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Information disclosure and funding success of green crowdfunding campaigns: a study on GoFundMe

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Abstract

Crowdfunding has become important in increasing financial support for the development of green technologies. Self-disclosed information significantly affects supporters' decisions and is important for the success of green project funding. However, current studies still lack investigations into the impact of information disclosure on green crowdfunding performance. This research aims to fill this knowledge gap by exploring eight information disclosure-relevant factors in green crowdfunding performance. Applying machine learning techniques (e.g., Natural Language Processing and Computer Vision) and logistic regression, this study investigates 720 green crowdfunding campaigns on GoFundMe and empirically finds that the duration, length of campaign introductions, and length of the title influence fundraising outcomes. However, no evidence supports the impact of goal size, emotion of campaign introduction, or image content on funding success. This study clarifies the information disclosure-related data that green crowdfunding campaigns should consider and provides founders with a constructive guide to smoothly raise money for a green crowdfunding campaign. This study also contributes to data processing methods by providing future studies with an approach for transferring unstructured data to structured data.

Keywords: Green crowdfunding, Funding success, Information disclosure, Successful factors

Introduction

In the face of growing global concerns regarding climate change and environmental sustainability (Yu et al. 2022), green innovation offers a promising pathway toward effective utilization of resource and energy (Chen et al. 2017; Rossolini et al. 2021; Yang et al. 2022). However, the crucial challenge of insufficient funding often hinders the development of green innovations (Wakeford et al. 2017; Takalo et al. 2021). Green-oriented ventures normally require large amounts of seed money and face daunting challenges (Butticè et al. 2019). Fortunately, the emergence of green crowdfunding campaigns, a new but widely used funding approach, has significantly improved the efficiency of raising initial funds (Chen et al. 2017; Yang et al. 2019) and has provided crucial support for innovative green technology start-ups (Lam and Law 2016).

Scholars (e.g., Adhami et al. 2018) argue that green crowdfunding campaigns can be categorized as reward- and donation-based crowdfunding. Green donation-based crowdfunding is a non-profit project with environmental protection purposes that aims to sell green products and services (Yang et al. 2017), such as tree planting, sand prevention, garbage classification, and renewable and sustainable energy (Yang et al. 2017, 2019). In short, environmental protection-related crowdfunding projects are called green crowdfunding campaigns (Lam and Law 2016).

Green crowdfunding campaigns are typically measured by the successful implications (Adhami et al. 2018). Although green crowdfunding can be seen as an effective approach for entrepreneurs to obtain external financial support from a large audience (Lam and Law 2016; Chan et al. 2018) which is not limited by place (Cohen and Muñoz 2016), fundraising outcomes for crowdfunding campaigns cannot always be guaranteed. As mentioned above, a green-related campaign normally requires large initial investments and should take more uncertainties and risks (Butticè et al. 2019), making it difficult to smoothly secure initial funding (Hörisch 2015; Yang et al. 2019). Although the success rate of green crowdfunding is still under investigation, data from Kickstarter, a well-known American-based crowdfunding platform, show that only 39.73% of campaigns across all categories were funded successfully. Additionally, only 18% of unsuccessful campaigns received 20% of the requested funds or more (Kickstarter 2022a). Therefore, it is crucial to investigate what factors may impact green crowdfunding campaigns' fundraising outcomes and guide green crowdfunding campaign founders to better design their campaigns and enhance the possibility of success.

Despite the existing studies focusing on the factors driving a crowdfunding campaign's success, such as campaign quality (Chan et al. 2018; Zhao et al. 2022), creativity (Mollick 2014), and non-profit-oriented features (Allison et al. 2015; Hörisch 2015; Ren et al. 2021a; Yuan et al. 2016), there remains notable scholarly attention specifically dedicated to green crowdfunding campaigns (Butticè et al. 2019; Rossolini et al. 2021). Scholars have outlined several factors that affect crowdfunding success in the existing studies investigating crowdfunding campaign fundraising outcomes (see Table 1). Based on the extant literature, a successful crowdfunding campaign should have several key features, such as reasonable goals and durations (Salahaldin et al. 2019; Rossolini et al. 2021), detailed and appealing project details (Yuan 2016; de Larrea et al. 2022; Ho et al. 2021; Rossolini et al. 2021), suitable location (Mollick 2014; Ho et al. 2021), effective communication (Mollick 2014; Larrea et al. 2022) and visual presentations (de Larrea et al. 2022; Ho et al. 2021), which construct the conceptual entry points of this study.

In this study, green crowdfunding campaigns refer to green reward-based and donation-based crowdfunding campaigns on online crowdfunding platforms (Yang et al. 2019). Although some existing studies generally indicated that environment-oriented crowdfunding campaigns are more likely to be funded (Lau et al. 2014; Hörisch 2015; Yuan et al. 2016; Ren et al. 2021a), there are still limited studies focused on green crowdfunding contexts (Butticè et al. 2019; Rossolini et al. 2021) and their empirical findings are controversial (Adhami et al. 2018). Notably, existing green crowdfunding-related studies do not focus on the factors affecting green crowdfunding campaigns' fundraising outcomes, especially information disclosure-related factors. Instead, existing green crowdfunding studies are more willing to investigate how crowdfunding may influence

Table 1 Factors influencing crowdfunding outcomes

Paper	Factors
de Larrea et al. (2022)	Images Communication with donors Title length Description length
Ho et al. (2021)	Title Project description length Location Visual presentations
Mollick (2014)	Personal networks Project quality Geography
Rossolini et al. (2021)	Campaign information structure Environmental protection purposes Goal size
Salahaldin et al. (2019)	Duration
Yuan (2016)	Textual content Topical feature

green campaigns (Butticè et al. 2019) or how environmental orientation impacts crowdfunding success (Hörisch 2015).

