

Country Green Brand Promotion: A Sentiment Analysis

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Abstract

Intensifying global environmental challenges have amplified the need for strategic ecological communication. With rapid digitalisation, public sentiment has become a key factor in shaping a country's green reputation, primarily through social platforms. These dynamics underscore the relevance of investigating the relationship between digital public sentiment and the effective promotion of a country's green brand. The aim of this study is to apply sentiment analysis to user-generated content to identify emotional trends in green brand promotion and determine the most effective digital channels for strategic ecological communication. To achieve this, the research applies sentiment analysis to user-generated content tagged with green-related hashtags (#GreenEconomy, #UkrainianBrand, #GreenUkraine, #SustainableUkraine) across various social media platforms. The methodology combines computational text analysis and content categorisation, focusing on the emotional polarity (positive, neutral, negative) and engagement levels of posts. Data were collected using digital monitoring tools, followed by a one-way ANOVA to assess differences in sentiment and user interaction across platform types. The findings indicate that #SustainableUkraine and #GreenEconomy are associated with the highest levels of positive sentiment, suggesting strong international receptiveness to sustainability narratives. In contrast, #UkrainianBrand often triggers more critical reactions, influenced by broader socio-political contexts. Visual platforms such as YouTube and Instagram generated the most positive emotional responses, while text-based platforms like X (Twitter) and Tumblr displayed more neutrality or criticism. LinkedIn emerged as a space for analytical and professional discussions. The study contributes to the field of green nation branding by offering a real-time, data-driven framework to assess public attitudes toward a country's environmental identity. Practically, the research provides evidence-based guidance for policy-makers and brand strategists on how to tailor green communication. It advocates for prioritising emotionally resonant visual content and platform-specific messaging to enhance a country's environmental image and reinforce global trust in its sustainability trajectory.

Key words

green brand, sentiment, social media, environmental communication, public perception, sustainable development, national branding, digital platforms, eco-communication strategy.

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Introduction

In the current context of promoting a country's green brand, it is crucial to select practical marketing tools and develop a deep understanding of target audience perceptions. A comprehensive analysis of both qualitative and quantitative characteristics of informational messages allows the identification of suitable content types for green brand promotion. This approach enables the precise adaptation of communication strategies to the expectations and sentiments of society. As demonstrated by Titko et al. (2023a), cultural factors significantly influence the achievement of sustainable development goals, suggesting that national branding must be aligned with a country's sociocultural values to enhance credibility and resonance. In this regard, Adamus-Matuszyńska and Dzik (2023) highlight the strategic importance of place branding in shaping a nation's identity, where sustainability becomes an integral element of the country's image. Moreover, insights from Titko et al. (2023b) on student attitudes in Latvia and Lithuania reveal that generational sentiment toward sustainable entrepreneurship plays a vital role in strengthening the long-term perception of a green national brand, particularly among younger, future-oriented audiences. Local initiatives also play a pivotal role in enhancing a country's green image. Faganel and Streicher (2022) demonstrate how social marketing for municipal waste management not only promotes behavioural change but also supports the development of a sustainable local identity that can be projected internationally. Pimiä et al. (2024) underscore how national transportation policies aimed at carbon neutrality, especially across European maritime and air sectors, contribute to the perception of a country's environmental responsibility, reinforcing its positioning as a forward-looking, green-oriented nation. From a macroeconomic perspective, Osinubi (2024) explores the link between economic complexity and carbon emissions (Hair et al., 2023), illustrating how innovation-led economies may better align with sustainability goals, thus supporting a green brand narrative grounded in technological advancement. Additionally, Cakirkaya and Kocyigit (2024) reveal the psychological underpinnings of consumer behaviour during periods of uncertainty, such as the COVID-19 pandemic. Their findings point to the importance of framing national communication strategies in ways that emphasize resilience, trust, and sustainable security core values that strengthen public confidence in a country's green trajectory (Doan et al., 2024; Kharazishvili et al., 2025).

The rapid development of social media platforms, including X (formerly Twitter), Facebook, Instagram, and LinkedIn, has fundamentally transformed how consumers interact with brands, turning them into active participants in shaping brand reputation. In today's digital environment, consumers function not only as passive recipients of information but also as content creators (Boumhidi et al., 2025), influencing brand perception through various forms of user-generated content such as tweets, product reviews, service ratings, and personal narratives. The analysis of different content types provides insights into consumer opinions, including:

- tweets, which represent brief, spontaneous expressions reflecting users' immediate emotional reactions;
- reviews, which are more structured and include detailed assessments of specific product attributes such as quality or service;
- ratings, which often serve as summarising evaluative judgments, allowing for the assessment of overall brand experience;
- personal stories, which create an emotional context of brand interaction through individual user experiences, thereby increasing consumer engagement.

The ease of generating content in the form of text, images, or videos has contributed to the rapid growth of unstructured data across social media platforms. This, in turn, presents new opportunities for in-depth analysis of public opinion. By accumulating various forms of content, businesses, governmental institutions, and other stakeholders actively leverage these data to monitor brand, product, or national image perception, aiming to manage reputation effectively and adapt communication strategies accordingly. Proper analysis of such data not only facilitates the development of a comprehensive picture of consumer preferences but also enables the formulation

of strategically grounded recommendations for enhancing brand reputation (Muralidhar & Hulipalled, 2023). Moreover, from the consumer's perspective, this information supports rational decision-making regarding the purchase of goods or services based on the experiences of others, thereby fostering social trust and strengthening the brand's competitive advantage.

Recent studies highlight the critical role of social media and influencer-driven communication in shaping public sentiment toward green brand narratives. Nadanyiova and Sujanska (2023) demonstrate that Generation Z's decision-making is significantly influenced by sustainability messages delivered through trusted influencers, while Onem and Selvi (2024) emphasize the importance of perceived authenticity in forming positive emotional responses to such content. Santoso (2024) confirms that social and environmental sustainability factors positively impact consumer attitudes, reinforcing the need for value-driven messaging in green brand promotion. Nastisin et al. (2024) further show that emotionally engaging content types on social media drive higher audience interaction, offering practical insights for national communication strategies.

Given the growing volume of user-generated content on social media, the need to systematically analyse these data has become increasingly relevant. In this context, sentiment analysis serves not only to structure informal expressions but also to extract key patterns in brand perception. This approach contributes to the formation of an objective view of consumer sentiment, which is essential for determining the most effective content formats for promoting Ukraine's green brand.

Sentiment analysis is a method for identifying and classifying subjective opinions in textual sources by combining techniques from natural language processing, computational linguistics, and text analytics (Md Saad & Hashim, 2023). It provides valuable insights into the current state of consumer attitudes and supports structured decision-making based on the analysis of opinions, satisfaction, and needs. This method explores users' emotional reactions and attitudes across three sentiment categories: positive (satisfaction), neutral, and negative (disappointment or dissatisfaction).

In the contemporary digital communication environment, selecting optimal online channels is a critical element of any strategy to promote a country's green brand. These channels not only facilitate message dissemination to broad audiences but also enable active engagement with potential partners, investors, and the general public. Justifying the selection of online communication channels for stakeholder engagement represents a key stage in developing a comprehensive green branding strategy. Choosing the appropriate platform ensures maximum reach across target audiences and contributes to the achievement of strategic goals such as attracting investment in the green economy (Kwilinski et al., 2023; Kwilinski 2024a; González-Argote et al., 2024), raising public environmental awareness, and strengthening the country's position on international sustainability platforms. Each communication channel offers distinct features that may be advantageous depending on the specific objectives and characteristics of the intended audience.

The selection process of online channels involves several key stages. The first is the clear definition of strategic communication objectives, such as raising awareness of environmental initiatives and projects and building a positive image of the country as a leader in sustainable development. The second stage involves analysing the characteristics of various digital platforms, including social networks, blogs, video-sharing platforms, news portals, and specialised online platforms focused on sustainable development initiatives.

