

Exploring Sentiment Analysis of Sustainable Finance Initiatives: A Text Mining Approach

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To combat climate change and mitigate its negative effects, it is necessary to increase public understanding of the significance of sustainable development. The discipline of sustainable finance offers a novel opportunity to maximize financial returns by capitalizing on social progress, which constitutes a substantial competitive advantage. Moreover, sustainable finance is not only a financial development instrument for prominent proponents of sustainability, but it also represents the underlying goal of decision-makers who prioritize social responsibility. Sentiment analysis is one of the most prevalent implementations of natural language processing; therefore, this article aims to examine how the general public perceives sustainable finance. The study revealed that positive sentiment ranked highest with a percentage of 62.8%, followed by neutral sentiment with a percentage of 26.9%, and then negative sentiment with a percentage of 10.4%. The increasing popularity of environmentally favourable financial instruments has the potential to generate the necessary financial resources in the future, which are essential for financing the transition to a sustainable economy. The suggestions presented in this article are predicated on the notion that activities promoting sustainable finance are essential to the environmental, social, and economic environments. To achieve sustainable finance, the current financial system must be reconstructed and modified in accordance with sustainable development principles. In order to implement sustainable finance, it is necessary to provide support and enhancement for the adequate human resources, institutions, and new financial literacy of financial institutions.

Keywords: Sustainable Finance; Sustainable Development; ESG; Sentiment Analysis; Twitter.

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INTRODUCTION

Society is confronting a major challenge in the form of climate change. As is becoming increasingly apparent in the literature, the physical and transitional effects of climate change pose substantial threats to macro-financial stability and, ultimately, to sovereign risk (Chen & Zhao, 2021). It is important to note that macro-financial risks related to climate change pose a threat not only to small island developing states but also to greater and more developed economies. Therefore, global financial safety net organizations (GFSN) should prioritize combating climate change (Farooq & Selim, 2020).

Countries have implemented numerous strategies to combat climate change. A nation's policies for attaining sustainability should be guided by its long-term vision or strategy. Japan announced in 2020 that it would achieve net-zero emissions by 2050, and China stated that it would reach peak carbon emissions by 2030 and carbon neutrality by 2060. CanREA's 2050 Vision, the UAE's National Energy Strategy 2050, Qatar's National Vision 2030, Turkey's renewable energy vision 2023, Korea's Energy Master Plan 2035, Germany's landmark Renewable Energy Act 2021, and Singapore's Green Plan 2030 are few of the other plans that have been developed; they all have clear targets and outline intermediate, operational, and ultimate objectives. As part of these long-term plans, nations are employing deterrent and incentive policies and instruments based on their economic systems, limitations, and capabilities (Poyser & Daugaard, 2023).

The implementation of these policies requires the development of interconnected projects and the procurement of sufficient funding to carry out those projects. In light of this, one of the most pressing and challenging issues that industry professionals have discussed in recent years is how to finance environmentally friendly initiatives (Srivastava et al., 2021). If a country lacks an effective sustainable financing structure, it cannot make progress toward its sustainable development objectives or reduce the hazards associated with climate change.

Sustainable finance refers to firms, governments, and macro-prudential authorities' environmental, social, and governance (ESG) efforts to fund renewable energy and environmentally friendly projects (Abrudan et al., 2021; Rodrigo-González et al., 2021). These projects are important for adjusting the financial structure and speeding up sustainable economic growth (Cunha et al., 2021). Due to their strong positioning in sustainability, responsibility, clean environment and green use of

energy, financing businesses through sustainable proposals has gained a lot of attention. This is because resources are moved from industries that pollute a lot and use a lot of energy to industries that support green investments and green schemes (Karmugilan & Pachayappan, 2019).

Sustainable finance presents a novel opportunity for maximizing financial returns by capitalizing on social advancement. Moreover, sustainable finance represents the intrinsic goal of prosocial decision-makers, in addition to functioning as a means of financial development for prominent sustainability supporters (Keenan et al., 2021). The benefits of utilizing sustainable finance applications extend beyond those that are environmentally beneficial. In addition to these advantages, sustainable finance can reduce the risk of financial loss, reduce expenses, and enhance the efficiency of banking operations (Liyanaage et al., 2021). To accomplish sustainable finance, the current financial system must be rebuilt and modified in accordance with specific sustainable development (Yu et al., 2022). For the purpose of implementing sustainable finance, it is necessary to provide support and enhancement for the sufficient capacity of financial institutions in terms of human resources, institutions, and new financial literacy.