To fill this gap, this study investigated how eight selected information disclosure-relevant factors impact green crowdfunding campaigns' fundraising outcomes on crowdfunding platforms. The selections of information-disclosure-relevant factors were synthesized from the existing relevant studies, such as goal size (Mollick 2014; Kunz et al. 2017; Felipe et al. 2022), duration (Frydrych et al. 2014; Hsieh et al. 2019; Salahaldin et al. 2019), and city size (Vulkan et al. 2016; Yu and Fleming 2021), the length of campaign title (Jamali and Nikzad 2011; Ren et al. 2020), the length of campaign introduction (Koch and Siering 2015; Barbi and Bigelli 2017; Bi et al. 2017), high-frequency words (Yuan et al. 2016; Igra et al. 2021; Kubo et al. 2021), and emotion of campaign introduction (Li et al. 2017; Korzynski et al. 2021; Ren et al. 2021a). Furthermore, this study also attempted to measure how the human face shown in a crowdfunding campaign's images would affect the fundraising outcome, since Xiao and Ding (2014) and Hou et al. (2019) empirically found that it makes a crowdfunding campaign more reliable and likely to affect investors' emotions, both of which would impact investors' intention to invest.

This study used Python, Selenium package, and Chrome Driver to collect information disclosure from 720 selected green crowdfunding campaigns from GoFundMe (an American crowdfunding platform) with different results. Logistic regression analysis was performed to measure the correlation between each information disclosure-relevant factor (eight factors) and the fundraising outcomes of the chosen green crowdfunding campaigns. This study offers three theoretical contributions. First, it enriches the existing green crowdfunding-related literature by comprehensively assessing the relationship between information disclosure and green crowdfunding campaigns' fundraising outcomes rather than generally regarding crowdfunding campaigns as the research objective. Second, this study proposes that some information disclosure-relevant factors that influence crowdfunding campaigns should also be considered in the context of green crowdfunding. More importantly, this study empirically clarifies several factors

that should be considered in green crowdfunding campaigns. Third, this study provides a creative technical approach for transforming unstructured data into structured data from a methodological perspective because it combines Natural Language Processing and Computer Vision in data processing. Hence, this study provides a new practical pathway for founders to better understand the factors that may influence their anticipated goals when raising money for a green crowdfunding campaign, making their management process more effective and focused.

The remainder of this paper proceeds as follows: Section "Hypotheses development" synthesizes the existing theoretical background to develop the hypotheses. Section "Methodology" describes the research design. Section "Empirical results and discussions" presents and discusses the empirical findings. Finally, this paper concludes by highlighting the contributions of this study and future research directions.

Hypotheses development

Although financial returns are unnecessary for green crowdfunding, making the return-related setting less applicable, previous studies (Chen et al. 2017; Yang et al. 2019; Bao et al. 2022) have highlighted that crowdfunding campaign design strategies are widely used to predict fundraising outcomes, including green crowdfunding campaigns' success.

Green crowdfunding campaigns' goal size and fundraising outcomes

When starting a crowdfunding campaign, founders often set a funding goal to demonstrate their aspirations for their campaign and help potential investors evaluate the campaign's feasibility and risks (Ren et al. 2021a). As a crucial factor in designing strategies for measuring the success of crowdfunding campaigns, regardless of whether the campaign is green crowdfunding, goal size is chosen to measure the fundraising outcomes of green crowdfunding campaigns. The goal size of a crowdfunding campaign reflects the amount of money expected by the founders; a campaign will fail if the funding goal is not satisfied (Hsieh et al. 2019). Many studies have discussed the relationship between crowdfunding campaign goal size and the probability of successful funding (Mollick 2014; Cordova et al. 2015; Kunz et al. 2017; Wang et al. 2018; Felipe et al. 2022). These studies have relatively consistent points of view—a larger funding goal would negatively impact fundraising outcomes. According to a Kickstarter-based study by Kuppuswamy and Bayus (2017), unsuccessful crowdfunding campaigns typically have larger goal size than successful campaigns on the same platform. Similarly, Barbi and Bigelli (2017) investigated over 120,000 Kickstarter campaigns and found that a larger goal size decreased the percentage of successful fundraising from 82.5% (for goals less than $100) to 18.7% (for a goal of $50,000 or more). The mainstream interpretation of the negative relationship between campaign goal size and fundraising goals emphasizes that a higher goal is more difficult to reach and reduces fundraising success (Mollick 2014; Wang et al. 2018). On the contrary, Salahaldin et al. (2019) argued that potential investors view campaigns as unrealistic and invest in other campaigns if they find the funding goal size too large. Adhami et al. (2018) argued that a small-scale project would be more suitable for green crowdfunding campaigns during the inception stage, supporting the view that

smaller goal setting would positively affect green crowdfunding campaigns' fundraising outcomes.

Felipe et al. (2022) focused on the time-to-success of a crowdfunding campaign and its funding goal size, and indicated that campaigns with smaller goal sizes are more likely to achieve their goal in a shorter period, while campaigns with greater goal sizes would have lower chances of success. Similarly, Cordova et al. (2015) found a negative relationship between fundraising goal size and a campaign's time-to-success, as a large goal size may not demonstrate a crowdfunding campaign's effective needs. In summary, existing studies highlight that a successful crowdfunding campaign tends to have a relatively smaller goal size (Frydrych et al. 2014; Mollick 2014; Hsieh et al. 2019; Ren et al. 2021a; Felipe et al. 2022).

To conclude, although previous studies investigated the relationship between goal size and fundraising outcomes, most focused on something other than the green crowdfunding context. Therefore, this study aims to test the relationship between a green crowdfunding campaign's goal size and successful fundraising using our models to fill this gap. As previous studies have empirically proven that goal size generally impacts the fundraising outcomes of crowdfunding campaigns, a green crowdfunding-related hypothesis (H) is posited:

H1 The green crowdfunding campaign's goal size impacts fundraising outcomes.

Green campaign duration and fundraising outcomes

Kuppuswamy and Bayus (2017) emphasized the importance of crowdfunding campaigns' timing, which can be seen as a theoretical rationale for treating green campaign duration as a crucial factor for successful fundraising. Typically, crowdfunding platforms suggest that founders set an appropriate duration to enhance potential funders' engagement and create a sense of urgency (Salahaldin et al. 2019). For example, the Kickstarter official vlog recommends setting up a campaign for 30 days or less (Kickstarter 2022b). Unlike the relatively consistent viewpoints on the relationship between campaign goal size and fundraising outcomes, previous crowdfunding-related studies on the relationship between campaign duration and fundraising outcomes have obtained contradictory results. Existing studies argue that campaign duration can positively (Burtch et al. 2013; Cordova et al. 2015; Salahaldin et al. 2019) or negatively (Mollick 2014; Kunz et al. 2017; Hsieh et al. 2019), or not significantly (Frydrych et al. 2014; Calic and Mosakowski 2016; Hobbs et al. 2016) impact crowdfunding campaign success. Moreover, some studies explore the non-linear relationships between duration and fundraising outcomes. For example, Nakagawa and Kosaka (2022) demonstrated an inverse U-shaped relationship between campaign duration and success.

