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An Analysis of Social Media Discourse on Public Perception of Sustainable Technology

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Abstract: In recent decades, sustainable technology has taken center stage in global discourse, underscoring sustainability as a vital issue across multiple facets of human life. This topic encompasses key areas such as environmental preservation and resource management, reflecting the pressing need for innovative strategies that minimize environmental impacts while fostering long-term societal benefits. The study aims to identify recurrent themes, trends, and the interconnections among variables as they manifest within online discourse. Social media, especially Instagram, is utilized as a digital arena where perceptions and opinions regarding sustainability are widely shared and discussed. The initial phase of the study focused on data collection, where public comments on posts specifically related to sustainable technologies were gathered based on predefined criteria. Selected posts centered on technologies aimed at sustainability, capturing public responses that reveal how sustainability and environmental themes are understood and discussed by Generation Z in particular. Leveraging digital tools has significantly enhanced the efficiency of text analysis, allowing for timely and comprehensive data processing. To achieve these analytical goals, this study employs Voyant Tools—a web-based platform designed for text analysis and data visualization. This platform supports various analyses, including word clouds, collocations, and contextual interpretations, which collectively elucidate how topics surrounding sustainability are discussed in public comments. Ultimately, this research posits that public comprehension and perception play an influential role in the successful adoption and integration of sustainable technology in Indonesia. By understanding the ways in which sustainability is perceived, discussed, and supported, stakeholders can develop more effective strategies for promoting sustainable practices and encouraging environmental responsibility within society. This study contributes to the discourse on sustainable technology adoption, offering insights that can guide policymakers, educators, and social influencers in fostering a culture of sustainability among digital users, particularly within the context of Generation Z in Indonesia.

Keywords: Social media discourse, public perception, sustainable technology

Introduction

In recent decades, the issue of sustainable technology has become one of the topics of global debate. Sustainability has become a major issue in various aspects of human life (Hendro & Bowo Pranogyo, 2023). Sustainable technologies include various innovations that aim to support environmentally friendly development, reduce carbon emissions, and increase the efficiency of natural resources, including responsible management (Sudipa et al., 2023). The concept of sustainability itself was first formally introduced by the United Nations (UN) Brundland Commission in 1987 through a report entitled "Our Common Future". The report defined sustainability as meeting the needs of the present without compromising the right of future generations to meet their own needs (Rohinun, 2024). With increasing awareness of the negative impacts of climate change, many countries and companies endeavouring to adopt sustainable

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technologies depend not only on the level of technical innovation, but also on public perception and acceptance.

Population composition is a reflection of a country's social and demographic dynamics (Rainer, 2023). The characteristics possessed by Generation Z determine Indonesia's future, given that Indonesia will experience a demographic bonus in the next few years (Khairunnisah & Fitriyani, 2023), and is predicted to become the fourth largest economic growth country in the world (Daly & Gedminas, 2022). All of this provides an opportunity for Indonesia to take one step up to become a developed country, and the determinant of all of this is the character found in Generation Z, which will dominate the productive age in Indonesia. This group is becoming increasingly important because in addition to determining the usefulness of the demographic bonus, they also determine social and economic trends (Khairunnisah & Fitriyani, 2023), including the adoption of sustainable technology.

Social media discourse encompasses the discussions and interactions that take place across social media platforms, both shaping and reflecting public sentiment and societal trends (Kunduru, 2018). These platforms are primarily designed to foster social connections, enable interaction, and facilitate the exchange of information among users (Ausat, 2023). Social media has evolved into a primary space for the creation, maintenance, and circulation of public discourse surrounding various events and issues, including through the analysis of keywords and hashtags linked to political developments. Additionally, the commercialization of social media can disrupt the power dynamics between users and corporations, as platforms may influence discourse by controlling which perspectives are amplified or suppressed (Lillqvist et al., 2016).

Voyant Tools is a web-based platform developed to simplify the exploration and visualization of textual data, making it especially accessible for users without advanced technical skills by offering a user-friendly interface for diverse text analysis processes (Shvetsova et al., 2023). This platform aims to assist readers in analyzing data, allowing them to generate lists of words or terms from documents uploaded to Voyant Tools (Nashihuddin et al., 2020). Through its data visualization capabilities, Voyant Tools supports digital text analysis by providing features such as word clouds, text concordances, and graphical representations of contextual relationships between words (Gregory et al., 2022).