Sustainable finance, which seeks to advance key sustainable development objectives, can result in increased capital inflows from both the public and private sector (Setyowati, 2023). Sustainable finance connects the financial and environmentally friendly industries (Cai & Guo, 2021). It can also guide capital flows, assisting in the optimization of industrial structures. To attain sustainability, green financial products have been developed. These items relate to financial services such as venture investment, risk assessment, and greener project activities that help to preserve the environment, professional energy preservation, and sustainable development (Poyser & Daugaard, 2023). Sustainable finance, according to Robertson (2020), aids in risk management and increases the market credibility of financial organizations.

Thus, the majority of publications on sustainable finance promote inclusive green finance. A few publications, on the other hand, adopt a more holistic and integrated approach, indicating which topics (aspects) of sustainable finance continue to be important to investors. In an effort to increase investor confidence, lending financial institutions have adopted a new strategy. The public's interest in financing sustainable investment, socially responsible investment, and social impact investing is a continuously evolving strategy. In

the meantime, knowledge of sustainable finance behavior is crucial for implementing the concept of sustainable development, which departs from conventional consumption patterns in favor of a more sustainable paradigm (Abrudan et al., 2021). Understanding which topics in the field of sustainable finance are pertinent to investors appears crucial for businesses and institutions engaged in achieving sustainable development objectives. Companies can use this information not only to meet customer needs more effectively, but also to do so in a sustainable manner.

Consequently, this paper aims to analyze public perceptions of Sustainable Finance using one of the most prevalent applications of Natural Language Processing, namely Sentiment Analysis. This paper investigates the benefits and pitfalls of Sustainable Finance and assesses whether the prospective environmental benefits, as revealed by mainstream studies, are generally recognized. Therefore, this work is predicated on the following hypothesis: people's perceptions are consistent with the findings of recent studies, particularly those that emphasize the sustainability-related benefits of Sustainable Finance.

Similarly, various institutions can utilize this knowledge to influence more responsible social patterns, for instance. In addition, to the best of our knowledge, this article is one of the first to address topic modelling techniques to comprehend and extract concealed aspects of sustainable public perception from Twitter data. In addition, the use of big data in studies of public perception is still uncommon, whereas the processing and analysis of big data are extremely valuable because it enables the discovery of new data that is helpful.

The remainder of the paper is structured as follows: Section 2 provides a literature review on Sustainable Finance. Section 3 then discusses the materials and procedures. The outcomes of the analysis are then presented in section 4, the findings are then discussed. Section 5 concludes the study by discussing its implications, limitations, and future directions for research.

LITERATURE REVIEW

It is obvious that sustainable development is necessary to integrate the economy, natural resources, and human well-being, both now and in the future. It is also obvious that the actions of both investors and companies can play a leading role in combating climate change and ensuring the sustainability of the global economy (Yu et al., 2022). This is due to the fact that

participants in the financial market are able to influence the corporate behavior of management and individuals (Miralles-Quirós & Miralles-Quirós, 2021). Furthermore, the role of finance is fundamental to sustainable development due to its focus on profit maximization and changes in shareholders' wealth, as well as its concern with environmental issues, a low-carbon economy, and climate change (Chiu et al., 2022). The word "sustainable finance" was originated by the European Union (EU) and refers to the practice of taking into account environmental, social, and governance (ESG) factors when making investment decisions in the financial sector. This ultimately results in an increase in long-term investments performed on economically beneficial activities and projects (European Commission, 2022).

In recent decades, the concept of sustainable finance has evolved as part of the broader concept of business sustainability. Schoenmaker (2017) divided the typology for sustainable finance into four categories: the value created, the ranking of the three factors, the optimization method, and the time horizon. The development emphasizes the expansion of shareholder value to stakeholder value or the triple bottom line: people, planet, and profit. The final phase focuses on the creation of shared value (Tirole, 2017). To avoid the dichotomy between private and public goods, we use the term common good to refer to what is shared and beneficial for all or the majority of a community's members. Next, the ranking demonstrates a transition from economic objectives to societal and environmental challenges (the common good) at the top of the list. Importantly, the horizon expands from the short term to the long term as the phases progress.