More specifically, scholars (Burtch et al. 2013; Cordova et al. 2015) have reported a positive relationship between campaign duration and fundraising outcomes, as they proved that existing financial support would generate additional financial support—a longer duration would be helpful. Similarly, Salahaldin et al. (2019) argued that a longer duration allows for a longer time to collect money, positively impacting fundraising outcomes. However, other scholars have stated that a longer duration reduces the

probability of successful funding and provides interpretations. Scholars (Mollick 2014; Barbi and Bigelli 2017; Kunz et al. 2017; Wang et al. 2018; Hsieh et al. 2019) argue that a long campaign duration reflects founders' lack of confidence in the campaign or business ideas, which would also reduce potential investors' confidence in the campaign. For instance, investors would doubt if the founders had sufficient capacity to complete the campaign on time (Hsieh et al. 2019). Salahaldin et al. (2019) found that a long campaign duration extends waiting time, which reduces the possibility of impatient investors' intentions to invest. Similarly, Kunz et al. (2017) and Hsieh et al. (2019) opposed a long campaign duration because potential investors would shift their interests to another campaign. Frydrych et al. (2014) synthesized Kickstarter's statistics and argued that a longer campaign duration encouraged procrastination and led to failure.

Nevertheless, this does not mean that shorter campaign duration would translate to better fundraising outcomes, because investors would doubt whether the campaign can collect the requested funds on time (Salahaldin et al. 2019). More importantly, Yang et al. (2019) argued that green crowdfunding campaigns normally need a longer term to exert effects, which means that a short-term duration may reduce the trustworthiness of a green crowdfunding campaign. Furthermore, only a few scholars (Frydrych et al. 2014; Calic and Mosakowski 2016; Hobbs et al. 2016) have empirically found no significant relationships between campaign duration and fundraising outcomes. A typical example was proposed by Solomon et al. (2015), who stated that investors normally contribute at the beginning and end of a crowdfunding campaign.

Nakagawa and Kosaka (2022) have shed light on the non-linear nature of the relationship between campaign duration and fundraising outcomes. Their research, based on the Japanese crowdfunding platform READYFOR, demonstrated that the duration had a positive impact on fundraising outcomes up to the 58th day (Nakagawa and Kosaka, 2022). Beyond that point however, it began to have a negative impact.

According to various viewpoints on the relationship between campaign duration and fundraising outcomes in the general context, this research assumes that duration is more likely to impact the success of green crowdfunding campaigns. After all, whether positive or negative, linear or non-linear, most studies prove that duration impacts fundraising outcomes. Therefore, in the green crowdfunding context, the following hypothesis is derived:

H2 The green crowdfunding campaign's duration impacts fundraising outcomes.

City size and fundraising outcomes

Scholars (Mollick 2014; Vulkan et al. 2016; Chan et al. 2018) suggested that geographic factors play a crucial role in crowdfunding success, although crowdfunding platforms and online crowdfunding campaigns have weakened the influence of geographic factors on fundraising outcomes. It is worth mentioning that this research did not focus on 'the shorter the geographical distance between founders and investors, the more a crowdfunding campaign would succeed,' as many previous studies (Mollick 2014; Chan et al. 2018) have reported. Instead, this study selected city size as the geographic factor and examined the relationship between city size and fundraising outcomes. The income level

and interpersonal ties of citizens living in big cities would make a green crowdfunding campaign more influential (Yu and Fleming 2021; Roe and Smith 2021).

Studies have also discussed the relationship between city size and fundraising outcomes. By conducting zip code-level regressions, Yu and Fleming (2021) empirically found that both population and income affect fundraising outcomes; crowdfunding campaigns operating in large cities with a greater population and lower median income are more likely to raise more money. This viewpoint is consistent with Chen et al. (2010), who proposed that crowdfunding campaigns are highly likely to be undertaken in wealthy regions with high human capital and creative people. Similarly, by analyzing 636 crowdfunding campaigns engaging over 17,000 investors in the U.K., Vulkan et al. (2016) empirically found that most investors using crowdfunding platforms were based in London, which also proved that crowdfunding campaigns are receiving more financial benefits from large cities. Roe and Smith (2021) apply social capital to explain the relationship between city size and fundraising outcomes, finding that crowdfunding campaigns in large cities would have a higher social capital level, including more potential customers and vendors. Thus, crowdfunding campaigns expect better fundraising outcomes in large cities because investors in large cities are more likely to possess more social ties and influence than those in small cities (Tang et al. 2020). However, other studies (Onginjo et al. 2021; Ren et al. 2021a) reported that geographical location does not significantly affect fundraising outcomes.

As discussed, existing city-size-related crowdfunding studies focus more on the general context than on green crowdfunding. Hence, this study tests how city size affects the fundraising outcomes of green crowdfunding campaigns. Following the results and explanations provided by most of the aforementioned studies, this study posits the following:

H3 City size impacts the green crowdfunding campaign's fundraising outcomes.

Length of green campaign title and fundraising outcomes

By applying signaling theory, Ross (1977) argued that one party determines how to interpret information, while another party determines how information can be communicated and signaled. Based on Defazio et al. (2020), each crowdfunding campaign presents its information in a hierarchical structure (e.g., title, promotional phrase, and pictures), which potential donors capture, process, and eventually make decisions.

Similar to Defazio et al. (2020), some existing studies (Frydrych et al. 2014; Courtney et al. 2016; Ba et al. 2020; Wang et al. 2020) also applied textual analysis and argued that textual information disclosure impacts fundraising outcomes. For instance, based on previous studies, the length of crowdfunding campaign titles (de Larrea et al. 2022; Jamali and Nikzad 2011) can also influence fundraising outcomes, since first impressions and more detailed information help potential investors decide to join green crowdfunding campaigns (de Larrea et al. 2022; Guo et al. 2019).

Founders have difficulty detailing campaign titles because they are always restricted by length (Wang et al. 2020). However, it is crucial to properly use content to persuade potential backers to contribute to campaigns (Stinchcombe 2000) because they are

antecedents of audiences' investment intentions (Kuppuswamy and Bayus 2017). Similar to the titles of academic publications, campaign titles provide potential backers with an initial indication and first impression of the campaign (de Larrea et al. 2022).