Previous studies examining the relationship between social media and public perception of sustainable technologies show that social media plays an important role in shaping public opinion and awareness. Alam & Khan (2015) identified the influence of social media on brand equity, which can strengthen or damage the image of sustainable technology based on content shared by users. In a study by Hady Surya & Pratamawaty (2022) emphasized that the use of social media, especially Twitter, encourages online political participation which also affects views on technology. Furthermore, Aria et al. (2020) found that social media has changed the way the public responds to social issues, including sustainable technology. Hafizi's research (2023) reinforces these findings by showing that online political participation is influenced by public perceptions of technology.

Furthermore, research by Saud et al. (2020) and Fajri et al. (2024) explored the influence of social media on political participation among the younger generation, which is often associated with digital campaigns that highlight sustainable technologies. This is reinforced by the research of Faradis et al. (2023) which shows the importance of digital literacy in understanding sustainable technology. Pratikto & Kristanty's (2018) research also highlights how digital media literacy among Generation Z helps them better accept sustainable technology, while Kasmantoni & Putra (2023) state that the intensity of social media use creates new perceptions of sustainable technology.

This research seeks to identify the primary topics prevalent in discussions surrounding sustainable technology, specifically by

examining the frequency of the most commonly used words. Additionally, it aims to analyze specific terms that reflect positive or negative attitudes, particularly as observed in comment sections. The study also focuses on associated terms that convey perspectives on sustainable technology, offering insights into the prevailing views within social media discourse.

Materials and Methods

Study Area

This study employs a qualitative approach utilizing social media discourse analysis to examine the dynamics of public discussion surrounding sustainable technology. Specifically, it aims to identify recurring themes, trends, and interrelationships among variables within social media discourse. Social media serves as the primary context for this research due to its role as a digital space where information and opinions are actively exchanged. Focusing on Instagram, this study collects posts and comments to capture Public perceptions and reactions toward sustainable technology. The public perceptions analyzed here consist of comments on posts related to sustainable practices, such as eco-bricks and other environmentally conscious technologies. The data for this research are categorized into primary data public comments on targeted posts and secondary data, including relevant prior studies supporting the research theme. The preliminary screening of the comment corpus revealed that Post 1 contained 880 words, consisting of various excerpts from the comments associated with the post. Post 2 comprised 965 words, while Post 3 included a total of 2,120 words. A comprehensive overview of the comment corpus is provided in Table 1.

Table1. Comment corpus of selected posts

Corpus Data	Total Words	Readability Index	Unique Words
Post 1	880	12.051	450
Post 2	965	13.477	491
Post 3	2.120	13.408	894

Figure1. Post 1 that discusses eco-friendly boarding pass technology

Source : Instagram

Figure2. Post 2 contains the use of eco paving technology for waste management and reduction

Source : Instagram

Figure3. Post 3 contains the use of solar PV as a sustainable technology

Source : Instagram

Procedures

The initial stage of the research involved collecting data in the form of public comments on sustainable technologies in selected posts. Posts were selected based on the criteria that they were about sustainable technology. The posts were taken from the social media platform Instagram considering it to be one of the platforms with the highest number of users based on we are social media analysis (Thompson, 2024). Posts discussing sustainable technology were identified through Instagram's search function using a selection of keywords, including "advanced technology," "sustainability," "sustainable technology," and

"green technology." Selection criteria for these posts included: 1) posts authored by Indonesian users, 2) posts focused on issues related to sustainable technology, and 3) posts with over one hundred comments. In the second phase, data was collected using web scraping tools. Web scraping is a method used to extract data from websites for research purposes (Nayoan, 2020). In this study, researchers utilized web scraping tools as a primary instrument for data collection. The third phase involved data cleaning, in which non-essential elements in the comments, such as dates, hashtags, and numbers, were removed. The cleaned data was then saved as a .txt file using Notepad. This processed data, organized according to specific categories, is referred to as a corpus. In the final phase, the corpus data was inputted into the Voyant Tools platform for analysis. The analytical output from Voyant Tools was subsequently interpreted to address the research questions concerning Generation Z's perceptions of sustainable technology.