Moreover, it is important to understand the specific characteristics of the target audience (general public, socially responsible and green businesses, environmentally focused non-governmental organisations, governmental authorities, financial institutions and investors, higher education institutions and research centres, etc.) with which the country's green brand aims to establish communication. For each stakeholder group, it is essential to identify the most appropriate communication channels and content formats to ensure effective feedback mechanisms and maximise the overall impact. Therefore, the selection of online communication channels for stakeholder engagement is a complex but essential step in developing a successful strategy for promoting a country's green brand (Grabowski et al., 2025).

Despite the growing body of research in branding and the use of digital media for business brand promotion, academic studies exploring the application of sentiment analysis in the context of green country branding remain limited. Existing literature primarily focuses on traditional branding approaches and the influence of digital marketing on corporate performance while paying insufficient attention to the analysis of green brand perception through users' emotional responses on digital platforms. This research gap highlights the need to investigate the emotional dimension of green brand perception via social media.

The aim of this study is to apply sentiment analysis techniques to user-generated content in order to identify key trends and emotional reactions that shape the effectiveness of green country brand promotion. The study seeks to determine the most effective online channels for this purpose and provide practical recommendations for enhancing communication strategies in support of green brand development.

1. Literature review

In light of the growing global attention to environmental concerns and the rising importance of digital presence, sentiment analysis has emerged as a pivotal analytical tool for evaluating public opinion in the domain of green branding. This methodology enables the identification of the emotional tone embedded in user-generated content across social media platforms, thereby facilitating the assessment of public sentiment toward environmental initiatives and uncovering trends in stakeholder engagement with a country's green brand. A growing body of literature confirms the expanding utility of sentiment analysis in gauging the effectiveness of environmental communication strategies. By processing and interpreting emotional reactions in real time, sentiment analysis not only enhances the capacity to monitor audience responses but also provides a data-informed foundation for adapting message content and optimizing communication channels in line with the evolving expectations of target audiences. Li and Chen (2024) evaluated the spatiotemporal evolution of green innovation efficiency in China from a two-stage value chain perspective, highlighting regional disparities that can inform targeted green branding strategies and strengthen narratives around national environmental leadership. Complementing this, Liu et al. (2024) explored how digital technology, green human resource practices, and digital innovation networks foster enterprise-level green innovation, demonstrating that organizational capabilities are integral to shaping a country's green brand identity – a dynamic that sentiment analysis can measure by tracking public and employee perceptions of these practices. Lyulyov et al. (2023) emphasized the role of stakeholder engagement in enhancing corporate green competitiveness, highlighting how multi-stakeholder narratives contribute to a country's green reputation. In the education sector, Olzhebayeva et al. (2024) investigated how Central Asian universities manage the green transition, illustrating how academic sustainability initiatives can enhance national brand credibility, with sentiment analysis evaluating public and international recognition of these efforts. At a broader socio-economic level, Poyraz (2023) demonstrated that green growth supports social development in OECD countries, providing evidence for branding strategies that highlight the co-benefits of sustainability and that can be reinforced through positive public sentiment. Moreover, Szczepańska-Woszczyna et al. (2022) assessed economic convergence among EU countries, positioning nations within regional economic and sustainability trends relevant to their branding narratives. In the tourism sector, Szczepańska-Woszczyna et al. (2024) examined green hotel initiatives from guests' perspectives, highlighting hospitality as a critical touchpoint for shaping international perceptions of a country's green commitment – an area where sentiment analysis can track tourist experiences and satisfaction.

In the context of energy and land resources, Teng (2024) explored green energy implications for BRICS countries post-COP27, underlining the importance of commitments to global sustainability goals in shaping a country's brand, while M. Xu et al. (2024) analyzed determinants of green total factor production efficiency, identifying structural drivers that can support data-driven branding

strategies. Yin and Zhao (2024) further emphasized the importance of public strategies in enhancing natural resource efficiency for green economic recovery, providing evidence that effective policy branding can be evaluated by sentiment analysis to assess public approval and trust.

The integration of sentiment analysis into green nation branding strategies is further supported by empirical studies that underscore the significance of aligning corporate, institutional, and technological domains with sustainability values. Lyulyov et al. (2024) assessed countries' green brands within the context of SDGs, establishing conceptual and empirical foundations for integrating sentiment analysis into country-level green branding frameworks. Tambovceva et al. (2017) and Us et al. (2023) emphasize the crucial role of corporate social responsibility (CSR) in reinforcing national-level sustainability discourses. Their investigation into the CSR perceptions of Latvian enterprises reveals how micro-level corporate behaviour can cumulatively contribute to the construction of a macro-level image of a nation as socially and environmentally responsible. This linkage between business ethics and national identity positions CSR as a foundational pillar in the development of a country's green brand equity. From an institutional perspective, Ziabina and Navickas (2022) highlight the instrumental role of public governance in driving energy efficiency innovations. The strategic direction and institutional capacity of public actors thus emerge as essential components in shaping a coherent and legitimate green country image, significantly contributing to the nation's reputational capital on the global stage (Kwilinski et al., 2024e, 2024f). The convergence of marketing innovation and digital technology further amplifies the potential of sentiment analysis in green branding. Maldonado-Canca et al. (2024) provide evidence of this through an examination of executive perspectives on the integration of artificial intelligence (AI) into marketing management. The study contends that AI-powered analytics support real-time sentiment tracking and communication optimization, enabling precision targeting and enhancing the emotional impact of green branding campaigns. In a complementary analysis, Cherkaoui et al. (2024) explore the application of recommender systems and statistical modelling in consumer behaviour research. Their study affirms the value of algorithmic personalization in delivering sustainability messages that resonate with specific audience segments, thus fostering deeper emotional and cognitive engagement with national environmental narratives. Recent research also emphasizes that managing AI technologies strategically contributes to green economic growth within the European Union (Kwilinski et al., 2024d), while green technology innovations demonstrate significant spatial spillover effects enhancing high-quality economic development (S. Xu et al., 2023). Furthermore, digital transformation drives green competitive advantage through innovation and is strengthened by effective government regulation (S. Wu et al., 2024). In the organizational context, integrating business intelligent systems into strategic management fosters the creation of green jobs (Kwiliński et al., 2025a, 2025d; Sołoducho-Pelc & Sulich, 2024), and adopting green HR approaches in sectors such as hospitality unlocks sustainability potential through innovative practices (Surya et al., 2024).

The role of digital transformation in shaping public perceptions of national sustainability is also highlighted in the previous studies (Kwilinski et al., 2023; Kwilinski, 2024b, 2025a; Parkhomenko et al., 2024), who investigate the influence of innovative digital marketing tools on consumer evaluation processes. Jiang and Yukio (2024) examine the communicative power of vlog-based promotional content in influencing consumer attitudes toward sustainability messaging. Their analysis of narrative-driven and influencer-generated media reveals that emotionally immersive storytelling significantly enhances the perceived authenticity and relatability of green brand narratives, thereby strengthening affective connections with environmentally conscious audiences.

The rising public awareness of environmental challenges calls for not only strategic decisions at the governmental level but also a precise understanding of societal attitudes toward sustainable development. In this context, sentiment analysis plays a pivotal role as a tool for detecting public perception. The study by Anderson et al. (2024) demonstrates the effectiveness of employing various machine learning and deep learning models to analyse social media platforms, particularly Twitter, with the aim of assessing public attitudes towards environmental initiatives. The authors compare the

performance of traditional algorithms (Logistic Regression, Support Vector Machines, and Naive Bayes) with more advanced architectures, such as LSTM, BERT, and GPT-2, emphasising the need to select models capable of accounting for the contextual specifics of sustainability-related discourse. In addition to its technical contributions, the study underscores the importance of transparency and reproducibility in building trust in AI-driven research within the environmental domain.