Title length is relevant to subsequent citations (Jamali and Nikzad 2011). For instance, Guo et al. (2019) argue that title length positively affects the funding ratio of public welfare crowdfunding projects because lengthy titles provide more evidence and attract backers' attention (Majumdar and Bose 2018). However, Ren et al. (2020) empirically found that a campaign with a 6, 7, or 9 word-title has a higher average number of donors, whereas a 10 or 11 word-title is more likely to achieve a better fundraising outcome. In other words, campaigns with titles of 6 to 11 words would raise more money. Because potential backers initially scan the titles of online green crowdfunding campaigns, the length of campaign titles should be considered a success factor in the green crowdfunding campaigns' fundraising outcomes.

Although there are limited findings on the impact of title length on fundraising outcomes, previous studies have shown that title length does matter. Hence, this study assumed the following:

H4 The title length impacts the green crowdfunding campaign's fundraising outcomes.

Length of green campaign introduction and fundraising outcomes

Crowdfunding platforms typically encourage founders to provide higher-quality content for campaign introduction to attract more funds, because sufficient explanations of products/services/goals will enhance funding outcomes (Anglin and Pidduck 2022). Furthermore, based on the application of signaling theory by Defazio et al. (2020) in crowdfunding, the introduction of a campaign is another type of information signaled and processed by potential investors, which is why the length of the green campaign introduction should be cautiously considered as a key factor in measuring the success of green crowdfunding. Based on Bi et al. (2017), although fewer studies have investigated the impact of campaign introduction length on fundraising outcomes, a detailed campaign introduction with more word count remains a crucial signal for measuring the quality of a campaign. Barbi and Bigelli (2017) maintained the same consistency as the above study, pointing out that crowdfunding campaign quality correlates with wider information disclosure—the length of the campaign introduction matters (Kim et al. 2016). Therefore, this study selected the length of campaign introduction as a crucial factor affecting green crowdfunding fundraising outcomes.

The length of the campaign introduction guarantees the quality of a green crowdfunding campaign. Barbi and Bigelli (2017) reported that a detailed and extensive campaign introduction significantly increases funding intentions because investors can sufficiently perceive the founder's efforts and time consumption for a particular project. Similarly, Koch and Siering (2015) and Bi et al. (2017) also mentioned that the better the campaign introduction, the more trustworthy or well-prepared the crowdfunding campaign. Written project introductions on crowdfunding platforms play a large role in interacting with investors and determining their decision-making (Maehle et al. 2021). However, an overly prolix campaign introduction may not always positively impact fundraising

outcomes since two contracting impressions would be brought to investors: (1) the founder made a great effort in preparing the campaign, or (2) the founder lacks conciseness, which fails to capture investors' interests and attention, which can be detrimental to investors' confidence in a campaign as the investors would doubt whether the founder has adequate ability to operate the campaign (Barbi and Bigelli 2017).

Additionally, although a detailed campaign introduction enhances fundraising outcomes, the length of the founder's introduction should be controlled because Anglin and Pidduck (2022) empirically found that an overlength introduction negatively affects investment intention. A detailed and extensive campaign introduction can positively affect fundraising success by reducing information asymmetry between founders and investors (Butticè et al. 2019). Ba et al. (2020) also supported this viewpoint, since they emphasized that a clear campaign introduction helped investors better understand fundraising purposes and facilitated willingness to invest. In conclusion, the longer the introduction, the more readers will understand the campaign and be willing to invest (Bi et al. 2017). However, some scholars (Beier and Wagner 2014; de Larrea et al. 2019; Ren et al. 2021a) tend to challenge this area because they cannot empirically find a significant relationship between the length of campaign introduction and fundraising outcomes. For instance, based on data captured from a Swiss crowdfunding platform, Beier and Wagner (2014) found that neither the links from the campaign webpage nor the campaign homepage would affect fundraising outcomes.

Although previous studies have different opinions on how the length of a crowdfunding campaign may impact fundraising outcomes, most of the above reported that the length of the campaign matters in enhancing fundraising outcomes in a general sense. Therefore, this study assumes the following when focusing on green crowdfunding campaigns.

H5 The length of the green campaign's introduction impacts fundraising outcomes.

Number of high-frequency words in green crowdfunding campaign's title and fundraising outcomes

Few studies have examined the influence of topical features of crowdfunding campaigns on fundraising outcomes (Yuan et al. 2016). However, this is crucial for the success of green crowdfunding campaigns because high-frequency words can easily capture potential customers interested in environmental protection projects (Yuan et al. 2016). The limited relevant studies on crowdfunding campaigns' high-frequency words (Yuan et al. 2016; Corsini and Frey 2021; Igra et al. 2021) are more interested in in-text high-frequency words in crowdfunding campaign descriptions rather than the number of high-frequency words in the title of crowdfunding campaigns. For instance, Yuan et al. (2016) indicate that in-text high-frequency words determine fundraising outcomes by reflecting the campaign's inherent nature. The logic is that when high-frequency words in a crowdfunding description fit real-world trends, such as 'environmental protection' and 'green project,' they may attract more investors. However, this does not imply that high-frequency words always promote fundraising outcomes. For instance, after investigating 3,000 sustainability-relevant campaigns on Kickstarter, Corsini and Frey (2021)

suggested that the high-frequency words used in crowdfunding descriptions should be specific (e.g., repairable, recycled) rather than too generic (sustainable, ecologic), or the success probability of the campaign would decrease. Furthermore, Kubo et al. (2021) empirically found that high-frequency words may lead to two contradictory results—success or failure, as they found that successful or failed crowdfunding campaigns may use the same or similar high-frequency words in campaign descriptions.

Although the high-frequency word studies above focused on either the title of crowdfunding campaigns or green crowdfunding contexts, they still indicated that high-frequency words drive crowdfunding campaign success in general. As mentioned, campaign titles offer backers the first impression of the campaign (de Larrea et al. 2022), which means that environmentally relevant high-frequency words would attract the attention of backers interested in green crowdfunding campaigns. Hence, in a title-oriented context, the following green crowdfunding-related hypothesis has been derived:

H6 The number of high-frequency words in the green crowdfunding campaign' title impacts fundraising outcomes.

