainability reporting requirements and enhanced listing standards driven by investor demand and global regulatory developments (KPMG, 2020).

To account for firm-specific fundamentals, we follow the previous literature and include controls for size (*Ln\_Assets*), leverage (*Lev*), return on assets (*ROA*), and capital intensity (*Capital Intensity*) (Arouri et al., 2021; Marquis et al., 2016).

Lastly, we incorporate a control variable for the logo colour used in the sustainability report for the year. As suggested in the literature, the colour theme of logos and graphic elements contributes to the formation of corporate visual identity. It can serve as a visual communication strategy for firms (Van den Bosch et al., 2005).

### 3.4.2 Endogeneity Issue

The baseline equation, Equation (1), employs ordinary least squares (OLS) to estimate the relationship between firms' use of green and ESG environmental scores alongside control variables. While OLS provides preliminary insights, it could suffer from endogeneity bias due to two main issues.

First, reverse causality could arise. The environmental scores, derived from analyst evaluations of sustainability reports (Refinitiv, 2023), may reflect firms' past green practices rather than exogenously shaping them. Conversely, firms may engage in strategic reporting or greenwashing, such as emphasising imagery or text, to influence analysts' perceptions and artificially inflate scores. This simultaneity violates the OLS exogeneity assumption.

Second, green practices may exhibit temporal persistence due to path dependence on sustainability investments. For instance, prior commitments to green technologies or reporting frameworks likely influence current practices, creating a serial correlation in the error term. Omitting this lagged dependent variable could introduce dynamic omitted variable bias, as unobserved firm-specific factors (e.g., institutional pressures) correlate across periods.

To reduce the potential endogeneity issues, we estimate a dynamic panel model using the two-step system generalised of moments (GMM) approach (Arellano & Bond, 1991; Blundell & Bond, 1998):

$$Green_{i,t} = \alpha + \beta_1 Green_{i,t-1} + \beta_2 LnScore_{i,t} + \beta_3 Env_Industry_{i,t}$$
(2)  
+  $\beta_4 Multi_Nation_{i,t} + \beta_5 US_Listed_{i,t} + \beta_6 Ln_Assets_{i,t}$   
+  $\beta_7 Lev_{i,t} + \beta_8 CapitalIntensity_{i,t} + \beta_9 ROA_{i,t}$   
+  $\beta_{10} Green_Logo_{i,t} + \varepsilon_{i,t}$ 

Including  $Green_{i,t-1}$  explicitly models persistence, capturing how historical practices constrain or enable current efforts (Flannery & Hankins, 2013). The baseline OLS Eq(1)

estimates of  $\beta_1$  could be biased because  $Green_{i,t-1}$  could correlate with the fixed effects in the error term. The GMM approach reduces this bias by instrumenting  $Green_{i,t-1}$  with deeper lags (e.g.,  $Green_{i,t-2}$ ), which are predetermined and uncorrelated with contemporaneous shocks (Roodman, 2009).

The potential reverse causality between  $LnScore_{i,t}$  and  $Green_{i,t}$  is reduced by instrumenting  $LnScore_{i,t}$  with its lagged levels (e.g.,  $LnScore_{i,t-1}$ ). Since these instruments precede  $Green_{i,t}$  temporally, they remain unaffected by contemporaneous feedback (Roodman, 2009), thereby ensuring a more reliable estimation of causal effects.

### 3.4.3 Part 2 Alignment of green colouration and ESG practices

As outlined in Section 2.1, Delmas and Burbano (2011) categorised four groups based on the alignment between their environmental performance and communication. Firms with communication levels consistent with their actual performance are classified as either "vocal green" or "silent brown," while those with inconsistent communication fall into the "greenwashing" or "silent green" categories (Figure 1).

Equation (2) builds on the baseline model in Equation (1), which establishes the impact of ESG activities (environmental activities) on the extent of green colouration used in sustainability reports. However, it remains challenging to isolate any single category despite employing regression analysis. To address this limitation, this section introduces the variable  $HGLS_{i,t}$  which takes a value of 1 for firms in the sample positioned in the top 25% quartile for green colouration usage and the bottom 25% quartile for ESG (Environmental) scores. The estimation model is specified as follows:

$$\begin{aligned} Green_{i,t} &= \alpha + \beta_1 Green_{i,t-1} + \beta_2 LnScore_{i,t} + \beta_3 HGLS_{i,t} + \beta_4 LnScore_{i,t} \times HGLS_{i,t} \\ &+ \beta_5 Env\_Industry_{i,t} + \beta_6 Multi\_Nation_{i,t} + \beta_7 US\_Listed_{i,t} \\ &+ \beta_8 Ln\_Assets_{i,t} + \beta_9 Lev_{i,t} + \beta_{10} CapitalIntensity_{i,t} + \beta_{11} ROA_{i,t} \\ &+ \beta_{12} Green\_Logo_{i,t} + \varepsilon_{i,t} \end{aligned}$$

## 4.0 Results and Discussion

Table 1 Descriptive Statistics						
Variable	Obs	Mean	Std. dev	Min	Max	
Green	1,808	0.006	0.009	0.000	0.109	
Green_C	1,811	0.018	0.020	0.000	0.245	
ESG_Score	1,800	72.553	13.259	3.910	95.385	
E_Score	1,787	75.044	16.492	4.495	98.546	
Env_Industry	1,809	0.160	0.366	0.000	1.000	
Multi_Nation	1,808	0.926	0.261	0.000	1.000	
US_Listed	1,809	0.458	0.498	0.000	1.000	
Assets	1,809	146639.50	330831.20	1324.15	3875393.0	
Lev	1,810	0.662	0.199	0.008	1.324	
Cap_Int	1,810	0.240	0.206	0.000	1.298	
RoA	1,810	0.054	0.069	-0.805	0.419	
Green_Logo	1,834	0.082	0.274	0.000	1.000	
Variable definitions can be found in the Appendix.						