Derrick (2024) conducted an in-depth analysis of the accuracy of machine learning algorithms in identifying ESG-related sentiments, comparing the performance of automated models (such as VADER, FINBERT, GPT-3.5, GPT-4, LLaMA2, T5, Mistral, and Mixtral) with expert human evaluations. The findings revealed that even the most advanced language models exhibit limitations in capturing the nuances of human perception regarding environmentally oriented messaging. At the same time, creating a "gold standard" based on inter-rater consensus significantly enhances the reliability of model evaluation and enables the identification of the most relevant approaches for analysing ESG discourse (Kwilinski et al., 2025b, 2025c).

The issue of cross-cultural perception of sustainable consumption gains particular relevance in the context of national green brand formation (Jefimovaitė & Vienažindienė, 2025). Drawing on a dataset of 72,000 tweets from the United States, Switzerland, and India, Diwanji et al. (2024) identified substantial differences in dominant values and emotional tone across these regions. Indian participants displayed a strong orientation toward biospheric and altruistic values, emphasising ecological and social dimensions of sustainability, while users from the United States and Switzerland tended to exhibit more self-oriented attitudes, with an emphasis on economic rationality. Moreover, the emotional structure of the tweets revealed predominantly positive sentiments among Indian and Swiss users, in contrast to the more negative tone observed in the American discourse.

These findings underscore the importance of culturally sensitive approaches in strategic sustainability communications. In the context of green country brand promotion, this research highlights that effective external communication must take into account local value systems and emotional responses. These factors can be reliably identified through sentiment analysis of social media content.

The increasing role of social media as a data source is fundamentally transforming research approaches in the field of sustainable development. Ghermandi et al. (2023) highlighted that social media platforms provide scalable, real-time insights into the complex interactions between society and nature, the dynamics of socio-ecological change, and the evolving construction of environmental values. The authors underscore the significant potential of social media data for supporting progress toward the Sustainable Development Goals while also emphasising key limitations, including restricted data access, ethical concerns, and privacy risks.

In the context of green country branding, social media function not only as tools for engagement but also as barometers of public sentiment toward environmental narratives and policies. Through sentiment analysis of Twitter data, Us et al. (2023) found that green brands are generally perceived with moderate positivity, indicating consistent public interest and acceptance of sustainability-focused messaging.

A longitudinal cross-platform analysis by Amangeldi et al. (2024), employing pointwise mutual information methods, examined public sentiment on climate and environmental topics over a ten-year period across Twitter, Reddit, and YouTube. The findings reveal a predominance of negative sentiment, particularly regarding issues such as climate change, air pollution, plastic pollution, and waste management. Dominant emotions included fear, trust, and anticipation, reflecting the depth of emotional engagement and the complexity of public discourse around environmental challenges. These findings reinforce the importance of incorporating culturally sensitive, emotionally informed communication strategies into green brand promotion. Sentiment analysis of social media content offers a valuable lens for understanding audience responses and tailoring content to enhance resonance, credibility, and long-term impact.

The significance of social media as a channel for shaping ESG (Environmental, Social, and Governance) reputation is increasingly explored in both academic and applied research, particularly regarding its influence not only on public sentiment but also on financial markets. L. Wu et al. (2024), who analysed how ESG performance drives corporate green innovation, suggesting that sentiment towards leading ESG performers shapes broader national green brand perceptions. Ziabina et al. (2024) highlighted reputational risks by examining countries' brands and greenwashing through bibliometric analysis, emphasizing the critical role of sentiment analysis in detecting public scepticism and preventing potential negative impacts on a country's green brand credibility. A large-scale study by Nicolas et al. (2024), analysing over 114 million tweets related to companies listed in the S&P 100 index (The Standard and Poor's Index) (2016-2022), investigated shareholder responses to ESG-related reputational risks originating from social media. ESG events were identified as surges in Twitter activity linked to ESG discourse, followed by an event study analysis of abnormal asset returns. The findings revealed a statistically significant decline in abnormal returns (on average -0.29%), particularly in the "Social" and "Governance" dimensions. Importantly, this research disentangles the reputational effect in the digital environment from the material consequences of ESG crises, thereby highlighting the value of sentiment analysis for understanding reputational risk in real-time.

In the domain of citizen engagement with sustainable energy practices, the concept of "energy communities" has gained traction. However, the study by Caratù et al. (2023) reveals a persistent gap between the potential of social media to foster public engagement and the actual interaction levels around this topic. Their analysis shows limited user involvement and suggests a more targeted communication strategy that bridges academic and practical narratives to stimulate interest and participation.

Another stream of research focuses on the potential of educational institutions to cultivate green consciousness and promote sustainability principles through social media platforms. Us et al. (2022) analysed the social media activity of leading global green universities and confirmed that universities can effectively disseminate environmental narratives in the digital sphere. Employing text mining, content analysis, and sentiment analysis, the study revealed that consistent presence on social media increases engagement with academic communities and broader audiences on environmental topics. These findings underscore the strategic value of utilising social media to promote environmental initiatives, particularly within educational environments with strong transformative potential. In a broader context, the study illustrates how digital communication channels can shape the image of sustainability-oriented institutions and contribute to forming a country's green brand.

The expanding integration of sentiment analysis into business practices reflects a growing interest in leveraging unstructured data from digital platforms for decision-making processes. A bibliometric review by Aguilar-Moreno et al. (2024), encompassing 85 articles indexed in Scopus and Web of Science, shows the rising application of sentiment analysis across sectors ranging from finance to logistics. The primary focus lies in enhancing customer orientation and adapting business strategies based on user feedback collected from platforms such as Twitter and Amazon.

Within the framework of green country branding, these approaches demonstrate strong potential for the strategic use of public sentiment data to adjust environmental policies and narratives in alignment with the expectations and attitudes of target audiences. Moreover, combining sentiment analysis with multi-criteria decision-making methods offers new avenues for evaluating the effectiveness of green communication strategies within the public sector.

Given the growing importance of sustainable corporate behaviour, there is a rising demand for objective ESG assessments, as conventional sustainability reports prepared by companies are often viewed as self-regulated and potentially biased. In this context, automated media analysis is gaining relevance through independent ESG monitoring. Fischbach et al. (2023) propose an innovative tool (ESG-Miner) that classifies news headlines according to environmental, social, or governance themes

and assigns corresponding sentiment scores. This method enhances transparency in evaluating corporate sustainability performance and provides valuable stakeholder insights.

The reviewed literature confirms the growing recognition of sentiment analysis as a powerful tool for examining public opinion on environmental initiatives, particularly in communication digitalisation. Researchers widely employ machine learning and deep learning techniques to analyse ESG-related discourse across social media platforms, identifying emotional patterns, cross-cultural perceptions of sustainability, and the reputational effects of public communication on companies and organisations. However, existing studies predominantly focus on the corporate level, while the application of green branding at the national level within the framework of social media interaction remains insufficiently explored.

In particular, there is a lack of empirical research that combines sentiment analysis of public social media content with the green brand positioning of countries and the evaluation of communication effectiveness. This limitation constrains the development of comprehensive strategies for ecological positioning on the international stage.

Accordingly, the motivation for this study lies in addressing this research gap by applying sentiment analysis methods to social media data to identify the most effective online channels for promoting a country's green brand. The study also provides actionable recommendations for enhancing governmental eco-communication strategies and strengthening the country's green reputation in the digital environment.

2. Methodology

According to the methodology proposed by Pang and Lee (2008), the sentiment analysis process consists of two main stages: opinion extraction and their classification by polarity. Utilising the toolkits provided by the search engines Social Searcher and Brand24, the first stage involved the identification of subjective statements across social media platforms. The data collection focused on the following major platforms:

1. Twitter, officially rebranded as X in 2023, is an American microblogging and social networking platform where users interact via short messages known as tweets. The collected data include tweets containing hashtags, comments, and replies, which are used for sentiment analysis to explore users' responses to specific topics or events. It is worth noting that, as of May 2024, this social network had over 500 million monthly active users (Dean, 2025a).