Emotion of green crowdfunding campaign's introduction and fundraising outcomes

Studies relevant to the text features of a green crowdfunding campaign introduction, especially those testing the relationships between linguistic features and fundraising outcomes, are limited (Zhu 2022). However, it is argued that the emotional words used in a crowdfunding campaign introduction would significantly impact investors' intentions to invest by triggering their emotions (Ren et al. 2021a) or engaging their limited rationalities (Liu et al. 2022), such as sympathy, hope, and imagination (Wu et al. 2022). For instance, previous studies (e.g., Kaminski and Hopp 2019; Johan and Zhang 2020; Anglin and Pidduck 2022) suggested that investors are more willing to contribute if the language used in the campaign introduction can build excitement. Investors, such as people who are keen to contribute to environmental protection, may not always be rational and may be driven by emotions (Ren et al. 2021b), such as people keen on contributing to environmental protection. Therefore, this study chooses the emotion of campaign introduction to influence the fundraising outcomes of green crowdfunding campaigns.

Valence is crucial when discussing the emotions of a crowdfunding campaign's text features because it contains both positive and negative emotions (Ren et al. 2021a). Previous studies (Li et al. 2017; Jiang et al. 2019; Korzynski et al. 2021) reported that fundraising outcomes can be positively impacted when founders express positive emotions when introducing crowdfunding campaigns, as this makes them more likely to receive more favorable feedback. Therefore, positive emotions increase the possibility of receiving more funding (Cardon et al. 2017; Li et al. 2017). Furthermore, Anglin and Pidduck (2022) note that campaign founders' positive psychological capital also makes them more optimized, hopeful, and confident, which promotes crowdfunding outcomes. Interestingly, negative emotional texts in campaign introductions can also produce favorable outcomes (Kim et al. 2016). This is supported by Majumdar and Bose (2018), who argued that negative emotions (e.g., a description of disease severity) are an emotional appeal that increases the persuasiveness of a campaign and thus promote

fundraising outcomes (Korzynski et al. 2021). However, Nakagawa and Kosaka (2022) empirically found that the degree of evoking empathy cannot significantly impact fundraising outcomes. Additionally, founders should cautiously use emotional words when introducing crowdfunding campaigns because there are differences in how people express and perceive emotions (Allison et al. 2022)— and investors' perceptions of emotions may not always align with the founders' emotional expressions (Lucas et al. 2016). Consequently, investors would reduce their intention to invest because they mistakenly perceive authentic emotional expressions as inauthentic (Allison et al. 2022), negatively impacting fundraising outcomes. Investors prefer not to perceive inauthenticity (Cardon et al. 2017).

In the general context, most emotion-relevant studies found that the emotions of a crowdfunding campaign's introduction would affect fundraising outcomes, which helped this research develop an emotion-related hypothesis in the green crowdfunding context:

H7 The emotion of the green crowdfunding campaign's introduction impacts fundraising outcomes.

Image features/contents of green crowdfunding campaign's introduction and fundraising outcomes

Visual information (e.g., pictures and videos) has been found to crucially affect investors' intentions to invest (Li et al. 2019). Based on previous studies, campaign founders increasingly use images and videos to promote their campaigns on crowdfunding platforms (Mollick 2014; Allison et al. 2017; Korzynski et al. 2021) as they argued that media usage demonstrates campaign quality and credibility (Courtney et al. 2016). In this study, images, especially the human face shown in the images of the green crowdfunding campaign's introduction, were selected as factors impacting fundraising outcomes, since the human face shown in the images impacts fundraising outcomes by affecting both investors' attention (Xiao and Ding 2014; Hou et al. 2019) and emotional responses (Hou et al. 2019).

Existing studies show that the image count and quality shown on e-commerce platforms positively increases backers' attention, trust, and conversion rate (Hou et al. 2019), which can be extended to crowdfunding contexts. For instance, when investigating the human face shown in print-formed advertising, Xiao and Ding (2014) empirically found that people prefer faces in advertising and that facial features affect readers' reactions to a particular campaign. Similarly, Hou et al. (2019) mentioned that human facial features in the title image of crowdfunding cause readers' emotional responses, impacting people's intention to invest. As mentioned in the previous section, emotions can also drive investors' investment intentions (Ren et al. 2021a, 2021b). Additionally, crowdfunding platforms suggest that founders show their faces when introducing their campaigns, similar to a key suggestion shown on Kickstarter's official webpage: 'Do not be afraid to put your face in front of the camera and let people see to whom they're giving money' (O'Connell and Kurtz 2012). More importantly, investors can capture a large amount of information from founders' faces, such as confidence or trustworthiness (Li et al. 2019)—which can also affect fundraising

outcomes. Similarly, Qi et al. (2022) also connected trustworthiness and facial image revealing, since founders would reduce dishonest behavior when their facial images are exposed to the public.

However, visual information does not always guarantee crowdfunding campaigns' success. For example, Frydrych et al. (2014) empirically found that, in their research, 144 of 177 (81.2%) failing Kickstarter crowdfunding campaigns also offered visual information (e.g., video presentation). After all, visual information in crowdfunding campaigns has become a must-do item rather than a unique selling point for predicting fundraising outcomes.

Taken together, the existing studies highlight the importance of the human face shown in crowdfunding introduction images. However, these studies do not focus on the context of green crowdfunding. Hence, to test how the human face shown in the images of a green crowdfunding campaign introduction may impact fundraising outcomes, the following hypothesis is proposed:

H8 The face shown in the image of the green crowdfunding campaign's introduction impacts fundraising outcomes.

Methodology

This section presents the data collection methods, processing, and hypothesis testing. We extracted data from the GoFundMe website using web crawling (see Fig. 1). Textual processing and computer vision techniques were used to process raw data. Finally, using the successful (funded smoothly) and failed (failed to get funds as raised money = 0) green crowdfunding campaigns as samples, we undertook logistic regression analysis to examine the proposed hypotheses.

Fig. 1 Information collected from gofundme webpage (an example)

Data collection

This research selected GoFundMe as the case platform because it was one of the most popular crowdfunding platforms, especially in the U.S. Moreover, the platform attracted green fundraisers, and as of March 2022, when data collection took place, 720 completed green crowdfunding campaigns were shown on this platform. We used *Selenium* (a web crawler supported by the Python programming language) to collect campaign information available on the platform. The crawler effectively captured and collected relevant data, including campaign title, campaign introduction, funding, goal size, posted date, location, and cover image (see Fig. 1).