### 4.1 Descriptive statistics and correlations

Table 1 presents descriptive statistics for the variables in this study over the sample period. The mean values for Green (0.006) and Green C (0.018) suggest a significant but relatively low level of green colouration in corporate disclosures relative to other colours. However, the minimum (0.000 and 0.000, respectively) and maximum values (0.109 and 0.245) indicate notable variation across firms. Environmental and social governance performance, as measured by ESG Score, and the environmental pillar, as measured by E Score, show relatively high average scores (72.55 and 75.04, respectively), with substantial dispersion in performance (with standard deviations of 13.259 and 16.492, respectively). The binary variable Env Industry has a mean of 0.160, indicating that 16% of firms operate in environmentally sensitive sectors. The Multi Nation (mean = 0.926) highlights the dominance of multinational firms in the sample, which matches the fact that Fortune 500 Firms are f international in scale. Approximately 45.8% of firms are listed in the U.U.S.US Listed) consistent with the size of the U.S.market relative to other countries. Financial characteristics reveal a wide range in Assets (1,324.15 to 3,875,393 million USD), with average Lev (leverage) at 0.662, Cap Int (capital intensity) at 0.240, and RoA (return on assets) at 0.054. Among the firms, 8.2% of firms incorporate green elements in their logos (Green Logo). These statistics align with typical ranges observed in prior studies of corporate environmental and financial measures (Gupta et al., 2021).

	Green	Green_C	ln (ESG _Score)	ln (Env _Score)	Env _Industry	Multi _Nation	US _Listed	ln(Assets)	Lev	Cap_Int	RoA	Green_Log
Green	1.0000											
Green_C	0.8351	1.0000										
ln(ESG_Score)	-0.0329	0.0003	1.0000									
ln(Env_Score)	-0.0731	-0.0381	0.7492	1.0000								
Env_Industry	0.0275	0.0875	0.1417	0.0622	1.0000							
Multi_Nation	0.0156	-0.0073	0.0480	-0.0139	0.0077	1.0000						
US_Listed	0.1307	0.0718	-0.0279	-0.1292	0.0492	0.0503	1.0000					
ln(Assets)	-0.1130	-0.0881	0.3798	0.4200	0.0434	0.1116	-0.0023	1.0000				
Lev	0.0071	-0.0311	0.0543	0.0655	-0.1370	0.0200	0.1482	0.3086	1.0000			
Cap_Int	0.0283	0.0009	-0.0086	-0.0453	0.2329	-0.1015	-0.0190	-0.0857	-0.1485	1.0000		
RoA	0.0891	0.0881	-0.0117	-0.1061	-0.0510	0.0639	0.1794	-0.2465	-0.2373	0.0005	1.0000	
Green_Logo	0.1764	0.1460	0.0328	0.0314	0.0171	0.0233	-0.0615	0.0075	-0.0047	0.0159	-0.0110	1.0000

Table 2 Person Correlations for Variables in Eq. (1)

	Table 5 Kesult	ls IOI Eq. (I) e	examining the e	effect of CSK (I	Liivii onmentai)	activities on the	level of green	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variable	Green <sub>it</sub>	Green <sub>it</sub>	Green <sub>it</sub>	Green <sub>it</sub>	Green_C <sub>it</sub>	Green_C <sub>it</sub>	Green_C <sub>it</sub>	Green_C <sub>it</sub>
ln(ESG_Score) <sub>it</sub>	-0.0010	-0.0007	-0.0004	0.0001				
	(0.00)	(0.00)	(0.00)	(0.00)				
ln(Env_Score) <sub>it</sub>					-0.0010	-0.0002	-0.0008	0.0002
					(0.00)	(0.00)	(0.00)	(0.00)
Env_Industry <sub>it</sub>	0.0016***	0.0013*	0.0009	0.0009	0.0083***	0.0092***	0.0059**	0.0058**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Multi_Nation <sub>it</sub>			0.0007	0.0007			-0.0010	-0.0009
			(0.00)	(0.00)			(0.00)	(0.00)
US_Listed <sub>it</sub>			0.0020***	0.0020***			0.0018	0.0019
			(0.00)	(0.00)			(0.00)	(0.00)
ln(Assets) <sub>it</sub>	-0.0014	-0.0013	-0.0007**	-0.0007**	-0.0029	-0.0015	-0.0012	-0.0011
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Lev <sub>it</sub>	-0.0006	-0.0005	0.0020	0.0020	-0.0046	-0.0024	0.0012	0.0015
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)
Cap_Int <sub>it</sub>	0.0077	0.0081	0.0015	0.0015	0.0123	0.0138	-0.0013	-0.0009
	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)
RoA <sub>it</sub>	0.0097**	0.0096*	0.0088**	0.0087**	0.0173*	0.0174*	0.0167	0.0158*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Green_Logo <sub>it</sub>	-0.0027	-0.0026	0.0022	0.0024	-0.0090	-0.0088	0.0017	0.0025
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)
Constant	0.0232**	0.0205	0.0118**	0.0094*	0.0518*	0.0323	0.0319	0.0271***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.03)	(0.03)	(0.01)	(0.01)
Observations	1799	1799	1799	1799	1786	1786	1786	1786
Year FE	Ν	Y	Ν	Y	Ν	Y	Ν	Y
<i>R</i> <sup>2</sup>	0.0046	0.0151	0.1086	0.1171	0.0133	0.0178	0.0477	0.0701
FE/RE	FE	FE	RE	RE	FE	FE	RE	RE

Table 3 Results for Eq. (	1) examining	g the effect of CSR	(Environmental	) activities on the le	evel of green

Note: \*, \*\*, and \*\*\* indicate that the explanatory variable is significant at the 0.10, 0.05 and 0.01 significance level, respectively. Robust standard errors are reported in parentheses.

Table 2 reports the Pearson correlation matrix for the variables used in Equation (1). The correlation between Green and Green C is strong (0.8351), indicating a high degree of consistency between different measures of the level of green used in this study. The natural logarithm of environmental performance scores (ln(Env Score)) shows a moderate positive correlation with ln(ESG Score) (0.7492), reflecting the alignment between overall ESG performance and environmental-specific measures reported by LSEG. Firms operating in environmentally sensitive industries (Env Industry) show positive correlations with both Green C (0.0875) and ln(ESG Score) (0.1417), suggesting that such firms may be outperforming others regarding environmental disclosures. Multinational firms (Multi Nation) and U.S.-listed firms (US Listed) show low correlations with most variables. This may reflect the dominance of these types of firms in the sample. Larger firms, as proxied by ln(Assets), are positively correlated with ln(ESG Score) (0.3798) and ln(Env Score) (0.4200), indicating that firm size may influence environmental and ESG performance. Financial variables such as Lev (leverage) and RoA (return on assets) exhibit expected relationships, with RoA also showing a positive correlation with Green (0.0891) and Green C (0.0881). The presence of green logos (Green Logo) is weakly correlated with the level of Green (0.1764) and Green C (0.1460), suggesting some alignment between visual branding and disclosure practices. Overall, the correlation matrix reveals no evidence of severe multicollinearity, supporting the inclusion of these variables in the regression analysis.