2. Facebook is one of the largest social networking platforms, enabling the exchange of text messages, images, and videos. According to statistical data, in 2024, the total number of users on this platform reached 5.17 billion, accounting for 59.38% of all social media users. The data retrieved from Facebook include posts, comments, reactions, and shares. The analysis of this content allows for assessing users' emotional sentiments toward specific brands, events, or social issues (DemandSage, 2024).

3. Instagram is a social media platform focused on sharing images and videos. As of 2024, it had approximately 2 billion monthly active users. The collected data include posts, captions, comments, and hashtags. This content is used to detect user sentiment regarding particular products, services, or trending topics (Metricool, 2024).

4. LinkedIn is a professional social networking platform designed for business connections and the exchange of professional content. The data encompass posts, articles, comments, and endorsements, which are used to analyse sentiment in the context of business events, labour market dynamics, and professional trends. It is noted that in 2024, LinkedIn had approximately 310 million monthly active users. Around 78% of users consumed content to stay informed about industry news, while 73% used the platform to discover new ideas (Cognism, 2024).

5. YouTube is a global video-sharing platform. Notably, approximately 47% of all internet users access YouTube monthly to watch, comment on, or upload videos. Data used for sentiment analysis

include video comments, which reflect audiences' emotional responses to various content and events (Dean, 2025b).

6. Tumblr is a microblogging platform for publishing text, images, quotes, and videos. The collected data reflect emotional content and user opinions within interest-based groups and subcultures. Although Tumblr's user growth has slowed in recent years, the platform still maintains a substantial audience, with over 300 million monthly active users. Demographically, Tumblr is characterised by a younger user base, with a significant portion under 35 (DemandSage, 2025).

7. Flickr is a photo-sharing social network that enables users to add tags and comments to images. These data can be utilised for sentiment analysis related to visual content and audience reactions to specific events.

8. The Web represents the largest unstructured data source, encompassing blogs, news sites, forums, and reviews. In 2024, internet users reached 5.5 billion, accounting for 68% of the global population. There is an increase from 65% in 2023. Internet usage varies significantly depending on economic development level: in high-income countries, 93% of the population has Internet access, while in low-income countries, the figure drops to just 27%. Thus, data collected from the Internet are valuable for analysing global sentiment and public opinion on various issues (ITU, 2024).

The selection of social media platforms for this research is driven by the need for a comprehensive approach to developing a strategy for promoting the country's green brand, considering audience characteristics, content specificity, and the analytical capabilities of each platform (Table 1).

Table 1. Overview of social media in Ukraine and worldwide as of 2024.

Platform	Number of users		Share of population		Dominant content format	Primary audience	
	In Ukraine, mln	worldwide	In Ukraine, %	worldwide			
Facebook	20.6	3020	~ 47.6	~ 37.5	Text, links, photos	women, aged 25-34	
Instagram	12.6	2500	~29.1	~ 31.1	Photos, videos, stories	women, aged 25-34	women, aged 18-34
YouTube	24.3	2740	~64.9	~ 34.0	Videos, live streams, short clips	Wide audience	
LinkedIn	5.9	900	~13.6	~ 11.2	Analytics, articles, case studies	professionals, aged 25-34	
X (Twitter)	4.55	556	~12.2	~ 6.9	Text, news, tweets	aged 18-34	
Tumblr	~ 0.24	3.5	~ 0.6	~ 0.8	Blogs, images, GIFs	youth, aged 18-24	
Flickr	~ 0.10	2.2	~ 0.3	~ 0.5	Photos, photo galleries	aged 25-44	aged 25-34

Source: systemised by authors based on (DataReportal, 2024; NapoleonCat, 2025; Statista, 2024).

Firstly, platforms with broad target audience reach were included in the sample, enabling maximum visibility and effectiveness of communication campaigns. YouTube and Instagram were selected due to their dominant position among visual content-sharing platforms. Given that forming a green brand largely relies on visual materials, these platforms provide favourable conditions for communicating environmental initiatives through videos and images. Meanwhile, Facebook and Twitter were chosen as key channels for disseminating informational content, facilitating public discourse and engaging audiences in discussions on sustainable development.

Secondly, the analysis includes social media platforms oriented toward professional and business communities, particularly LinkedIn. This platform enables the dissemination of analytical materials

and the engagement of experts involved in environmental topics, which is essential for building the country's expert reputation in the context of the green economy.

Thirdly, the sample also incorporates less widespread but strategically significant platforms such as Tumblr and Flickr. Tumblr was selected due to its ability to attract a younger audience through visual and blog-based content formats. Flickr, in turn, provides opportunities for curating thematic photo collections, which contribute to promoting the aesthetic component of the green brand through high-quality imagery.

Thus, the selection of social media platforms is justified by the need to ensure comprehensive audience coverage, the use of multimedia content formats, and the potential of professional platforms for communicating environmental initiatives. This integrated approach to platform selection supports the development of a coherent strategy for promoting Ukraine's green brand on a global scale.

Data collection for the analysis was conducted using the following hashtags: #GreenEconomy (1487 mentions), #UkrainianBrand (1535 mentions), #GreenUkraine (830 mentions), and #SustainableUkraine (1200 mentions). Based on the gathered data, an analysis of the research sample was performed. Table 2 presents the key indicators, including the number of mentions, the number of unique users, and the ratio of positive to negative mentions for each selected hashtag.

Table 2. Research sample.

Indicator	#GreenEconomy	#UkrainianBrand	#GreenUkraine	#SustainableUkraine
M	1960	1651	1487	1556
U	802	830	1209	803
Sent	9:1	2:3	1:1	4:1

Note: M – total number of hashtag mentions across selected social media platforms within a specified period, indicating the level of topic engagement (a higher number of mentions corresponds to greater popularity); U – number of unique users who generated the content; Sent – ratio of positive to negative mentions.

Source: authors' calculations.

Firstly, data were collected on the number of hashtags mentions associated with different content types on each selected online platform. To ensure analytical accuracy, the data were structured by content categories, allowing for the classification of major formats (statuses, photos, videos, links). Then, the null (H_0) and alternative (H_1) hypotheses were formulated to test the relationship between the mean number of hashtags mentions across different content types.

The total number of mentions (M) reflects the level of topic engagement, with the highest number recorded for #GreenEconomy (1960 mentions) and the lowest for #GreenUkraine (1487 mentions). At the same time, the number of unique users (U) who generated content with the respective hashtag was highest for #GreenEconomy (802 users) and lowest for #SustainableUkraine (803 users). The sentiment ratio (Sent) allows for the assessment of the overall emotional tone of the content, which was most favourable for #SustainableUkraine (4:1) and least favourable for #UkrainianBrand (2:3).

In the next stage, data filtering and cleansing were performed to eliminate duplicates and irrelevant content. The collected data were then categorised into three sentiment classes: positive, negative, and neutral. This enabled an evaluation of the emotional colouring of the posts.

The analysis of content types was conducted based on several key criteria that allow for determining the overall emotional tone of communication messages, their semantic content, and contextual framing (Table 3). The research structure considers the following components: keywords, emotion polarity, word frequency, context, and text structure.

The identification of the online communication channel with the country's stakeholders and the type of content used to promote the green brand of the country was carried out using a one-way analysis of variance (ANOVA) (KSUL, 2024). This method made it possible to determine the influence of content type on the popularity and discussion of key topics across various social media platforms.

Table 3. Criteria for determining content sentiment.