Data processing and analysis

As most of the raw data collected were unstructured, we transformed them into structured data using different processing techniques, including Natural Language Processing and Computer Vision.

Goal size (H1) We used the information captured from GoFundMe directly as a feature. However, we transferred the goal size from string data to integer data.

Duration (H2) 'Date' had been transferred to the duration of the green crowdfunding campaigns. We used the dates selected for the green crowdfunding campaigns to deduce the campaigns' posted dates and to obtain the durations of all chosen campaigns. If the duration we got was less than one day, we still count it as one day because we unified 'day' as the unit.

City size (H3) We use the locations of the selected green crowdfunding campaigns to measure whether they were located in large cities. Based on the latest statistics for 2021 (Elledge 2022), this study identified the top 10 large cities as London, Manchester, Birmingham, Leeds, Glasgow, Southampton, Liverpool, Newcastle, Nottingham, and Sheffield. Furthermore, if the selected green crowdfunding campaigns were posted in large cities, we assumed that the founders were based in the same city.

Length of title (H4) As mentioned in Sect. "Hypotheses development", we extracted each green crowdfunding campaign's title length (in words) as a successful fundraising outcome factor.

Length of introduction (H5) Similar to the existing textual analysis-relevant studies in Sect. "Hypotheses development", we identify the length of each green crowdfunding campaign's introduction as a key factor affecting fundraising outcomes. We directly used the word count to measure the length of the introductions.

High-frequency words in the green crowdfunding campaign's introductions (H6) Based on the existing studies synthesized in Sect. "Hypotheses development", we extracted high-frequency words from the titles of the chosen green crowdfunding campaigns. To measure the number of high-frequency words contained in each title, we preprocessed the generated textual data using the following steps:

1. Lower case enforcement: this step prevents computers from identifying the same words written in upper and lower cases as different words.
2. Remove punctuation: punctuation had no semantic meaning, so we removed it.

Table 2 The top 40 high-frequency words in green campaign titles

Words	Frequency	Words	Frequency	Words	Frequency	Words	Frequency
Save	36	Wildlife	17	Cop	12	Change	9
Trees	33	Conservation	17	Ride	11	Village	9
Project	29	Support	17	Environment	11	Money	8
Climate	25	Plant	17	Forest	11	Protect	8
Build	21	Challenge	16	Charity	10	School	8
Tree	20	Expedition	16	Walk	10	Mile	7
Community	19	Green	16	Park	10	Bike	7
Water	18	Fundraiser	14	Nature	10	Land	7
Fund	18	Planting	13	Building	9	Fundraising	7
Clean	18	Garden	12	Raising	9	Donate	7

Table 3 Summary statistics of numerical data

	Goal size	Duration	Length of title	Length of introduction	Number of high-frequency words in title	The emotion of introduction
Count	720.000	720.000	720.000	720.000	720.000	720.000
Mean	3,411,939.790	146.200	32.950	1386.710	0.790	0.130
Std	5,352,964.920	132.030	11.010	1411.820	0.840	0.130
Min	1.000	1.000	5.000	28.000	0.000	−0.600
25%	500.000	39.000	24.000	483.000	0.000	0.060
50%	1500.000	113.500	34.000	923.000	1.000	0.130
75%	5000.000	248.250	42.000	1721.500	1.000	0.200
Max	1,000,000,000.000	1863.000	50.000	9817.000	4.000	0.800

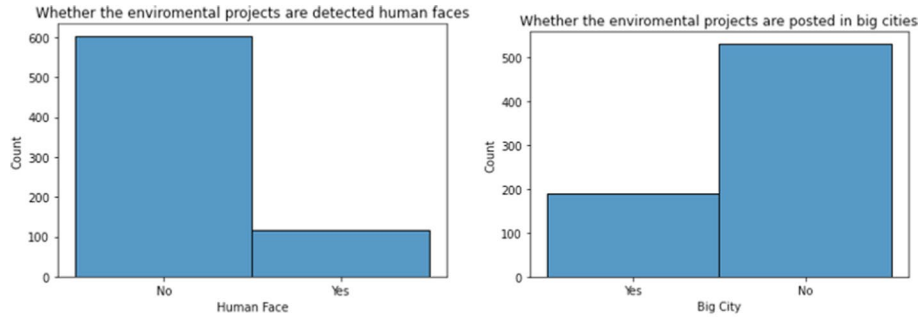
3. Remove numbers: this step helped identify high-frequency words. Hence, the number was not crucial in the sentences.
4. Remove personal pronouns: personal pronouns had no special meanings, for instance, 'we,' 'our,' and 'you.' Therefore, we deleted the step words to make the remainder of the information in the campaign titles more concise and straightforward.

After summarizing the number of high-frequency words in each title, the top 40 high-frequency words were sorted (see Table 2).

The emotion of introduction (H7) TextBlob (Loria 2018), a sentiment package in Python, was applied to process and measure the emotion of the textual description of each green crowdfunding campaign. The final emotion scores ranged from −1 to 1. −1 indicated the emotion was extremely negative, 0 indicated neutral, and 1 indicated extremely positive.

Cover Image (H8) We used Microsoft Azure API to detect whether human faces appeared in the cover image. If human faces were detected, we assigned it '1'; otherwise, it was '0'.

We generated eight features, including six numerical and two categorical datasets. The summary statistics for the six numerical variables are presented in Table 3. Goal Size had



a.H3 b. H8

Fig. 2 Summary statistics of categorical data

Table 4 Correlation of the independent variable

	Target money	Duration	Length of title	Length of introduction	Number of high-frequency words in title	The emotion of introduction	Big city	Face
Goal size		−0.047	−0.056	−0.045	−0.060	−0.092	0.094	0.114
Duration	−0.047		0.118	0.128	0.050	0.139	−0.042	−0.031
Length of title	−0.056	0.118		0.272	0.254	0.072	−0.002	0.049
Length of introduction	−0.045	0.128	0.272		0.119	0.079	0.055	0.039
Number of high-frequency words in title	−0.060	0.050	0.254	0.119		0.102	0.059	−0.077
The emotion of introduction	−0.092	0.139	0.072	0.079	0.102		−0.015	0.024
City size	0.094	−0.042	−0.002	0.055	0.059	−0.015		0.142
The face shown in the cover image of the introduction	0.114	−0.031	0.049	0.039	−0.077	0.024	0.142	

the highest standard deviation, around 54 million, which meant that the different green crowdfunding campaigns had large differences in expected funding targets. The lowest standard deviation was observed for the emotion score, which was approximately 0.13. In other words, there are no significant differences in emotion scores among the chosen green crowdfunding campaigns. For the categorical data (see Fig. 2), only 1/7 of the chosen green crowdfunding campaigns showed human faces in the campaign cover images (see Fig. 2a). Furthermore, green crowdfunding campaigns in large cities account for less than half of those in smaller cities (see Fig. 2b). In addition, this study tested the correlation between the eight variables (see Table 4). From Table 4, the highest correlation value between the length of the introduction and title was 0.272.