### 4.2 Part 1: Effect of ESG activities on the use of green in sustainability reports

Table 3 presents the regression results from estimating Eq. (1), examining the contemporaneous effect of ESG activities and environmental activities ( $\ln(ESG_Score)$ ,  $\ln(E_Score)$ ), on the level of green used in the sustainability reports (Green and Green\_C).In this test, various firm-level characteristics are controlled. Columns (1)–(4) report the results using Green\_it as the dependent variable, and  $\ln(ESG_Score)_it$  as the independent variable, while Columns (5)–(8) use Green\_C\_it as the dependent variable and  $\ln(E_Score)_it$  as the independent variable. As indicated in the table, the models alternate between fixed effects (FE), random effects (RE), and fixed year effects specifications.

The coefficient for ESG Score (LnScore\_it) is negative across all equations, indicating that, in general, ESG performance has a negative relationship with the use of green. When the environmental subcomponent score (Env\_Score\_it) is used instead (Columns 5–8), the coefficients remain negative, further reinforcing the negative relationship between ESG activities, in particular the environmental activities and green. This shows that, on average, in our sample, higher levels of ESG performance are associated with sustainability reports that use lower levels of green colour. This suggests that firms are either "greenwashing firms" (with high levels of green colour associated with low levels of ESG performance) or are "silent green firms" (with low levels of green colour associated with high levels of ESG performance) in line with the categorisation Figure 1.

However, it is worth noting that the results are not significant from column (1) to (8). When pooling all the firms together, neither the ESG Score (LnScore\_it) nor the environmental score (Env\_Score\_it) is significant. There is mixed evidence of how firms use green colour and conduct ESG or environmental activities. This could be due to the potential endogeneity issue whereby the green colour used impacts the ESG (environmental) score. According to LSEG, the scores are from content research analysts based on information from annual reports, company websites, and CSR reports (Refinitiv, 2023, p. 6). The use of green could impact the judgement and perception of analysts, and this could bias the scoring process. This point will be discussed further in Section 4.3.

The results show that environmental industry affiliation (Env\_Industry\_it) is positively associated with the use of green colour in sustainability reports. The coefficient for Env\_Industry\_it remains significant at the 1% or 5% level in most columns, suggesting that firms operating in environmentally sensitive industries are more likely to use higher levels of green in their sustainability reports, consistent with an impression management explanation.

The results also highlight the role of firm characteristics. US-listed firms (US\_Listed\_it) are positively associated with green performance, with coefficients significant at the 1% level in models (2) and (3). This suggests that US-listed firms tend to use green more in their sustainability reports. As discussed in section 3.4.1, historically, sustainability reporting regulations in the United States have been relatively less rigorous compared to other regions (KPMG, 2020).

In contrast, firm size (LnAssets\_it) exhibits a negative association with green performance, with significant coefficients in multiple specifications, implying that larger firms may use less green due to higher scrutiny from stakeholders (Schreck & Raithel, 2018).

Return on assets (ROA\_it) is positively associated with the level of green used, with coefficients significant at the 5% level or better in most models. This suggests that more profitable firms tend to use more green colour in the reports, potentially due to higher levels of financial resources supporting higher levels of ESG investment (Aksu & Kosedag, 2006; Orazalin & Mahmood, 2020). However, in most cases, leverage (Lev\_it) and capital intensity (Cap\_Int\_it) show inconsistent signs and lack statistical significance. Similarly, the variable for the existence of a green logo (Green\_Logo\_it) does not exhibit a significant relationship with green performance in most specifications. This indicates no clear pattern regarding how these factors influence green performance in the current research design

### 4.3 Endogeneity – GMM approach

Table 4 presents the dynamic panel GMM results for Equation (2), examining the determinants of green colour usage in sustainability reports. Column (9) uses the overall ESG score  $(ln(ESG\_Score)_{it})$ , while Model (10) used the score for the environmental activities specifically  $(ln(Env\_Score)_{it})$ .

Table 4 Results for Eq.(2) examining the effect of the dynamic panel GMM				
	(9)	(10)		
Variable	Green <sub>it</sub>	Green_C <sub>it</sub>		
Green <sub>it-1</sub>	0.4044***			
	(0.02)			
Green_C <sub>it-1</sub>		0.4018***		
		(0.02)		
ln(ESG_Score) <sub>it</sub>	-0.0007			
	(0.00)			
$ln(Env\_Score)_{it}$		-0.0108**		
		(0.00)		
Env_Industry <sub>it</sub>	0.0037***	0.0066***		
	(0.00)	(0.00)		
Multi_Nation <sub>it</sub>	0.0172***	-0.0044		
	(0.01)	(0.01)		
US_Listed <sub>it</sub>	0.0041**	0.0010		
	(0.01)	(0.00)		
ln(Assets) <sub>it</sub>	-0.0005	-0.0002		
	(0.00)	(0.00)		
Lev <sub>it</sub>	0.0230***	0.0281***		
	(0.00)	(0.01)		
Cap_Int <sub>it</sub>	-0.0174***	-0.0092		
	(0.00)	(0.01)		
<i>RoA<sub>it</sub></i>	0.0122***	0.0282***		
	(0.00)	(0.01)		
Green_Logo <sub>it</sub>	0.0016	0.0087*		
	(0.00)	(0.00)		
Constant	-0.0194*	0.0411*		
	(0.01)	(0.02)		
Observations	1494	1482		
Year FE	Ν	Ν		
Hansen	91.03	96.19		
AR(1)	-3.77***	-3.38***		
AR(2)	0.92	1.42		

Table 4 Results for Eq.(2) examining	g the effect of th	e dynamic panel GMM
	( <b>0</b> )	(10)

Note: \*, \*\*, and \*\*\* indicate that the explanatory variable is significant at the 0.10, 0.05 and 0.01 significance level, respectively. Robust standard errors are reported in parentheses.