Data analysis

The use of technology significantly aids in efficiently analyzing texts within a short timeframe. Accordingly, this study employs Voyant Tools, a web-based platform for text analysis and visualization (Wachyudi, 2022). The Latent Dirichlet Allocation (LDA) method plays a pivotal role in this research methodology, offering significant utility for text-based dataset classification (Ortu et al., 2024). This approach operates under the premise that each dataset encompasses multiple latent topics. Through word distribution analysis, LDA enables the identification and learning of these mixed topics within datasets (Aminpour & Saidi, 2025). This assumption also states that a small set of topics is contained in a relatively small set of words (Hetenyi et al., 2019). This study utilizes several analytical models, including the Cirrus tool, which generates word clouds to visualize and identify the most frequently used words (Hetenyi et al., 2019). The second analytical method employed is the Collocates tool, which examines words or phrases that frequently co-occur with keywords like "sustainable technology." This helps identify patterns of association and highlights how specific attitudes or sentiments connect to the theme of sustainability. The third analysis utilizes the Context tool, which examines words and phrases within complete sentences to better understand public attitudes and perspectives on sustainable technology.

Results and Discussion

Word Cloud Result

Figure4. Word cloud result of post 1
Source : Primary data processing

Figure5. Word cloud result of post 2
Source : Primary data processing

Figure6. Word cloud result of post 3
Source : Primary data processing

The first post highlights KAI's endorsement of sustainable, eco-friendly technology through initiatives like replacing paper boarding passes with facial recognition systems. The word cloud analysis presented in Figure 4 reveals a few prominent terms in the comment corpus related to Post 1, with "face," "boarding," and "ticket" being the most frequently mentioned. The predominance of "face" in the comment section suggests that the focus of the conversation centers around face recognition technology. As defined by Li et al. (2020), face recognition refers to a biometric technology that identifies individuals by analyzing unique facial characteristics through the collection and automated processing of image data.

In first post (Figure 1), the implementation of face recognition is framed as an initiative supporting sustainable technology. This post centers primarily around discussions of face recognition, evident from the frequent mention of "face" as a key term. Alongside "face," the word "boarding" also appears prominently, referring to an access document that permits entry onto specific transportation (Ayu, 2024). The prominent appearance of this word suggests that the comments revolve around the tools available to fulfill consumer needs in utilizing transportation services, such as trains. In these discussions, the term "boarding" often addresses access to services and the potential benefits or drawbacks they entail. Commenters debate the choice between face recognition and paper tickets, considering both options' implications. To gain a deeper understanding of perceptions toward face recognition as sustainable technology, further analysis through collocation analysis is required.

The second post (Figure 2) discusses the application of eco-paving technology as an innovative approach to repurposing plastic waste into valuable, recycled materials. Eco-paving refers to a construction block product created from polyethylene and terephthalate plastic waste, combined with sand as a compaction material at specific ratios (Hasaya & Masrida, 2021). Based on the word cloud results in Figure 5, the term "waste" is the most frequently mentioned in the comments, indicating that waste is the primary theme of discourse. This prominence suggests a strong focus on waste management and reduction within the discussion. Other frequently used terms, such as "child," "friend," and "agree," suggest that the implementation of eco-paving is perceived as a community-oriented or educational initiative, highlighting the involvement of youth and community members in supporting waste management efforts. Furthermore, terms like "plastic" and "environment" underscore concerns regarding environmental impacts, particularly those associated with plastic waste. Words such as "friendly" and "safe" imply an emphasis on environmentally sustainable practices and safe waste disposal methods. Additionally, terms like "treated" and "processing" indicate a focus on the recycling and transformation processes of waste materials, reflecting an interest in sustainable waste management practices.

The third post (Figure 3) discusses the export of electricity generated from solar power technology (PLTS). The word cloud in Figure 6 highlights key topics related to energy and electricity in Indonesia. Terms such as "electricity," "energy," "EBT" (renewable energy), "Indonesia," and "negara" suggest an emphasis on the distribution and accessibility of electricity across different regions in Indonesia, including efforts to incorporate renewable energy sources. The presence of terms like "islands" and "regions" likely reflects the unique challenges and ongoing initiatives aimed at providing electricity to remote and isolated areas within the Indonesian archipelago. Words such as "country" and "government" imply a significant role for

government policies and interventions, potentially in the form of energy infrastructure development or initiatives to promote renewable energy. Moreover, the mention of "export" suggests discussions surrounding Indonesia's potential as an energy exporter, particularly through the use of solar power technology. This focus on renewable energy export indicates a forward-looking approach to sustainable energy production, positioning Indonesia as a contributor to regional or global energy markets. Overall, the word cloud suggests a discourse on energy policy, government involvement, infrastructure challenges, and renewable energy export potential in Indonesia.