Measurement methods

This empirical study explored how the three clusters of information disclosure-relevant factors affect the fundraising outcomes of green crowdfunding campaigns. However, the outcomes were categorical; therefore, we used logistic regression to measure them.

Two-sample t-tests have been widely adopted to examine numerical data if significant differences can be found between different data groups (Cressie and Whitford 1986). Since the number of chosen successful (raised money smoothly) and failed (failed to raise money) green crowdfunding campaigns were not equal, we applied independent two-sample t-tests with an unequal sample size, which are written as

$$t = \frac{\overline{X}_1 - \overline{X}_2}{s_p \cdot \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$s_p = \sqrt{\frac{(n_1-1)s_{X_1}^2 + (n_2-2)s_{X_2}^2}{n_1 + n_2 - 2}}$$

n_1 and n_2 are the sample sizes of groups 1 and 2, respectively, and 1 and $\bar{x}_2$ represent the means of groups 1 and 2, respectively. S is the standard deviation and Sp is the pooled standard deviation of the two groups.

However, two-sample t-tests could not measure significant differences between two categorical data groups. Hence, we used chi-square tests, which can be written as

$$\mathcal{X}^2 = \sum_{i=1}^{k} \frac{(A_i - E_i)}{E_i} = \sum_{i=1}^{k} \frac{(A_i - np_i)}{np_i} \quad (\mathrm{i} = 1, 2, 3, \ldots, \mathrm{k})$$

A_i and E_i mean observation and expectation frequencies at i, n means total frequency, and p_i means the expectation possibility at i. As the precondition for applying the chi-square test is to generate two equal-sized sample groups, we randomly chose 150 sample green crowdfunding campaigns from each group.

Empirical results and discussions

This study selected eight relevant information disclosure factors that may affect the fundraising outcomes of green crowdfunding campaigns. The logistic regression results supported three of our hypotheses (three out of eight). Empirically found by this research, the duration (H2), length of the title (H4), and length of the introduction (H5) are proven to significantly affect a green crowdfunding campaign's fundraising outcome. Goal size (H1), city size (H3), high-frequency words in the title (H6), emotion of the introduction (H7), and image features (e.g., the human face shown in the cover image) (H8) did not significantly affect the chosen green crowdfunding campaigns on GoFundMe.

Goal size and fundraising outcomes (H1)

Based on our regression results (see Table 5), the p-value of goal size was 0.319. This empirical result was interesting because it challenged existing studies (e.g., Mollick 2014; Kunz et al. 2017; Felipe et al. 2022), proving that a crowdfunding campaign's goal size negatively influences fundraising outcomes. Goal size did not significantly influence the fundraising outcomes of the selected green crowdfunding campaigns (both successful

Table 5 Logistic regression result

	Coefficient	Standard error	Z	*P*-value
Goal size	−5.139e−09	5.15e−09	−0.997	0.319
Duration	0.0216	0.002	8.913	**0.001**
Length of title	−0.0342	0.007	−4.740	**0.001**
Length of introduction	0.0006	0.000	4.306	**0.001**
Number of high-frequency words in title	0.1283	0.138	0.933	0.351
The emotion of introduction	−1.2374	0.831	−1.489	0.137
City size	0.0586	0.254	0.231	0.817
The face shown in the cover image of the introduction	−0.1906	0.308	−0.619	0.536

and failed). Because we assumed that goal size would affect the fundraising outcomes of green crowdfunding campaigns, we reject H1. Anglin and Pidduck (2022) explain this empirical finding by arguing that investors are more willing to invest in appealing campaigns than simply considering whether it is a large campaign. Investors are more likely to invest in items with a cause behind them (Hsieh et al. 2019), such as items that meet their needs or tastes.

Duration and fundraising outcomes (H2)

This research supports most existing duration-related crowdfunding studies because it empirically found that the duration of a green crowdfunding campaign impacts fundraising outcomes. The p-value of the selected campaigns was 0.02, indicating a significant difference between the duration of successful and failed campaigns. Hence, we accepted H2, as a longer duration would enhance the chances of collecting money (Burtch et al. 2013; Cordova et al. 2015). Meanwhile, this study challenged previous studies (e.g., Mollick 2014; Kunz et al. 2017; Hsieh et al. 2019), arguing that a long duration would reduce fundraising outcomes. As mentioned earlier, this study empirically found that a longer duration positively influences fundraising outcomes, consistent with Burtch et al. (2013) and Cordova et al. (2015), who argued that a longer duration enhances the chances of being funded.

City size and fundraising outcomes (H3)

This study empirically found that city size ($p=0.817$) does not affect the fundraising outcomes of the chosen green crowdfunding campaigns on GoFundMe. Hence, this research challenges existing studies, such as those by Vulkan et al. (2016) and Roe and Smith (2021), as they both argue that crowdfunding campaigns in large cities are more likely to achieve expected fundraising outcomes. The above-mentioned empirical findings can be explained in two dimensions: (1) although a larger city size normally means a larger population (Yu and Fleming 2021) and potential backers (Roe and Smith 2021), the city size cannot always effectively reflect the overall size of the population; (2) the population size cannot fully reflect the number of potential crowdfunding backers, since Wood et al. (2020) found that crowdfunding campaigns can still be well-received even when a city has a small population. This evidence may weaken the links between city size and fundraising outcomes of crowdfunding campaigns.

Length of title and fundraising outcomes (H4)

This study empirically found that the length of a green crowdfunding campaign's title matters for fundraising outcomes, as the p-value was less than 0.05. Based on this research, potential backers of GoFundMe are more likely to focus on green crowdfunding campaigns with a longer title, which further supports previous studies (Majumdar and Bose 2018; Guo et al. 2019; Ren et al. 2020) and may prove that title length impacts the details of the green crowdfunding campaign and potential backers' attention. Consequently, the title length of a green crowdfunding campaign significantly affects fundraising outcomes.