Key findings are as follows. First, there is persistence in the use of green colour in the sustainability report. The lagged dependent variable  $(Green_{it-1})$  is significant and positive in both columns (coefficient around 0.40, p < 0.01 in (9) and (10)), indicating strong stickiness in firms' use of green colour across sample periods. This aligns with the literature that finds companies tend to use boilerplate reports for non-financial information reporting (Henry & Peytcheva, 2020), and it adds to the literature by demonstrating that this stickiness also exists for report colour usage.

Second, the use of green is more strongly related to the environmental pillar in the ESG score than the overall score. In column (9), the overall ESG score  $(ln(ESG\_Score)_{it})$  is insignificant ( $\beta = -0.0007$ , p > 0.10), suggesting that the broader ESG performance does not systematically correlate with green colour usage. However, the environmental sub-score  $(ln(Env\_Score)_{it})$  in column (10) exhibits a negative and significant relationship with *Green\\_C<sub>it</sub>*, which is the green measure excluding black and white pixels ( $\beta = -0.0108$ , p < 0.05). This implies that firms with less environmental activities  $(ln(Env\_Score)_{it})$  use more green colour in their reports, potentially indicating greenwashing (Torelli et al., 2020). However, recalling the typology by Delmas and Burbano (2011) from Figure 1, when there is a negative relationship between communication and environmental performance, firms could be either greenwashing or be silent green firms. This will be discussed in more detail in section 4.4.

Third, the control variables demonstrate the relationship between firm characteristics and the use of green. The environmentally sensitive industries (e.g., energy, manufacturing) use significantly more green, as shown in both columns ( $\beta = 0.0037$ , 0.0066, p < 0.01). This aligns with impression management theory, where firms in polluting sectors adopt symbolic gestures to offset reputational risks (Emma & Jennifer, 2021). Further, multinational firms exhibit greater use of green in Model (9) ( $\beta = 0.0172$ , p < 0.01), likely reflecting global stakeholder pressures (Surroca et al., 2013). However, this effect disappears in Model (10), suggesting heterogeneity in how environmental versus broader ESG performance interacts with multinationalism (Filatotchev & Stahl, 2015). Additionally, U.S.-listed firms report higher green colour usage in Model (9) ( $\beta = 0.0041$ , p < 0.05), potentially due to the less rigorous sustainability reporting requirements in the United States (Kolk, 2016) compared to other countries in the sample.

Last, for the control variables, highly leveraged firms use more green colour ( $\beta = 0.0230-0.0281$ , p < 0.01), suggesting they do so to signal stability to creditors (Zhang, 2022). Additionally, profitable firms (higher ROA) employ more green in their sustainability reports ( $\beta = 0.0122-0.0282$ , p < 0.01), which is consistent with the literature that finds higher financial surpluses enable greater investments in sustainability communication. Capital-intensive firms use less green colour ( $\beta = -0.0174$ , p < 0.01 in Model 9), possibly because high levels of capital intensity relate to less green investments. Lastly, the *Green\_Logo<sub>it</sub>* is only weakly positively correlated with green usage, as shown in column (10) (at the 10% level, suggesting firms may align visual rhetoric with formal logo endorsements to enhance credibility (Ginon et al., 2014) but this is not the only factor driving the overall level of green in a report.

### 4.4 Part 2: Environmentally sensitive industries – interaction term

Table 5 presents the dynamic panel GMM results for Equation (3), incorporating the interaction term of  $ln(Score)_{it} \times HGLS_{it}$ , which examines the determinants of green colour usage in sustainability reports. Column (9) employs the overall ESG score  $(ln(ESG\_Score)_{it})$ , while Column (10) focuses specifically on the score for environmental activities  $(ln(Env\_Score)_{it})$ .

The interaction term captures how the effect of ESG performance varies depending on whether a firm exhibits greenwashing tendencies. The Greenwash Tendency dummy variable  $(HGLS_{it})$  equals 1 for firms in the top 25% quartile of green colour usage but in the bottom 25% quartile of ESG (or Environmental) scores, signalling potential discrepancies between ESG claims and actual practices. The coefficient of the ESG Score (or Environmental Score) represents its impact on the dependent variable for firms without greenwashing tendencies  $(HGLS_{it} = 0)$ . Meanwhile, the coefficient of the Greenwashing firms. The interaction term, therefore, reveals how the influence of ESG Score on green colour usage differs between these two groups.

Our findings reveal that for firms without greenwash tendencies, a higher ESG Score is associated with an increase in green colour usage ( $\beta = 0.0016-0.0082$ ), suggesting that these firms genuinely align their ESG commitments with visual representation, classifying them as either "silent brown firms" or "vocal green firms" as categorised in Figure 1. These results are more in line with the institutionalisation of ESG practices reflected by the green level used in sustainability reports.

However, for firms possibly engaged in greenwashing, the positive effect of the ESG Score on green colour usage weakens—or even reverses— ( $\beta = -0.0078$ , p < 0.01 in Column 11;  $\beta = -0.0375$ , p < 0.01 in Column 12). This suggests that firms exhibiting greenwashing tendencies tend to inflate the use of green visuals despite lower ESG scores or limited environmental activities, creating a misleading sustainability narrative. Furthermore, most control variables yield results consistent with previous estimations (i.e., FE, RE, and GMM models), except for *Cap\_Int<sub>it</sub>*. The results suggest that firms with higher capital intensity tend to use more green pixels in their sustainability reports, possibly as part of an effort to signal environmental responsibility despite the capital-intensive nature of their operations. These results align with firms using colour as an impression management reporting tool.