The primary focus of discussion in the comments section emphasizes the adoption of sustainable technologies to address environmental issues. For instance, the first post highlights the use of facial recognition technology as a means to promote sustainability, with community perceptions reflecting the effectiveness of services enabled by this technology. The second post addresses the application of eco-paving technology as a strategy for waste management and reduction, emphasizing the value of transforming waste into practical products like eco-paving blocks. This suggests a community-driven interest in waste repurposing and the creation of eco-friendly materials that contribute to sustainable development. The third post discusses the deployment of solar panels as a sustainable technology within the energy export sector. In this discussion, "electricity" emerges as the dominant term, underscoring that the main focus revolves around electricity generation and distribution, particularly in ways that could bolster economic growth and benefit society. Together, these posts reflect a discourse on the integration of sustainable technologies across various sectors, including digital services, waste management, and renewable energy, highlighting public awareness and support for eco-friendly innovations with positive societal impacts.

Collocation Result

Collocation of some of most frequently used words

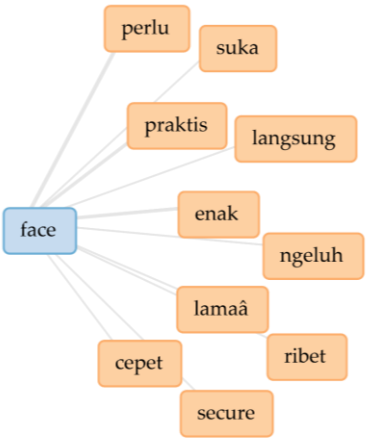


Figure7. Collocation result of post 1
Source : Primary data processing

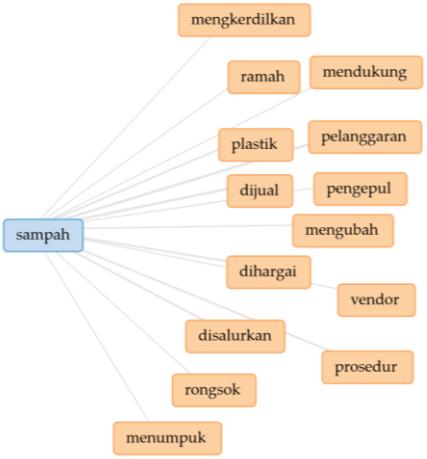


Figure8. Collocation result of post 2
Source : Primary data processing

Figure9. Collocation result of post 3
Source : Primary data processing

Figure 7 presents a collocation-based visualization with "face" as the central word in the comment data corpus. The central position of "face" highlights its prominence in the discussion, with several words surrounding it that reflect users' perceptions and experiences regarding facial recognition technology in this context. Words like "practical," "safe," "fast," and "immediate" suggest positive attitudes, emphasizing the technology's efficiency, security, and ease of use. This indicates that certain users appreciate its convenience and straightforward functionality. Conversely, terms like "long" (time-consuming), "ngeluh" (complaining), and "complicated" (cumbersome) represent a contrasting perspective, where some users find the technology frustrating or perceive it as overly complex and slow. This illustrates a mixed response, with some individuals viewing the technology as inconvenient or challenging.

Figure 8 highlights the word "sampah" as the central term, indicating that waste is a focal point in the discussion within the comments on the second post. Overall, the collocation results reflect public perceptions regarding waste issues and its management. These collocations illustrate various aspects related to the topic of waste, including views on its value, handling methods, management procedures, as well as its social and environmental impacts. Words such as "dijual," "dihargai," and "pengepul" indicate that waste is perceived as having economic value. This may reflect the view that waste can be utilized as a source of income or processed into something useful, such as in recycling. The presence of the word "vendor" also implies the involvement of external parties or businesses in the waste management process. Words like "disalurkan," "mengubah," and "prosedur" indicate a structured process in waste handling, involving the distribution or transfer of waste to various parties. This may refer to an organized recycling or waste processing system, which likely includes various procedures for effective management. Words such as "mengerdilkan," "menumpuk," and "pelanggaran" suggest a negative view of waste management, where accumulated waste or improper management may become a social and environmental problem. The term "rongsok" further reflects a negative view, potentially related to waste management practices that do not adhere to applicable standards or regulations.