Criteria	Types of content sentiment		
	Positive (Pos)	Negative (Neg)	Neutral (Neutr)
Keywords	Contains positive words: "environmental", "sustainable development", "clean environment", "green future"	Contains negative words: "pollution", "ecological crisis", "danger", "destruction of nature"	Absence or balance of emotionally charged words: "renewable energy", "ecological investments"
Emotion polarity	High percentage of positive words (70%+ in the text)	High percentage of negative words (70%+ in the text)	Balanced proportion of positive and negative words (40–60%)
Words frequency	Positive words appear more frequently (dominance of green brand terms)	Negative words appear more frequently (focus on environmental problems)	Balanced frequency of both positive and negative words
Context	Balanced frequency of both positive and negative words	Expresses disappointment or criticism of environmental policy failures	Presents facts without emotional colouring, provides information on environmental policy
Text structure	Short positive evaluations: "Ukraine has become a leader in green energy!"	Short negative evaluations: "Environmental standards are not being met!"	Informative statements: "Ukraine has launched a new support program for renewables"

Source: systematised by the authors.

H_0 : The mean number of hashtag mentions does not differ across all content formats. Formally, this can be expressed as:

$$H_0: \mu_{Links} = \mu_{Photo} = \mu_{Status} = \mu_{Video} \quad (1)$$

H_1 : At least one mean value of hashtag mentions for a specific content format significantly differs from the others.

$$H_1: \text{at least one } \mu_i \neq \mu_j \quad (2)$$

where μ_i is the mean value for the i -th content type.

Before applying ANOVA, the study included verification of the main statistical assumptions. In particular, the normality of data distribution for each content group was tested using the Shapiro–Wilk test. This allowed for the assessment of how much the distribution of data in each group deviated from normality. The homogeneity of variances across content groups was examined using Levene's test. In addition, the independence of observations was tested, which is a mandatory condition for conducting ANOVA.

Prior to performing ANOVA, the following statistical assumptions were tested:

- normality of data distribution within each group (assessed using graphical methods and the Shapiro–Wilk test)
- homogeneity of variances (Levene's test)
- independence of observations

At the next stage, a one-way ANOVA test was conducted separately for each online platform (SAS Institute Inc., 2024), where the independent factor was the content type (links, photos, status, video), and the dependent variable was the number of hashtag mentions. The total variance was assessed as the sum of squares of deviations of all observations from the overall mean. The between-group variance was calculated as the sum of squares of deviations of the group means from the overall mean. The within-group variance was defined as the sum of squares of deviations of each observation from the mean of its respective group.

In cases where the ANOVA results revealed statistically significant differences ($p < 0.05$), a post hoc analysis was conducted using Tukey's test to identify specific pairs of groups with significant differences. This enabled the determination of which content types significantly differed in terms of effectiveness.

At the following stage, for better visualisation, the ANOVA and post hoc analysis results were presented using mean plots with 95% confidence intervals. This allowed for a visual comparison of the effectiveness of different content formats on each platform.

In order to assess the level of content popularity based on the studied hashtags, a content analysis of the online platforms was conducted. Table 5 summarises the analysis results, displaying each online platform's activity by content type: videos, photos, links, and status updates.

3. Research results

According to the obtained results, specific patterns were identified across positive, negative, and neutral content categories. Positive content includes words that emphasise environmental friendliness, sustainable development, and a clean environment. In contrast, negative content focuses on issues of pollution and ecological crises, highlighting the failure to meet environmental standards and the degradation of natural resources. Neutral content primarily presents facts without emotional colouring, often providing information about events or initiatives.

Word frequency analysis enables the identification of the dominance of positive, negative, or neutral messaging in the content. Emotion polarity reveals the percentage composition of positive, negative, and neutral words in the texts, allowing for an overall assessment of message tone and identifying key trends in the perception of Ukraine's green brand. In terms of context, the study highlights key messages directed at the country's environmental initiatives and their role in shaping the national brand. Text structure illustrates the main expressions used to emphasise either environmental achievements or shortcomings in sustainable development.

The sentiment analysis of content based on selected hashtags (Table 4) allows for an evaluation of the general emotional tone of communication messages, their impact on the audience, and their potential to shape a positive image of the country in the green context.

Table 4. Sentiment analysis results of the research sample.

Sentiment	#GreenEconomy	#UkrainianBrand	#GreenUkraine	#SustainableUkraine
Positive (Pos)	34%	23%	12%	46%
Negative (Neg)	2%	30%	13%	13%
Neutral (Neutr)	64%	47%	75%	41%

Source: authors' own calculations.

Table 4 presents the distribution of sentiment polarity for the studied hashtags (#GreenEconomy, #UkrainianBrand, #GreenUkraine, and #SustainableUkraine). The results showed that #GreenEconomy is dominated by neutral content (64%), while the share of positive mentions is 34%, and negative mentions account for only 2%. This content structure indicates the overall stability of the green economy theme within the information space.

A different trend is observed for #UkrainianBrand. While 30% of the mentions are negative, representing the highest proportion among the analysed hashtags, positive mentions account for 23%. Meanwhile, 47% of the content remains neutral in tone. The analysis of these data suggests the need to adjust the communication strategy to reduce the share of negative messages and emphasise the brand's positive aspects.

In the case of #GreenUkraine, 75% of the messages are neutral, whereas the share of positive mentions is limited to 12% and negative to 13%. This structure reflects substantial informational content that lacks a strong emotional tone. Nonetheless, it contains relevant messages that could contribute to shaping a more positive image of the country.

The most favourable situation in terms of emotional impact is observed for the hashtag #SustainableUkraine, where 46% of the content is positive. That is the highest share among all analysed hashtags. At the same time, 41% of the messages remain neutral, and the share of negative mentions is only 13%. This dynamic indicates the effectiveness of the communication strategy in promoting sustainable development and the implementation of renewable energy in Ukraine.

The results of sentiment analysis across communication channels revealed differences in the perception of environmental topics among users of various platforms. The findings are visualised using charts illustrating the emotional polarity distribution for each hashtag across different online communication channels (Figure 1).

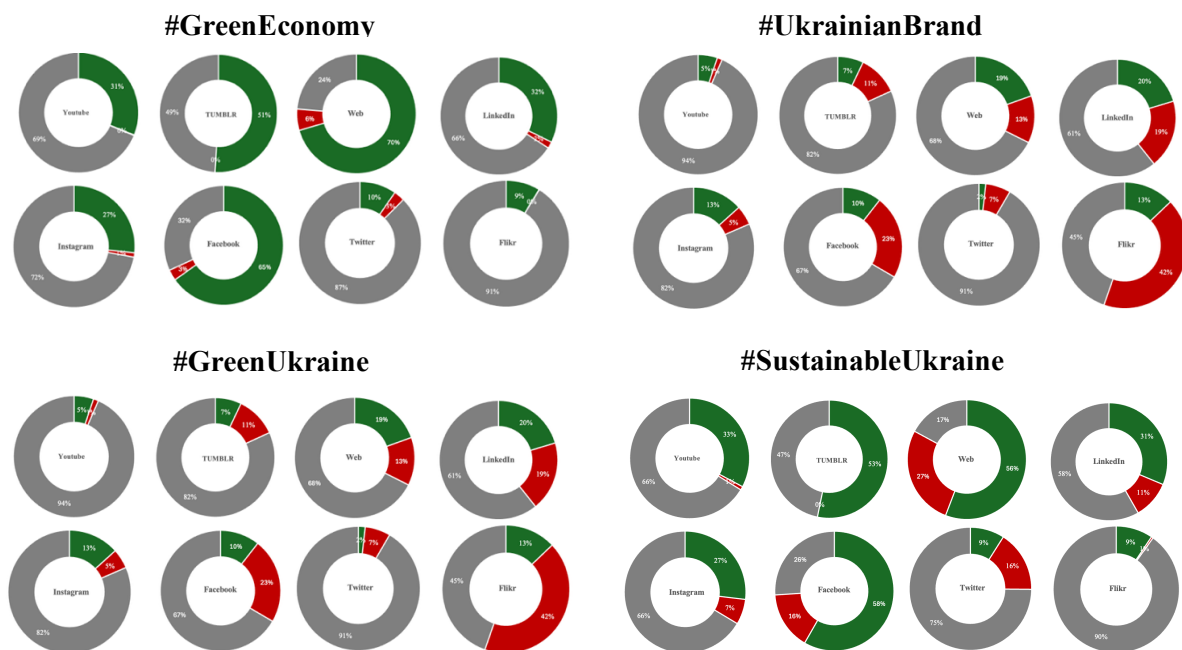


Figure 1. Sentiment analysis results of the constructed research sample across online communication channels.