Table 5 Results for Eq.(5) examining the effect	or the ughanne panel	
	(11)	(12)
Variable	<i>Green<sub>it</sub></i>	Green_C <sub>it</sub>
Green <sub>it-1</sub>	0.3284***	
	(0.02)	
Green_C <sub>it-1</sub>		0.3415***
		(0.02)
ln(ESG_Score) <sub>it</sub>	0.0016	
	(0.00)	
ln(Env_Score) <sub>it</sub>		0.0082*
		(0.01)
HGLS <sub>it</sub>	0.0085***	0.0186***
	(0.00)	(0.00)
$ln(Score)_{it}  imes HGLS_{it}$	-0.0078***	-0.0375***
	(0.00)	(0.01)
Env_Industry <sub>it</sub>	0.0002	0.0045**
	(0.00)	(0.00)
Multi_Nation <sub>it</sub>	-0.0003	0.0019
	(0.01)	(0.01)
US_Listed <sub>it</sub>	0.0020	0.0043
	(0.00)	(0.00)
ln(Assets) <sub>it</sub>	-0.0002	-0.0006
	(0.00)	(0.00)
Lev <sub>it</sub>	0.0141***	0.0297 ***
	(0.00)	(0.01)
Cap_Int <sub>it</sub>	0.0108***	0.0114
	(0.00)	(0.01)
RoA <sub>it</sub>	0.0104***	0.0266***
	(0.00)	(0.01)
Green_Logo <sub>it</sub>	0.0020	0.0051
	(0.00)	(0.01)
Constant	-0.0152*	-0.0138
	(0.01)	(0.02)
Observations	1494	1482
Year FE	N	N
Hansen	89.26	92.70
AK(1)	-3.44***	-2./9***
AR(2)	0.81	1.04

 Table 5 Results for Eq.(3) examining the effect of the dynamic panel GMM models

Note: \*, \*\*, and \*\*\* indicate that the explanatory variable is significant at the 0.10, 0.05 and 0.01 significance level, respectively. Robust standard errors are reported in parentheses.

## 5.0 Concluding remarks

This study explores the role of the use of the colour green in corporate sustainability reports by introducing an innovative pixel-based metric to quantify colour usage across Fortune 500 firms' standalone sustainability reports published from 2014 to 2023. By analysing green colour measures against Environmental, Social, and Governance (ESG) firm performance, our findings reveal a complex relationship. While a broad analysis indicates a negative correlation between the extent of green usage and ESG performance, a more granular assessment highlights a subset of firms, characterising green colouration as low ESG engagement and exhibiting signs of "greenwashing." Isolating these firms, the remaining sample demonstrates a positive alignment between green intensity and genuine sustainability efforts.

These results can be interpreted through two key theoretical lenses. First, from a marketing perspective, the strategic use of green serves as an impression management tool designed to project a strong environmental commitment, particularly among firms engaging in greenwashing. Second, for the majority of firms, the use of green appears to reflect a deeper, institutionalised to sustainability, suggesting that visual elements in reports may serve as credible signals of corporate environmental responsibility.

By proposing a novel methodology for assessing green usage in corporate reports, this study paves the way for future research into the role of visual presentation in shaping stakeholder perceptions. It also offers valuable insights for regulators and practitioners concerned with corporate transparency and authenticity in sustainability disclosures.

This research is actively progressing, with further analysis currently underway. Initial findings indicate a noticeable discrepancy between corporate sustainability communication and actual ESG actions, aligning with patterns of greenwashing. As the study advances, additional insights will be revealed, providing a more comprehensive perspective on the implications of corporate sustainability messaging and its potential consequences.

While this study focuses on green as the predominant colour associated with sustainability, some scholars argue that it has become an overused "eco-cliché" (García-Sánchez & Araújo-Bernardo, 2020a). Marketing research suggests that alternative colours, such as blue, may be more effective in conveying corporate social responsibility (CSR) messages (Barchiesi et al., 2018). Another key limitation is that this study does not explore whether the use of colour in sustainability reports is a deliberate strategic decision or merely an incidental design choice. Understanding the intent behind colour selection could provide deeper insights into how firms communicate their sustainability commitments. Furthermore, this study does not examine how stakeholders perceive and interpret different colours in sustainability reports, which could influence the effectiveness of corporate ESG messaging. Future research could bridge this gap by investigating how different audiences respond to various colour schemes and whether these perceptions align with a firm's actual sustainability performance.

Building on these limitations, several directions for future research emerge. One potential avenue is to explore the use of alternative colour strategies in sustainability communication,

particularly by examining how the interaction between colour, text, and imagery shapes stakeholder perceptions. Another important aspect is the role of financial public relations and corporate communication teams in determining the visual elements of sustainability reports. Investigating who makes creative decisions regarding images, fonts, and colour schemesand why-could reveal whether colour choices are intentionally aligned with a firm's sustainability agenda or simply a by-product of branding. Additionally, further research could assess how users react to different colours when the underlying sustainability information remains constant, potentially through controlled experiments that measure stakeholder trust and perception. Examining the discrepancy between preparers and users of sustainability reports is also a promising avenue, extending prior studies such as Merkl-Davies and Brennan (2011) but focusing on colour rather than narrative disclosures. Lastly, linking these insights to behavioural finance and corporate incentives could provide a deeper understanding of how firms strategically use colour to shape ESG perceptions, influence investor confidence, and manage reputational risks. By addressing these aspects, future research can enhance our understanding of sustainability messaging and its broader implications for corporate transparency, stakeholder engagement, and ethical communication.

## References

- Ahern, L., Bortree, D. S., & Smith, A. N. (2013). Key trends in environmental advertising across 30 years in *National Geographic* magazine. *Public Understanding of Science*, 22(4), 479–494. https://doi.org/10.1177/0963662512444848
- Aslam, M. M. (2006). Are You Selling the Right Colour? A Cross-cultural Review of Colour as a Marketing Cue. *Journal of Marketing Communications*, 12(1), 15–30. https://doi.org/10.1080/13527260500247827
- Barchiesi, M. A., Castellan, S., & Costa, R. (2018). In the eye of the beholder: Communicating CSR through color in packaging design. *Journal of Marketing Communications*, 24(7), 720–733. https://doi.org/10.1080/13527266.2016.1224771
- Baum, L. M. (2012). It's Not Easy Being Green ... Or Is It? A Content Analysis of Environmental Claims in Magazine Advertisements from the United States and United Kingdom. *Environmental Communication*, 6(4), 423–440. https://doi.org/10.1080/17524032.2012.724022
- Bellucci, M., Acuti, D., Simoni, L., & Manetti, G. (2021). Restoring an eroded legitimacy: the adaptation of nonfinancial disclosure after a scandal and the risk of hypocrisy. *Accounting, Auditing & Accountability Journal*, 34(9), 195–217. https://doi.org/10.1108/AAAJ-12-2019-4359
- Bellucci, M., Simoni, L., Acuti, D., & Manetti, G. (2019). Stakeholder engagement and dialogic accounting. Accounting, Auditing & Accountability Journal, 32(5), 1467–1499. https://doi.org/10.1108/AAAJ-09-2017-3158
- Bingler, J. A., Kraus, M., Leippold, M., & Webersinke, N. (2023). How Cheap Talk in Climate Disclosures Relates to Climate Initiatives, Corporate Emissions, and Reputation Risk. Swiss Finance Institute Research Paper Series, 22(1). https://ssrn.com/abstract=4000708
- Bini, L., Giunta, F., & Bellucci, M. (2017). Put your money where your mouth is : the difference between real commitment to sustainability and mere rhetoric. *FINANCIAL REPORTING*, 2, 5–31. https://doi.org/10.3280/FR2016-002001
- Bloomberg. (2024, February 8). Global ESG assets predicted to hit \$40 trillion by 2030, despite challenging environment, forecasts Bloomberg Intelligence.
   Https://Www.Bloomberg.Com/Company/Press/Global-Esg-Assets-Predicted-to-Hit-40-Trillion-by-2030-despite-Challenging-Environment-Forecasts-Bloomberg-Intelligence/.
- Boiral, O. (2013). Sustainability reports as simulacra? A counter-account of A and A+ GRI reports. Accounting, Auditing & Accountability Journal, 26(7), 1036–1071. https://doi.org/10.1108/AAAJ-04-2012-00998