Figure 9 centers on the word "listrik," highlighting various public perceptions and issues related to electricity within society. The collocations illustrate viewpoints regarding electricity distribution, usage, and related challenges. Terms like "dialirkan," "dipake," "pelosok," and "pasok" emphasize the focus on electricity provision to different areas, including remote regions, which may reflect discussions about the difficulties of achieving equitable electricity distribution, especially in isolated or less accessible places. Words such as "ketidakmampuan" and "mencukupi" reveal concerns about whether the electricity supply meets the population's needs. Additionally, "menikmati" and "merasakan" convey people's experiences with electricity access, potentially indicating either satisfaction or dissatisfaction with the service. The terms "dijual" and "gunain" refer to discussions around the commercial application of electricity, possibly pointing to its role in business activities or energy trade topics.

Context Result

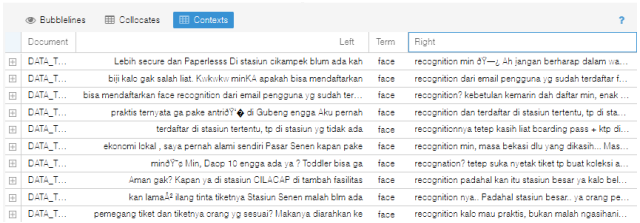
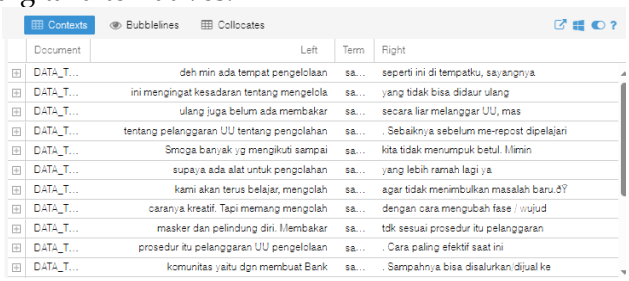


Figure10. The term "face" within the comment data corpus of the first post

In Figure 10, the term "face" is positioned as a central concept to facilitate a comprehensive analysis of the surrounding context, enhancing the understanding of public perception. Utilizing the contextual analysis tool, it is evident that responses to sustainable technology, particularly regarding face recognition tools, are diverse. Many individuals exhibit enthusiasm, as reflected in their inquiries about the accessibility of these technologies. Conversely, there are expressed

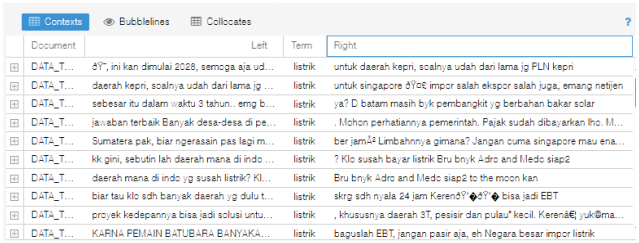
concerns regarding the effectiveness of such devices. Additionally, negative perceptions emerge, with some users arguing that the implementation of face recognition technology is overly complex and time-consuming. Furthermore, there are contrasting views concerning the preferred types of boarding passes, with a notable inclination towards traditional paper tickets over digital alternatives.


Contexts | Bubblelines | Collocates

Document	Left	Term	Right
DATA_T…	deh min ada tempat pengelolaan	sa…	seperti ini di tempatku, sayangnya
DATA_T…	ini mengingat kesadaran tentang mengelola	sa…	yang tidak bisa didaur ulang
DATA_T…	ulang juga belum ada membakar	sa…	secara liar melanggar UU, mas
DATA_T…	tentang pelanggaran UU tentang pengolahan	sa…	. Sebaiknya sebelum me-repost dipelajari
DATA_T…	Smoga banyak yg mengikuti sampai	sa…	kita tidak menumpuk betul. Mimin
DATA_T…	supaya ada alat untuk pengolahan	sa…	yang lebih ramah lagi ya
DATA_T…	kami akan terus belajar, mengolah	sa…	agar tidak menimbulkan masalah baru.ðŸ
DATA_T…	caranya kreatif. Tapi memang mengolah	sa…	dengan cara mengubah fase / wujud
DATA_T…	masker dan pelindung diri. Membakar	sa…	tdk sesuai prosedur itu pelanggaran
DATA_T…	prosedur itu pelanggaran UU pengelolaan	sa…	. Cara paling efektif saat ini
DATA_T…	komunitas yaitu dgn membuat Bank	sa…	. Sampahnya bisa disalurkan/dijual ke