In conventional finance, shareholder value is maximized by seeking the optimal financial return and risk combination. Although shareholder value should also consider the medium to long term, there are incentives for focusing on the immediate, such as quarterly financial reporting and monthly/quarterly investment performance benchmarking. Finance as usual adheres to Friedman's (1970) argument that "the business of business is business." The only social responsibility of business is to use its resources and engage in profit-maximizing activities, so long as it follows the laws of the game. Friedman (1970) argues that it is the responsibility of the government to regulate social and environmental objectives and to establish the norms of the game for sustainability. However, product demand is ultimately influenced by societal requirements. Furthermore, externalities are not

perfectly distinct from production preferences (Hart and Zingales, 2017). There is a strong argument against corporate philanthropy, but there is no argument against integrating sustainability into strategy and finance.

The three phases of the Sustainable Finance typology presented in Table 1 are discussed one by one in the sections that follow:

Type	Value created	Ranking of factor	Optimization	Horizon
Sustainable Finance 1.0	Refined shareholder value	$F \gg S$ and E	Max F subject to S and E	Short-term
Sustainable Finance 2.0	Stakeholder value (triple bottom line)	$I = F + S + E$	Optimize I	Medium-term
Sustainable Finance 3.0	Common good value	S and $E > F$	Optimize S and E subject to F	Long-term

Note: F = financial value; S = social impact; E = environmental impact; I = integrated value. At Sustainable Finance 1.0, the maximization of F is subject to minor S and E constraints.

Source: Schoemaker (2017).

Sustainable Finance 1.0

One of the first principles of sustainable finance is that banks and other financial institutions cannot support or conduct business with "sin" companies. These are organizations with significant negative impacts. enterprises that sell tobacco, anti-personnel mines, cluster bombs, or employ children are examples of socially irresponsible enterprises. Both dumping trash and killing whales have a lengthy history of negative environmental effects. Coal and the broader category of fossil fuels have recently been excluded from the investment policies of some financial institutions due to their high carbon emissions. These blacklists are frequently the result of pressure from non-governmental organizations (NGOs) that disseminate their messages through traditional and social media (Pisani & Russo, 2021).

However, the immediate impacts of exclusion and divestment are limited (Skancke, 2016). In general equilibrium, fewer investors own the excluded businesses, resulting in lower stock prices and a higher cost of capital. According to Heinkel et al., (2001), an empirically calibrated model requires more than 20% of green investors to encourage polluting businesses to reform. Existing empirical evidence suggests that green investors only spend 10% of funds. A rising number of investors' divestment could tip the scales. Another consequence of divestment is that it may stigmatize a sector or company to the point where they lose its social license to function. This could result in less investment in that industry. Exclusion criteria aimed at a sector or

the worst performers within a sector may have an impact by establishing a benchmark for acceptable standards.

Financial institutions and businesses can improve their shareholder value by implementing systems for managing energy and emissions, making sustainable purchases, upgrading IT, buildings, and infrastructure to meet higher environmental standards, and hiring a more diverse workforce (Volz, 2022). The economic benefit is still the driving force behind these actions. While there may be positive outcomes for certain sustainability metrics as a result of incorporating sustainability into business, the primary motivation is to increase short-term profits, market positions, competitiveness, and shareholder value by decreasing expenses and risks and attracting and retaining talented employees. The success of a company is still measured solely economically, and its operations are still geared towards furthering the company's bottom line (Srivastava et al., 2021).

Sustainable Finance 2.0

In Sustainable Finance 2.0, financial institutions overtly incorporate negative social and environmental externalities into their decision-making. Over the medium to long term, these externalities may be priced (e.g., through a carbon tax) and/or negatively impact an institution's reputation. Incorporating externalities reduces the risk of financial investments becoming unprofitable. This risk is proportional to the maturity of the financial asset and is therefore greater for equities than for bonds. (bonds and loans). As the opposite of reputation risk, the internalization of externalities aids

financial institutions and enterprises in restoring confidence.