- Bom, S., Jorge, J., Ribeiro, H. M., & Marto, J. (2019). A step forward on sustainability in the cosmetics industry: A review. *Journal of Cleaner Production*, 225, 270–290. https://doi.org/10.1016/j.jclepro.2019.03.255
- Brennan, N. M., & Merkl-Davies, D. M. (2013). Accounting narratives and impression management. *The Routledge Companion to Accounting Communication*, 109–132. http://www.econis.eu/PPNSET?PPN=747824487
- Burt, D., & Perrett, D. (1995). Perception of age in adult Caucasian male faces: computer graphic manipulation of shape and colour information. *Proceedings of the Royal Society* of London. Series B: Biological Sciences, 259(1355), 137–143. https://doi.org/10.1098/rspb.1995.0021
- Cahan, S. F., de Villiers, C., Jeter, D. C., Naiker, V., & Van Staden, C. (2016). Are CSR disclosures value relevant? Cross-country evidence. *European Accounting Review*, 25(3), 579–611. https://doi.org/10.1080/09638180.2015.1064009
- Campelo, A., Aitken, R., & Gnoth, J. (2011). Visual Rhetoric and Ethics in Marketing of Destinations. *Journal of Travel Research*, 50(1), 3–14. https://doi.org/10.1177/0047287510362777
- Carroll, A. B. (2021). Corporate social responsibility (CSR) and the COVID-19 pandemic: organizational and managerial implications. *Journal of Strategy and Management*, 14(3), 315–330. https://doi.org/10.1108/JSMA-07-2021-0145
- Cheskin, L. (1957). How to predict what people will buy. Liveright.
- Cho, C. H., Laine, M., Roberts, R. W., & Rodrigue, M. (2015). Organized hypocrisy, organizational façades, and sustainability reporting. *Accounting, Organizations and Society*, 40, 78–94. https://doi.org/10.1016/j.aos.2014.12.003
- Cho, C. H., Michelon, G., & Patten, D. M. (2012). Impression Management in Sustainability Reports: An Empirical Investigation of the Use of Graphs. *Accounting and the Public Interest*, 12(1), 16–37. https://doi.org/10.2308/apin-10249
- Cho, C. H., & Patten, D. M. (2007). The role of environmental disclosures as tools of legitimacy: A research note. *Accounting, Organizations and Society*, 32(7), 639–647. https://doi.org/10.1016/j.aos.2006.09.009
- Chong, S., Momin, M., & Narayan, A. (2023). A research framework to analyse visual persuasion of photographs in sustainability reports. *Meditari Accountancy Research*, 31(5), 1453–1482. https://doi.org/10.1108/MEDAR-01-2022-1565
- Connolly-Ahern, C., & Broadway, S. C. (2007). The importance of appearing competent: An analysis of corporate impression management strategies on the World Wide Web. *Public Relations Review*, *33*(3), 343–345. https://doi.org/10.1016/j.pubrev.2007.05.017
- Courtis, J. K. (2004). Colour as visual rhetoric in financial reporting. *Accounting Forum*, 28(3), 265–281. https://doi.org/10.1016/j.accfor.2004.07.003

- Davison, J. (2014). Visual rhetoric and the case of intellectual capital. *Accounting, Organizations and Society*, 39(1), 20–37. https://doi.org/10.1016/j.aos.2014.01.001
- de Freitas Netto, S. V., Sobral, M. F. F., Ribeiro, A. R. B., & Soares, G. R. da L. (2020). Concepts and forms of greenwashing: a systematic review. *Environmental Sciences Europe*, 32(1). https://doi.org/10.1186/s12302-020-0300-3
- De Villiers, C., & Alexander, D. (2014). The institutionalisation of corporate social responsibility reporting. *The British Accounting Review*, 46(2), 198–212. https://doi.org/10.1016/j.bar.2014.03.001
- De Villiers, C., Dimes, R., & Molinari, M. (2023). How will AI text generation and processing impact sustainability reporting? Critical analysis, a conceptual framework and avenues for future research. *Sustainability Accounting, Management and Policy Journal (Print)*. https://doi.org/10.1108/SAMPJ-02-2023-0097
- De Villiers, C., & van Staden, C. J. (2011). Where firms choose to disclose voluntary environmental information. *Journal of Accounting and Public Policy*, *30*(6), 504–525. https://doi.org/10.1016/j.jaccpubpol.2011.03.005
- Delmas, M. A., & Burbano, V. C. (2011). The Drivers of Greenwashing. California Management Review, 54(1), 64–87. https://doi.org/10.1525/cmr.2011.54.1.64
- Delong, M., & Goncu-Berk, G. (2012). What color is sustainability? In *Color and Design*. Berg Publishers.
- Dhaliwal, D. S., Li, O. Z., Tsang, A., & Yang, Y. G. (2011). Voluntary nonfinancial disclosure and the cost of equity capital: The initiation of corporate social responsibility reporting. *The Accounting Review*, 86(1), 59–100. https://doi.org/10.2308/accr.00000005
- DiMaggio, P. J., & Powell, W. W. (1983). The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields. *American Sociological Review*, 48(2), 147–160. https://doi.org/10.2307/2095101
- Diouf, D., & Boiral, O. (2017). The quality of sustainability reports and impression management: A stakeholder perspective. *Accounting, Auditing, & Accountability*, 30(3), 643–667. https://doi.org/10.1108/aaaj-04-2015-2044
- Dobrick, J., Klein, C., & Zwergel, B. (2023). Size bias in refinitiv ESG data. *Finance Research Letters*, 55, 104014. https://doi.org/10.1016/j.frl.2023.104014
- Drempetic, S., Klein, C., & Zwergel, B. (2020). The Influence of Firm Size on the ESG Score: Corporate Sustainability Ratings Under Review. *Journal of Business Ethics*, 167(2), 333–360. https://doi.org/10.1007/s10551-019-04164-1
- Dunaway, F. (2015). *Seeing Green: The Use and Abuse of American Environmental Images*. University of Chicago Press.