Source: visualised by the author based on own calculations.

Thus, neutral content dominates for the hashtag #GreenEconomy on Facebook, accounting for more than 65% of the messages, while positive mentions reach 30%. On Twitter, a significant share of content is positive (45%), indicating active discussion of the topic in a favourable light. On Instagram, positive mentions also exceed 35%, which reflects strong user engagement in discussions related to green development.

The hashtag #UkrainianBrand shows the opposite trend. YouTube and Tumblr record high levels of negative mentions, reaching 40% and 38%, respectively, indicating a considerable volume of critical statements regarding Ukraine's brand. On LinkedIn, by contrast, neutral content prevails (50%), which may be explained by the platform's formal communication style.

For #GreenUkraine, neutral mentions dominate across all platforms, particularly on LinkedIn (78%) and the Web (75%). Meanwhile, Instagram shows a higher percentage of positive content (20%), suggesting a growing presence of environmental initiatives in visual formats.

The most positive sentiment is observed for #SustainableUkraine, where Facebook and LinkedIn demonstrate over 50% positive mentions. A high level of positivity is also recorded on Instagram (42%), indicating the active use of visual materials for promoting sustainable development and Ukraine's environmental achievements.

The obtained results demonstrate a diversity of sentiment across social networks in relation to the analysed hashtags: #GreenEconomy, #UkrainianBrand, #GreenUkraine, and #SustainableUkraine. This leads to the conclusion that communication strategies must be adapted to the specific

characteristics of each social media platform to increase the effectiveness of promoting Ukraine's green brand. In this context, the following subsection will justify the selection of optimal online communication channels for engaging with stakeholders in promoting the green brand. The methodological tools developed in the research will facilitate the identification of effective channels for interaction with target audiences and provide recommendations for strengthening their impact on the perception of environmental messaging.

In order to determine the level of content popularity based on the studied hashtags, a content analysis of online platforms was conducted. Table 5 summarises the analysis results, presenting each online platform's activity level by content type: videos, photos, links, and status updates.

Table 5. Heatmap of hashtag popularity by content type across online communication channels.

	YouTube	TUMBLR	Web	LinkedIn	Instagram	Facebook	X(Twitter)	Flickr
#GreenEconomy								
Video	Green	Red	Red	Red	Green	Yellow	Red	Red
Photo	Red	Red	Yellow	Red	Green	Yellow	Green	Yellow
Links	Red	Red	Green	Yellow	Red	Red	Yellow	Red
Status	Red	Red	Red	Yellow	Red	Yellow	Green	Red
#UkrainianBrand								
Video	Green	Red	Red	Red	Green	Yellow	Red	Red
Photo	Red	Red	Yellow	Red	Green	Yellow	Red	Red
Links	Red	Red	Green	Green	Red	Red	Red	Red
Status	Red	Red	Red	Yellow	Green	Yellow	Red	Red
#GreenUkraine								
Video	Yellow	Red	Red	Red	Red	Red	Red	Red
Photo	Red	Red	Red	Red	Yellow	Red	Red	Red
Links	Red	Red	Yellow	Yellow	Red	Red	Yellow	Red
Status	Red	Red	Red	Yellow	Red	Yellow	Red	Red
#SustainableUkraine								
Video	Red	Red	Red	Red	Red	Red	Red	Red
Photo	Red	Red	Yellow	Red	Yellow	Yellow	Yellow	Red
Links	Red	Red	Red	Red	Red	Red	Red	Red
Status	Red	Red	Red	Yellow	Red	Yellow	Green	Red

Note: green indicates high topic popularity and strong presence on the platform; yellow – moderate popularity; red – low popularity or minimal discussion of the topic on the platform.

Source: visualised by the authors based on their own calculations.

According to the results presented, green indicates high topic popularity and a strong presence on the platform; yellow reflects moderate popularity; and red signifies low popularity or limited discussion of the topic on the platform.

The hashtag #GreenEconomy demonstrates high activity in video and photo formats on platforms such as Tumblr, the Web, and Instagram. Notably, Tumblr emerges as a visually oriented platform, where images serve as a primary means of communication. This suggests considerable potential for using visual content to highlight achievements in the area of green economy. The webspace shows moderate popularity, primarily through links to disseminate information. In contrast, platforms such as YouTube, Facebook, and Flickr display low activity, which may be attributed to the lack of a targeted content campaign.

The hashtag #UkrainianBrand shows notable popularity on Tumblr, where content primarily consists of photographs and status updates. This indicates the opportunity to engage audiences through emotionally resonant visual imagery that reinforces national identity and enhances Ukraine's brand reputation. In the web domain, the prevalence of link-based content reflects an attempt to build a positive brand image through informational materials. However, this hashtag demonstrates limited activity on Instagram, Facebook, and X, which may point to an underutilisation of contemporary marketing tools within the communication strategy.

The hashtag #GreenUkraine exhibits low activity across nearly all platforms except Tumblr, where moderate popularity is observed in video and photo formats. This indicates a limited volume of content aimed at promoting environmental themes through visual formats. The lack of engagement on platforms such as YouTube, Facebook, and Instagram may be attributed to the insufficient integration of sustainable development topics into Ukraine's overall brand promotion strategy.

The hashtag #SustainableUkraine demonstrates a moderate level of activity on Tumblr and within the web environment, particularly in the form of photographic content. This highlights the importance of leveraging visual media to draw attention to sustainability-related issues. At the same time, other platforms (including Facebook, Instagram, and X) show low levels of engagement, suggesting the absence of a cohesive communication strategy for promoting this topic.

Table 6. ANOVA test results.

Platform	R-squared	Adj R-squared	F	Prob>F
YouTube	0.9610	0.9512	98.55	0.0000
TUMBLR	0.7876	0.7345	14.83	0.0002
Web	0.5545	0.4432	4.98	0.0180
LinkedIn	0.8424	0.8030	21.38	0.0000
Instagram	0.5392	0.4240	4.68	0.0218
X (Twitter)	0.5328	0.4160	4.56	0.0236
Facebook	0.9688	0.9610	124.13	0.0000
Flickr	0.3239	0.1548	1.92	0.0181

Note: R-squared – coefficient of determination; Adjusted R-squared – adjusted coefficient of determination; F – F-statistic; Prob > F – p-value for the F-test; Contrast – compared groups.

Source: authors' own calculations.

The results of the ANOVA test are presented in Table 6. The analysis reveals that the highest coefficients of determination (R-squared) were recorded for Facebook (0.9688) and YouTube (0.9610), indicating a strong relationship between content type and its popularity on these platforms. This suggests that both platforms play a significant role in shaping audience engagement with thematic content. Similarly, Tumblr (0.7876) and LinkedIn (0.8424) also correlate highly with content volume and user engagement.

In contrast, the lowest R-squared value was observed for Flickr (0.3239), pointing to a weak relationship between content type and audience interaction and indicating limited user engagement with thematic material on that platform. Prob > F values for Facebook, YouTube, and LinkedIn were all below 0.0001, confirming the statistical significance of the differences in content popularity across these platforms. Conversely, Flickr and the Web showed considerably lower F-statistics, suggesting no significant variation in content performance across different formats.

These results suggest that Facebook and YouTube are currently the most impactful platforms for promoting Ukraine's green brand, owing to their high levels of user engagement with relevant content. On the other hand, Flickr and the broader web environment require a more robust and targeted content strategy to enhance the effectiveness of communication efforts.

To gain deeper insights into differences across content formats on individual platforms, pairwise comparisons with 95% confidence intervals were conducted. The findings are summarised in Table 7.