Sustainable Finance 2.0 can take various forms. Triple bottom line (people, ecology, profit) and integrated profit-loss accounting are examples. In corporate governance, we can speak of an extended stakeholder approach, in which indirect stakeholders such as society and the environment are included in addition to direct stakeholders such as shareholders, suppliers, employees, and customers. In spite of this, [Dyllick and Muff \(2016\)](#) assert that corporations continue to adopt an inside-out perspective by inquiring about how to reduce their social and environmental impact. While this is beneficial, it limits their ability to address social and environmental issues.

Sustainable Finance 3.0

Sustainable Finance 3.0 shifts the focus from risk to chance. Rather than avoiding unsustainable businesses due to risk, financial institutions only engage in sustainable businesses and initiatives. Finance is used to promote sustainable development in this strategy, for example, by funding healthcare, green buildings, wind farms, electric car manufacturers, and land-reuse initiatives. Sustainable Finance 3.0 begins with a positive selection of investment projects based on their potential to produce the social and environmental effects, rather than an exclusion list as in Sustainable Finance 1.0. In this manner, the financial system contributes to the medium- to long-term development agenda.

Moving on to corporate governance, legitimacy theory underpins Sustainable Finance 3.0, which aims to create long-term value for the public benefit. According to legitimacy theory, businesses seek to legitimize their corporate actions in order to gain acceptance from society and thus ensure their continued existence ([Omran and Ramdhony, 2015](#)). This social license to operate represents a plethora of societal standards about how an organization should conduct its operations. Thus, the company operates within the parameters and norms of what society defines as socially responsible behavior, which includes meeting social and environmental standards.

The three stages of sustainable finance result in varying degrees of social-environmental worth realization. Sustainable Finance 1.0 establishes a minimum threshold below which investors are not permitted to invest. Corporates and investment projects that do not reach this minimum level are placed on a list of exclusions. The following stage, Sustainable Finance 2.0, balances privately discounted financial, social, and

environmental value in an overall strategy that optimizes integrated value. Finally, Sustainable Finance 3.0 maximizes the worth of the social-environmental system. Companies and initiatives that provide this optimized social-environmental value are suitable for investment or lending and are included on a list of eligible companies.

PREVIOUS STUDY

[Ferris and Rykaczewski \(1986\)](#), who addressed the challenges and benefits of social investing in portfolio management, are the authors whose work can be traced back to the beginning of the literature on sustainable finance. After the publication of this fundamental article, the subsequent decade of study, which lasted from 1986 through 1995, added to the body of knowledge concerning the most important aspects contributing to the success of socially responsible investing ([Camey, 1994](#); [Diltz, 1995](#)). In the subsequent decade, from 1996 to 2005, new research expanded our understanding of socially responsible investing in terms of its performance in comparison to conventional funds ([Guerard & John, 1997](#)), as well as the necessity to broaden its scope in order to take into account issues of ethics ([Wilson, 1997](#)) and the environment ([Heinkel et al., 2001](#)), such as climate change and renewable energy ([Van Der Laan & Lansbury, 2004](#)).

New fields of study, such as carbon finance ([Vanderheiden, 2015](#)), conscious capitalism ([Wang, 2013](#)), ESG-CSR and company performance integration ([Dorflleitner et al., 2015](#)), and ethical investment ([Dorflleitner et al., 2015](#)), have been pioneered in the later decade (2006–2015), which has seen a rise in the number of studies in these areas ([Belghitar et al., 2014](#)). The most recent half decade (2015–2020) is characterized by research that is a response to the Paris agreement and the launch of the Sustainable Development Goals in 2015. There has been an exponential growth in publications focusing on impact investing ([Agrawal & Hockerts, 2021](#)), innovative financial instruments such as social impact bonds ([Carè et al., 2020](#)), and ESG investing and firm performance during this time period ([Alessandrini & Jondeau, 2020](#)).

The discipline of sustainable finance is a relatively recent invention. Economists and governments around the world have been hesitant to develop a precise definition or reach a consensus on a particular one. Nonetheless, numerous academics, institutions, and governments have devised workable definitions. Rather than defining sustainable finance, certain institutions have coined the phrase "sustainable financial system"

(Migliorelli, 2021), which is an intriguing variation on this theme. However, their instruments and mechanisms remain unchanged. According to the UNEP, a sustainable financial system incorporates the development of values and facilitates the management of financial assets so that actual wealth can be used to meet the long-term needs of an ecologically sustainable and inclusive economy.