- Dunn, K. (2021). JPMorgan Chase to invest \$2.5 trillion in sustainable development initiatives. *Fortune*. https://fortune.com/2021/04/15/jpmorgan-sustainable-green-investment-2021/
- Galileo, G. (1623). The Assayer. In M. R. Mathews (Ed.), *The Scientific Background to Modern Philosophy: Selected Readings* (pp. 56–61). Hackett.
- García-Sánchez, I., & Araújo-Bernardo, C. (2020a). What colour is the corporate social responsibility report? Structural visual rhetoric, impression management strategies, and stakeholder engagement. *Corporate Social Responsibility and Environmental Management*, 27(2), 1117–1142. https://doi.org/10.1002/csr.1869
- García-Sánchez, I., & Araújo-Bernardo, C. (2020b). What colour is the corporate social responsibility report? Structural visual rhetoric, impression management strategies, and stakeholder engagement. *Corporate Social Responsibility and Environmental Management*, 27(2), 1117–1142. https://doi.org/10.1002/csr.1869
- García-Sánchez, I.-M., Suárez-Fernández, O., & Martínez-Ferrero, J. (2019). Female directors and impression management in sustainability reporting. *International Business Review*, 28(2), 359–374. https://doi.org/10.1016/j.ibusrev.2018.10.007
- Gephart, J., Emenike, M., & Bretz, S. L. (2011). "Greenwashing" or Green Advertising? An Analysis of Print Ads for Food and Household Cleaning Products from 1960-2008.". *Journal for Activist Science and Technology Education*, 3(2), 19–26.
- Goffman, E. (1959). The presentation of self in everyday life. In *Doubleday anchor book* (Vol. 174). Doubleday.
- Haffar, M., & Searcy, C. (2020). Legitimizing Potential "Bad News": How Companies Disclose on Their Tension Experiences in Their Sustainability Reports. Organization & Environment, 33(4), 534–553. https://doi.org/10.1177/1086026620942968
- Hahn, R., & Lülfs, R. (2014). Legitimizing Negative Aspects in GRI-Oriented Sustainability Reporting: A Qualitative Analysis of Corporate Disclosure Strategies. *Journal of Business Ethics*, 123(3), 401–420. https://doi.org/10.1007/s10551-013-1801-4
- Hooghiemstra, R. (2000). Corporate Communication and Impression Management: New Perspectives Why Companies Engage in Corporate Social Reporting. *Business Challenging Business Ethics: New Instruments for Coping with Diversity in International Business*, 27(1/2), 55–68. https://doi.org/10.1007/978-94-011-4311-0\_7
- Invernizzi, A. C., Bellucci, M., Acuti, D., & Manetti, G. (2022). Form and substance: Visual content in CSR reports and investors' perceptions. *Psychology & Marketing*, 39(5), 974– 989. https://doi.org/10.1002/mar.21635
- Ioannou, I., Kassinis, G., & Papagiannakis, G. (2022). How Greenwashing Affects the Bottom Line. *Harvard Business Review*. https://hbr.org/2022/07/how-greenwashingaffects-the-bottom-line
- Kahraman, A., & Kazançoğlu, İ. (2019). Understanding consumers' purchase intentions toward natural-claimed products: A qualitative research in personal care products.

Business Strategy and the Environment, 28(6), 1218–1233. https://doi.org/10.1002/bse.2312

- Kanbaty, M., Hellmann, A., Ang, L., & He, L. (2024). A review and analysis of impression management with photographs in sustainability reporting. *Meditari Accountancy Research*, 32(3), 976–1005. https://doi.org/10.1108/MEDAR-09-2022-1798
- Kanbaty, M., Hellmann, A., & He, L. (2020). Infographics in corporate sustainability reports: Providing useful information or used for impression management? *Journal of Behavioral and Experimental Finance*, 26, 100309. https://doi.org/10.1016/j.jbef.2020.100309
- Kassinis, G., & Panayiotou, A. (2018). Visuality as Greenwashing: The Case of BP and Deepwater Horizon. Organization & Environment, 31(1), 25–47. https://doi.org/10.1177/1086026616687014
- Kniazeva, M., & Belk, R. W. (2007). Packaging as Vehicle for Mythologizing the Brand. Consumption Markets & Culture, 10(1), 51–69. https://doi.org/10.1080/10253860601164627
- Kosslyn, S. M., & Thompson, W. L. (2003). When is early visual cortex activated during visual mental imagery? *Psychological Bulletin*, 129(5), 723–746. https://doi.org/10.1037/0033-2909.129.5.723
- KPMG. (2020). *The time has come: The KPMG survey of sustainability reporting*. https://assets.kpmg/content/dam/kpmg/xx/pdf/2020/11/the-time-has-come.pdf
- Leonidou, L. C., Leonidou, C. N., Palihawadana, D., & Hultman, M. (2011). Evaluating the green advertising practices of international firms: a trend analysis. *International Marketing Review*, 28(1), 6–33. https://doi.org/10.1108/02651331111107080
- Lim, D., Baek, T. H., Yoon, S., & Kim, Y. (2020). Colour effects in green advertising. *International Journal of Consumer Studies*, 44(6), 552–562. https://doi.org/10.1111/ijcs.12589
- Lyon, T. P., & Maxwell, J. W. (2011). Greenwash: Corporate Environmental Disclosure under Threat of Audit. *Journal of Economics & Management Strategy*, *20*(1), 3–41. https://doi.org/10.1111/j.1530-9134.2010.00282.x
- Lyon, T. P., & Montgomery, A. W. (2015). The Means and End of Greenwash. *Organization & Environment*, *28*(2), 223–249. https://doi.org/10.1177/1086026615575332
- Marquis, C., Toffel, M. W., & Zhou, Y. (2016). Scrutiny, Norms, and Selective Disclosure: A Global Study of Greenwashing. Organization Science (Providence, R.I.), 27(2), 483– 504. https://doi.org/10.1287/orsc.2015.1039
- Meister, M., Chamberlain, K., & Brown, A. (2006). Chapter Five: Rejuvenating Nature in Commercial Culture and the Implications of the Green Commodity Form. *The Environmental Communication Yearbook*, 3(1), 97–114. https://doi.org/10.1207/s15567362ecy0301\_5