The analysis of pairwise marginal comparisons revealed significant differences between content formats across various platforms. The most pronounced contrasts were observed for video content on YouTube, where the contrast values between video and other formats were the highest (104.8454 – 121.1237), with p-values < 0.001. This indicates the high effectiveness of video materials in engaging audiences on this platform.

On Tumblr, the most significant contrast was found between video and links (26.02911), which may suggest a greater popularity of multimedia content among users of this platform.

Table 7. Results of pairwise marginal comparisons of linear predictions with 95% confidence intervals.

Platform	Metric	Status vs. Photo	Status vs. Links	Photo vs. Links	Video vs. Photo	Video vs. Links	Video vs. status
YouTube	Contrast	-16.27827	-5.1	11.17827	104.8454	116.0237	121.1237
	P > t	0.244	0.922	0.541	0.000	0.000	0.000
TUMBLR	Contrast	-29.10066	-3.071548	-1.868274	1.203274	26.02911	27.23239
	P > t	0.000	0.928	0.982	0.995	0.001	0.001
Web	Contrast	-130.3047	-96.26194	-90.78734	-56.7446	-39.51734	34.04274
	P > t	0.018	0.091	0.116	0.444	0.711	0.792
LinkedIn	Contrast	-121.946	-99.36734	-39.99411	-17.41548	22.57863	81.95186
	P > t	0.000	0.000	0.118	0.712	0.529	0.001
Instagram	Contrast	-176.6055	-126.2873	-4.275	46.04323	50.31823	172.3305
	P > t	0.029	0.142	1.000	0.828	0.788	0.034
Twitter	Contrast	-79.08008	-73.69734	-56.39579	-51.01305	-22.68429	-5.382742
	P > t	0.041	0.059	0.179	0.245	0.813	0.997
Facebook	Contrast	-214.3286	-213.9036	-7.58	-7.155	.425	206.7486
	P > t	0.000	0.000	0.941	0.949	1.000	0.000
Flickr	Contrast	-68.08097	-44.86871	-34.61137	-33.4696	-11.39911	23.21226
	P > t	0.141	0.441	0.641	0.664	0.978	0.852

Note: t – t-statistic for each comparison; p-value – level of statistical significance (if $p < 0.05$, the difference between groups is statistically significant).

Source: author's own calculations.

Text-based posts on web platforms showed higher popularity compared to photos. This may reflect a preference for informational content on news sites and blogs. On Instagram, photos proved to be more popular than text-based status updates, highlighting the platform's strong visual orientation.

Textual status updates on LinkedIn exhibited significantly higher popularity compared to other formats, indicating the professional and business-oriented nature of the platform. Links and photos were less attractive to users, which is expected given the platform's emphasis on text-heavy professional communication.

On X (formerly Twitter), text-based statuses remain the dominant content format. However, photo content is approaching statistical significance in terms of engagement, suggesting a gradual shift in user interest toward more visual content.

Video content is the most effective on Facebook, substantially outperforming textual formats, as confirmed by high contrast values. Meanwhile, on Flickr, photo content remains the primary format, though the difference from status updates is not statistically significant, reflecting the platform's niche audience.

Figure 2 presents a graphical visualisation of the mean number of hashtag mentions across different content formats (Links, Photo, Status, Video) on selected online platforms: YouTube, Tumblr, Web, Instagram, X (formerly Twitter), Facebook, LinkedIn, and Flickr. The graphs display mean values with 95% confidence intervals, enabling an assessment of the statistical significance of differences between content formats within each platform.

On YouTube, video content has a clearly defined dominance over all other formats. The mean values for video significantly exceed those for statuses, photos, and links. This suggests that video is the most effective content format on this platform, consistent with its video-centric structure. Other content formats demonstrate similar mean values with no statistically significant differences.

On Tumblr, status updates show the highest mean values among all formats, indicating their priority in engaging the audience. Photos also exhibit relatively high average values, while video and link formats show similar but substantially lower results. This may reflect the dominance of textual and visual content on the platform, with a lesser emphasis on video formats.

Within the web environment, links display the highest average values, underlining their leading role in the platform's content structure. Photos and status updates have significantly lower mean

values, suggesting that informational content in hyperlinks form is the primary format on web-based platforms. Video occupies an intermediate position, though it does not show statistically significant differences.

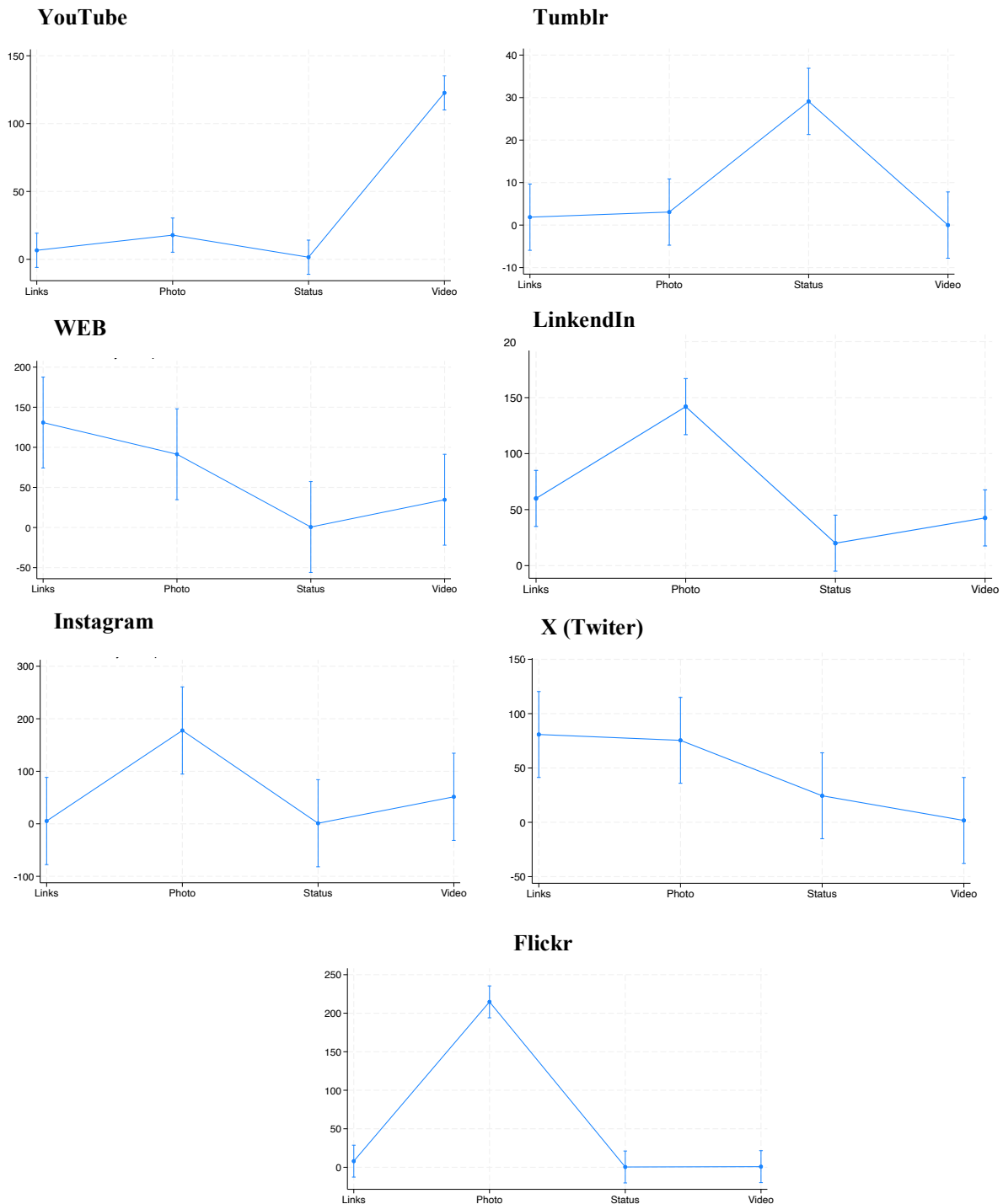


Figure 2. Visualisation of model-adjusted estimates derived from ANOVA testing.
Source: compiled by the authors based on their own calculations.