Length of introduction and fundraising outcomes (H5)

This study empirically found that the length of the chosen green crowdfunding campaigns' introduction to GoFundMe significantly affected funding outcomes ($p < 0.05$). We accept H5 because we argue that successful green crowdfunding campaigns on GoFundMe are more likely to have longer introductions than failed campaigns. Consistent with previous studies, crowdfunding campaigns are crucial for connecting founders and investors (Maehle et al. 2021). Hence, a detailed and extensive introduction may enhance investors' intentions to invest because they will better perceive the founders' efforts (Barbi and Bigelli 2017) and comprehensive preparations (Koch and Siering 2015; Bi et al. 2017).

Number of high-frequency words in title and fundraising outcomes (H6)

In contrast to previous studies (e.g., de Larrea et al. 2022; Kubo et al. 2021), which emphasized the impact of high-frequency word numbers on fundraising outcomes, this study found that the p-value of the high-frequency word number in green crowdfunding campaign titles was 0.138, which empirically showed no significant difference between the number of high-frequency words in successful and failed green crowdfunding campaign titles. Although the 'Top 40 high-frequency words' extracted (see Table 2) were environmentally relevant, this study proved that none of the green-related words outlined helped attract more funding. More importantly, despite Yuan et al. (2016), who argued that the high-frequency words of successful green crowdfunding campaigns should reflect the campaign's inherent nature, the high-frequency words of the selected green campaigns from GoFundMe do not always address the core of green-based or sustainable nature in terms of numbers, which weakens the connections between the number of high-frequency words and fundraising outcomes. Additionally, because campaign titles on crowdfunding platforms (e.g., GoFundMe) are always restricted by length (Wang et al. 2020), which only provides limited information about the campaigns, backers may focus more on the introductions rather than concentrating on the high-frequency words in the campaign titles. However, the viewpoint above also consolidates why H4 and H5 are justified: backers would like to obtain more details from both campaign titles and introductions.

The emotion of introduction and fundraising outcomes (H7)

Surprisingly, we found no significant relationship between the emotional scores of the introduction of green crowdfunding campaigns and fundraising outcomes. These

findings differ from those of previous studies (e.g., Kaminski and Hopp 2019; Johan and Zhang 2020; Anglin and Pidduck 2022) since they announced the importance of emotions in introducing or promoting crowdfunding campaigns. Instead, this study proves that the emotional scores of both successful and failed green crowdfunding campaigns are neutral. Although our results are similar to those of Nakagawa and Kosaka (2022), we proved that emotional introductions may not help green crowdfunding campaigns facilitate fundraising outcomes, rather than rejecting the opinion that evoking empathy cannot always enhance fundraising outcomes.

Human face shown in cover images of introduction and fundraising outcomes (H8)

We found that the chosen green crowdfunding campaigns' fundraising outcomes were not significantly affected by the human face shown in the cover images (p-value: 0.308), which challenged some previous studies (e.g., Xiao and Ding 2014; Hou et al. 2019; Li et al. 2019) since they argued that humans prefer to see faces in advertizing, and readers' reactions would be affected by human facial features in visual information (e.g., images and videos). A possible explanation is provided by Frydrych et al. (2014), who argue that visual information has been treated as a compulsory element of promoting a crowdfunding campaign online and cannot be utilized in predicting fundraising outcomes. Therefore, in the context of green crowdfunding, visual information and the human face shown in the visual information may not always affect fundraising outcomes.

Conclusion

By investigating 720 green crowdfunding campaigns collected from GoFundMe, this study examines how eight selected information disclosure-relevant factors impact fundraising outcomes. This study contributes to the crowdfunding literature by examining how information disclosure-relevant factors affect fundraising outcomes in green crowdfunding contexts. Most studies have investigated the factors influencing crowdfunding campaigns. This research focuses on the green crowdfunding contexts, which require further scholarly exploration (Butticè et al. 2019; Rossolini et al. 2021). Furthermore, this study highlights that the disclosure-relevant factors used to measure the outcomes of normal crowdfunding campaigns (the factors we outlined and investigated) can also be applied to green crowdfunding fundraising, providing a new research path for future studies. From a methodological perspective, this study provides future studies with an approach for transforming unstructured data into structured data through machine learning. Regarding practical contributions, this study empirically identifies crucial information disclosure-relevant factors in the context of green crowdfunding, guiding the founders of green crowdfunding campaigns to better design and introduce their work on crowdfunding platforms. For instance, founders should (1) cautiously design the duration of the green crowdfunding campaign and ensure that the campaigns have sufficient time to be financially supported, (2) focus on population size and highlight the value and green-relevant nature of the campaigns rather than locate their campaigns in large cities, and (3) provide more details in both campaign titles and introductions. Moreover, this study provides crowdfunding platforms with practical guidance to support green crowdfunding founders in improving the quality of their campaigns and in obtaining funds smoothly.

Future research should consider regional and cultural differences in different countries, since they may influence the findings in the context of green crowdfunding, which would also affect the generalizability of a particular study. This study selects only a well-known American-based crowdfunding platform as a case study and does not entirely reflect the features of crowdfunding platforms in other countries. Therefore, future studies should investigate this question from a cross-cultural perspective (Ba et al. 2020). Furthermore, to optimize the categories of information disclosure-relevant factors, qualitative research methodologies can be applied in future studies, such as interviews with the founders of green crowdfunding campaigns and crowdfunding platforms. By applying qualitative methodologies, future studies should better understand what founders and crowdfunding platforms consider to enrich or adjust the information disclosure-related factors of a green crowdfunding campaign. Future research should also consider the importance of demographics and founders' experiences in green crowdfunding fundraising outcomes.

Abbreviations

H1 to H8	Hypothesis 1 to Hypothesis 8
n	Total frequency
$n1$	The sample size of group 1
$n2$	The sample size of group 2
$\overline{x}_1$	The mean of group 1
$\overline{x}_2$	The mean of Group 2
s	The standard deviation
s_p	The pooled standard deviation of the two groups
A_i, E_i	Observation and expectation frequency at i
p_i	The expectation possibility at i

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Declarations

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