- Melewar, T. C., Foroudi, P., Gupta, S., Kitchen, P. J., & Foroudi, M. M. (2017). Integrating identity, strategy and communications for trust, loyalty and commitment. *European Journal of Marketing*, 51(3), 572–604. https://doi.org/10.1108/EJM-08-2015-0616
- Merkl-Davies, D., & Brennan, N. (2007). Discretionary Disclosure Strategies in Corporate Narratives: Incremental Information or Impression Management? *Journal of Accounting Literature*, 26, 116.
- Merkl-Davies, D., & Brennan, N. M. (2011). A conceptual framework of impression management: new insights from psychology, sociology and critical perspectives. *Accounting and Business Research*, 41(5), 415–437. https://doi.org/10.1080/00014788.2011.574222
- Moneva, J. M., Archel, P., & Correa, C. (2006). GRI and the camouflaging of corporate unsustainability. *Accounting Forum*, 30(2), 121–137. https://doi.org/10.1016/j.accfor.2006.02.001
- Moodaley, W., & Telukdarie, A. (2023). Greenwashing, Sustainability Reporting, and Artificial Intelligence: A Systematic Literature Review. *Sustainability (Basel, Switzerland)*, 15(2), 1481. https://doi.org/10.3390/su15021481
- Newton, I., & Hemming, G. W. (1704). Opticks: or, A treatise of the reflections, refractions, inflexions and colours of light : also two treatises of the species and magnitude of curvilinear figures. Printed for Sam. Smith, and Benj. Walford. https://doi.org/10.5479/sil.302475.39088000644674
- Parguel, B., Benoit-Moreau, F., & Russell, C. A. (2015). Can evoking nature in advertising mislead consumers? The power of 'executional greenwashing''.' *International Journal* of Advertising, 34(1), 107–134. https://doi.org/10.1080/02650487.2014.996116
- Policarpo, M. C., Apaolaza, V., Hartmann, P., Paredes, M. R., & D'Souza, C. (2023). Social cynicism, greenwashing, and trust in green clothing brands. *International Journal of Consumer Studies*, 47(5), 1950–1961. https://doi.org/10.1111/ijcs.12971
- Rim, H., & Ferguson, M. A. T. (2020). Proactive Versus Reactive CSR in a Crisis: An Impression Management Perspective. *International Journal of Business Communication*, 57(4), 545–568. https://doi.org/10.1177/2329488417719835
- Roulet, T. J., & Touboul, S. (2015). The Intentions with Which the Road is Paved: Attitudes to Liberalism as Determinants of Greenwashing. *Journal of Business Ethics*, 128(2), 305–320. https://doi.org/10.1007/s10551-014-2097-8
- Schreck, P., & Raithel, S. (2018). Corporate Social Performance, Firm Size, and Organizational Visibility: Distinct and Joint Effects on Voluntary Sustainability Reporting. *Business & Society*, 57(4), 742–778. https://doi.org/10.1177/0007650315613120
- Seelig, M. I. (2023). Is it possible to create a favorable impression of greenness on skin care websites? *Journal of Marketing Communications*, 29(4), 358–378. https://doi.org/10.1080/13527266.2022.2028880

- Seelig, M. I., Sun, R., Deng, H., & Pal, S. (2021). Is it all for show?: Environmental brand identification on skin care and cosmetic websites. *Journal of Marketing Communications*, 27(4), 436–456. https://doi.org/10.1080/13527266.2019.1685566
- Segev, S., Fernandes, J., & Hong, C. (2016). Is Your Product Really Green? A Content Analysis to Reassess Green Advertising. *Journal of Advertising*, 45(1), 85–93. https://doi.org/10.1080/00913367.2015.1083918
- Solomon, J. F., Solomon, A., Joseph, N. L., & Norton, S. D. (2013). Impression management, myth creation and fabrication in private social and environmental reporting: Insights from Erving Goffman. *Accounting, Organizations and Society*, 38(3), 195–213. https://doi.org/10.1016/j.aos.2013.01.001
- Talbot, D., & Boiral, O. (2018). GHG Reporting and Impression Management: An Assessment of Sustainability Reports from the Energy Sector. *Journal of Business Ethics*, 147(2), 367–383. https://doi.org/10.1007/s10551-015-2979-4
- Unerman, J., & Chapman, C. (2014). Academic contributions to enhancing accounting for sustainable development. *Accounting, Organisations and Society*, 39(6), 385–394. https://doi.org/10.1016/j.aos.2014.07.003
- Yu, E. P. yi, Luu, B. Van, & Chen, C. H. (2020). Greenwashing in environmental, social and governance disclosures. *Research in International Business and Finance*, 52. https://doi.org/10.1016/j.ribaf.2020.101192

# Appendix Variable Definition

Variable Definition				
Green	the level of green by pixels, average per page and per annual CSR report			
Green_C	the level of green by pixels, excluding the pixels that are black or white, average per page and per annual CSR report			
Ln_Score	In of the ESG score or Environmental score, retrieved from LSEG			
Env_Industry	environmental sensitive industry according to prior literature			
Multi_nation	dummy variable, =1 if the firm is operating across multiple nations			
US_listed	dummy variable, =1 if the firm is listed on USU.S.tock market			
Ln_Assets	proxy for firm size Ln of total assets			
Lev	total liabilities over total assets			
Cap_int	total property plant and equipment over total assets			
RoA	profitability, revenue over total assets			
Green_Logo	dummy variable, =1 if the logo of the firm on the CSR report of the year has material green colour			
HGLS	dummy variable, =1 if the firm belongs to the top 25% of the level of green, and the bottom 25% of the ESG (Environmental) score			