On LinkedIn, photos emerge as the most effective content format, with mean values significantly higher than those for status updates and videos. This aligns with the platform's focus on professional visual content used in presentations, infographics, and business reports. Links demonstrate the lowest mean values, indicating a limited impact of this format on user engagement.

Instagram exhibits a clear dominance of photo content, consistent with the visual nature of the platform. Videos also show high mean values, though slightly lower than those for photos. Status

updates have the lowest average values, possibly due to lower user engagement with text-based content on a highly visual platform.

On X (formerly Twitter), status updates are the most effective content format, aligning with the platform's text-focused orientation. Video and photo formats display similar mean values, while links occupy an intermediate position. Except for status updates, the absence of distinct differences between formats suggests a relatively balanced distribution of user attention between visual and textual content.

Flickr, in turn, shows the highest mean values for photo content, corresponding to the platform's visual nature. Video content exhibits substantially lower average values, indicating its limited role for Flickr's audience. Links and status updates yield similar results, indicating their minor influence on user engagement.

The visualisation results support the earlier findings of the ANOVA analysis regarding differences in content formats and their relative effectiveness across various platforms.

4. Discussion

Assessing the effectiveness of a country's green brand promotion within the digital landscape represents a critical tool for strategic positioning in global environmental communication. This type of evaluation allows for identifying key drivers that foster a positive international image of the country as a committed actor in sustainable development while simultaneously uncovering structural or communicative barriers that may hinder the advancement of its green reputation. The analysis of digital engagement through social media platforms provides nuanced insights into how environmental narratives are interpreted and received by diverse audience segments. These findings lay the groundwork for designing adaptive, evidence-based branding strategies that address global sustainability imperatives and reflect locally embedded values and sociocultural contexts.

The application of sentiment analysis to digital content enables the measurement of the emotional tone surrounding specific aspects of a country's green brand. As demonstrated by the findings of this study, a predominantly positive sentiment is associated with posts tagged with #SustainableUkraine and #GreenEconomy, indicating the strong potential of sustainability-related topics in fostering a favourable national image. In contrast, the hashtag #UkrainianBrand is more frequently accompanied by critical reactions, primarily attributed to the broader political and economic instability. These findings align with the conclusions of Shaheen (2025), who emphasises that the reputational resilience of a national brand is closely linked to the emotional tone prevailing in the digital environment.

The choice of communication channels plays a pivotal role in shaping public perceptions of state environmental policy. The analysis reveals that visual platforms such as YouTube and Instagram are the most effective in generating positive emotional responses. This observation is consistent with the work of Maroto-González et al. (2024), who highlight the credibility-enhancing potential of video formats in promoting green initiatives. Conversely, text-oriented platforms like Twitter/X and Tumblr tend to exhibit a higher concentration of neutral or critical content. At the same time, LinkedIn offers the most significant degree of analytical depth and is thus well-suited for facilitating expert discourse.

A critical aspect of promoting a country's green brand in the digital environment lies in the strategic adaptation of content to the specific characteristics of each platform. As demonstrated by the case of France, tailoring messages to the unique audience profiles of platforms such as TikTok, YouTube, or Telegram enables effective engagement across diverse demographic groups, including both youth and older generations (Maroto-González et al., 2024). The Ukrainian case confirms this trend: the highest levels of emotional engagement were recorded for video and photo materials disseminated via visual platforms. These results are consistent with the findings of Nabivi (2025), who showed that emotionally charged visual content (photo and video posts) significantly enhances the effectiveness of environmental communication on social media, contributing to a more favourable brand reputation among users.

Given these findings, establishing a dedicated centre for digital eco-communication appears to be a relevant institutional step. Such a centre could coordinate national campaigns, conduct targeted audience segmentation, analyse digital footprints, and integrate social monitoring tools. Institutionalising this function would support a more systemic positioning of Ukraine as an environmentally responsible country and increase its reputational capital in the global arena.

Thus, the results of this study confirm that sentiment analysis, when combined with platform-specific analytics, can effectively promote a country's green brand and develop a strategic, adaptive system of digital public diplomacy in the environmental dimension.

Conclusions

Utilising key hashtags such as #GreenEconomy, #UkrainianBrand, #GreenUkraine, and #SustainableUkraine, a sentiment analysis of digital content dedicated to the topic of Ukraine's green brand was conducted in this study. The results demonstrate that posts tagged with #SustainableUkraine and #GreenEconomy exhibit the highest share of positive emotional sentiment, indicating a generally favourable public perception of sustainable development issues within the international digital discourse. In contrast, the hashtag #UkrainianBrand is frequently associated with negative reactions, primarily from discussions of political and economic instability. Content labelled with #GreenUkraine is characterised predominantly by a neutral tone and focuses mainly on disseminating information about environmental initiatives.

The analysis highlights a distinct platform-specific pattern in the formation of emotional tone. Visual-centric social media platforms, namely YouTube and Instagram, tend to generate a higher proportion of positive or neutral emotional responses due to the prevalence of image and video formats. In contrast, text-oriented platforms such as X (formerly Twitter), Tumblr, and selected web resources show a higher concentration of neutral or critical sentiment. LinkedIn, as a platform targeting professional audiences, demonstrates a high degree of analytical depth and a predominantly neutral portrayal of environmental themes.

Furthermore, the study evaluated the effectiveness of content formats in terms of audience engagement. The highest levels of emotional interaction were observed in video and photo materials, particularly on YouTube and Instagram, thereby positioning these platforms as priority channels for communicating and promoting a country's green brand. Although text-based formats (hyperlinks, status updates, analytical commentaries) exhibit lower emotional engagement, they retain relevance for expert and professional communities, particularly on platforms such as LinkedIn and Facebook.

The obtained results significantly enrich the scientific discourse at the intersection of sustainable development, digital communication, and nation branding research. In particular, the study advances the understanding of how the emotional perception of environmental initiatives is shaped within the digital environment and how this perception contributes to a country's reputational capital. Based on hashtag-oriented sentiment analysis of social media, the proposed analytical approach enables the identification of both general trends and platform-specific features of public responses to environmental narratives. This offers a methodological foundation for the further development of tools to assess public support for national environmental policies in real-time.

From a practical perspective, the study offers clear and actionable recommendations for government agencies, marketing professionals, and country branding strategists regarding the optimal selection of communication channels and content formats. Thus, visual-based social media platforms such as YouTube and Instagram are recommended as priority tools for promoting a positive image of the country in the context of sustainable development. Meanwhile, LinkedIn is identified as an effective platform for fostering expert-level discourse and engaging the international professional community.

This article is among the first to apply sentiment analysis methods to the study of a country's green brand in social media using a multi-platform approach. It systematically assesses the emotional tone

of digital content based on thematic hashtags, opening new avenues for real-time monitoring of public sentiment toward national environmental policies.

One of the key limitations of this study lies in its reliance on a selected set of hashtags, which, although thematically relevant, may not fully capture the breadth and diversity of the environmental discourse across digital platforms. Additionally, the analysis was conducted using publicly available data within a specific timeframe, which may limit the generalizability of the findings and does not account for temporal fluctuations in public sentiment. Furthermore, the study does not address potential distortions caused by bot activity, automated content generation, or platform-specific algorithmic amplification, which could influence the emotional tone and visibility of posts.

Future research should consider expanding the geographical scope of the analysis to enable cross-country comparisons of green brand promotion strategies within diverse cultural and informational contexts. Particular attention could also be devoted to the dynamic monitoring of public sentiment in response to specific events, policy interventions, or sustainability-related campaigns. Such longitudinal approaches would allow for a deeper understanding of the temporal and contextual drivers of emotional engagement with environmental narratives and enhance the responsiveness of strategic green communication at the national level.

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