Figure11. The term "sampah" within the comment data corpus of the second post
Source : Primary data processing

In Figure 11, the term "sampah" emerges as a central concept in this contextual analysis. The findings reveal a range of community responses to the implementation of eco paving as a sustainable technological solution for waste management. While some individuals express support for this innovative approach, others raise concerns regarding the processing method, which involves burning waste and consequently generates smoke. Notably, some community members highlight the legal ramifications of illegal burning, which may incur penalties. This suggests that sustainable technologies like eco paving encounter several challenges, including legislative constraints that may conflict with the objectives of effective waste management and reduction. Additionally, there is a societal aversion to smoke, indicating the necessity for precise operational protocols to ensure public comfort. This perspective underscores the critical need for proper waste management procedures in the deployment of such technologies.


Contexts | Bubblelines | Collocates

Document	Left	Term	Right
DATA_T…	ðŸ˜, ini kan dimulai 2028, semoga aja ud…	listrik	untuk daerah kepri, soalnya udah dari lama jg PLN kepri
DATA_T…	daerah kepri, soalnya udah dari lama jg …	listrik	untuk singapore ðŸ¤£ impor salah ekspor salah juga, emang netijen
DATA_T…	sebesar itu dalam waktu 3 tahun.. emg b…	listrik	ya? D batam masih byk pembangkit yg berbahan bakar solar
DATA_T…	jawaban terbaik Banyak desa-desa di pe…	listrik	. Mohon perhatiannya pemerintah. Pajak sudah dibayarkan lho. M…
DATA_T…	Sumatera pak, biar ngerasain pas lagi m…	listrik	ber jamÂª Limbahnnya gimana? Jangan cuma singapore mau ena…
DATA_T…	kk gini, sebutin lah daerah mana di indo …	listrik	? Klo susah bayar listrik Bru bnyk Adro and Medc siap2
DATA_T…	daerah mana di indo yg susah listrik? Kl…	listrik	Bru bnyk Adro and Medc siap2 to the moon kan
DATA_T…	biar tau klo sdh banyak daerah yg dulu t…	listrik	skrg sdh nyala 24 jam Kerenð? ð? ð bisa jadi EBT
DATA_T…	proyek kedepannya bisa jadi solusi untu…	listrik	, khususnya daerah 3T, pesisir dan pulau kecil. Kerenâ€¦ yuk@ma…
DATA_T…	KARNA PEMAIN BATUBARA BANYAKA…	listrik	baguslah EBT, jangan pasir aja, eh Negara besar impor listrik

Figure12. The term "listrik" within the comment data corpus of the third post
Source : Primary data processing

In Figure 12, "listrik" serves as the central term, enabling an examination of preceding and succeeding words. The contextual analysis reveals that equitable access to electricity is a prominent issue among Indonesians. Some perceive that certain regions in Indonesia remain without electricity access, while others disagree, suggesting that public perception often focuses on electricity consumption rather than on sustainable electricity provision that considers environmental impact. Although this analysis pertains to posts discussing hydropower as an eco-friendly technology, public discourse largely centers on the goal of equitable electricity distribution. However, there is also a positive outlook on hydropower as a renewable energy source. Negative sentiments are often rooted in concerns over the commercialization of electricity, particularly for export, which some view as prioritizing national economic interests over domestic access in underserved areas. Even though some comments question the existence of unelectrified regions, these discussions reflect an underlying public concern evident in the comment section.

Conclusions

Comments on social media serve as a reflection of the public's understanding and perceptions of various issues. By utilizing discourse analysis through Voyant tools, we can gain insights into how individuals perceive sustainable technology. While some responses are positive, others express negative viewpoints accompanied by diverse arguments. These findings underscore the significance of public comprehension regarding sustainability and sustainable technology to ensure

that their implementation is favorably received. Analyses such as word clouds, collocation, and context have been employed to explore how topics related to sustainability and environmental friendliness emerge in public comments concerning sustainable technology. Ultimately, public understanding plays a crucial role in the successful adoption of sustainable technology in Indonesia.

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