The use of green finance, which seeks to advance key sustainable development objectives, enables increased capital inflows from the public and private sectors (Kumar et al., 2022). Sustainable finance functions as a bridge between the financial and environmentally conscious sectors. It can also direct the passage of capital, helping to optimise industrial structures. To attain sustainability, green financial products were created. These items refer to financial services such as venture investment, risk assessment, and ecological project activities that protect the environment, aid in professional energy conservation, and promote sustainable development (Mohanty et al., 2023).

In general, financial institutions concerned with environmental sustainability trade green financial securities on the market (Talan and Sharma 2019). Moreover, establishing a green financial system can facilitate the allocation of social capital for investments in green businesses, heighten corporate social responsibility awareness, and expedite the industry's overall transition to a greener economy (Chen et al. 2022). This evidence was highly convincing during the COVID-19 pandemic. Using green finance and market mechanisms, environmental and natural resource externalities can be addressed. (Narayan et al., 2022; Ghosh et al., 2022). Green and sustainable financing provides benefits and possibilities (Meher et al., 2020). As a result, numerous businesses emphasise sustainability and implement eco-friendly business practises that are beneficial to the environment and promote sustainability (Desalegn and Tangl 2022).

The academic world has a lot to contribute to the current climate of realizing new realities and adapting to the new goals that have been set. When academics incorporate these goals into their work, they help to promote awareness not only in society as a whole but also specifically among people working in the financial sector, who are in a position to contribute to the overall process (Di Marco et al., 2022). Therefore, it is very important for the academic community to provide appropriate financial tools and investment strategies, broader knowledge about the benefits of investing in

financial assets related to the SDGs, and ways of measuring the value created for a country's or a company's economy, among others, if they contribute to the SDGs. This research is important for the academic community to provide broader knowledge about public perceptions of sustainable finance initiatives.

METHODS

The method employed is a qualitative approach with descriptive statistics derived from tweets related to Sustainable Finance by Twitter application users. Twitter is a microblogging website that was founded in 2006 and allows users to "tweet" 140-character messages (increased to 280 in 2017). Tweets appear immediately on the timelines of the user's "followers," as well as to anyone searching the Twitter website. Interestingly, even if they are not a "follower," anyone can see the posted tweets. Twitter was chosen for this study because it is the largest and most popular microblog website. Although Twitter data can be sampled using hashtags, keywords, or target users (Boecking, Hall, & Schneider, 2015), we chose a keyword search for the term "Sustainable Finance" because it has been shown that hashtag sampling can introduce sampling bias by artificially cropping periphery activities (Mostafa, 2018).

This study employs sentiment analysis to determine the perspective of the general public on a given topic. Opinion mining (OM) or sentiment analysis (SA) is a new and active research field that aims to automatically evaluate large quantities of unstructured texts containing opinions, feelings, judgments, and attitudes about products and services, among other targets. In order to categorize tweets, the Python library VADER (Valence Aware Dictionary and Sentiment Reasoner) is utilized. VADER is a lexicon and rule-based tool for analyzing the sentiment of social media posts. However, it is also capable of analyzing text from other domains. By exposing lexicon and rule-based models, VADER makes the inner workings of sentiment analysis engines more accessible (and, as a result, more interpretable) to a human audience that extends beyond the community of computer science students (Hossain et al., 2022).

The data for this study was compiled from tweets posted by Twitter users. Our analysts examine word-based tweets for the purpose of determining sentiment. Snsrape is used to collect the necessary data for analysis via the scraping technique. The Snsrape package, which is a component of the Python programming language, can be used to scrape Tweets from the Twitter

application. This scraping can be accomplished without using the Twitter API.

Vader will calculate an overall score, which will then be used for tweet categorization. The total score is determined by first adding the valence ratings of each word in the lexicon, then making any necessary adjustments in accordance with the guidelines, and finally standardizing the result to fall between -1 (the most extreme negative) and +1 (the most extreme positive). Tweets are deemed positive if their total score is at least 0.05 points higher than the required minimum. Tweets with a total score of -0.05 or less are considered negative. If a tweet's total score falls between -0.05 and 0.05, it is considered neutral (Cjhutto, 2022).

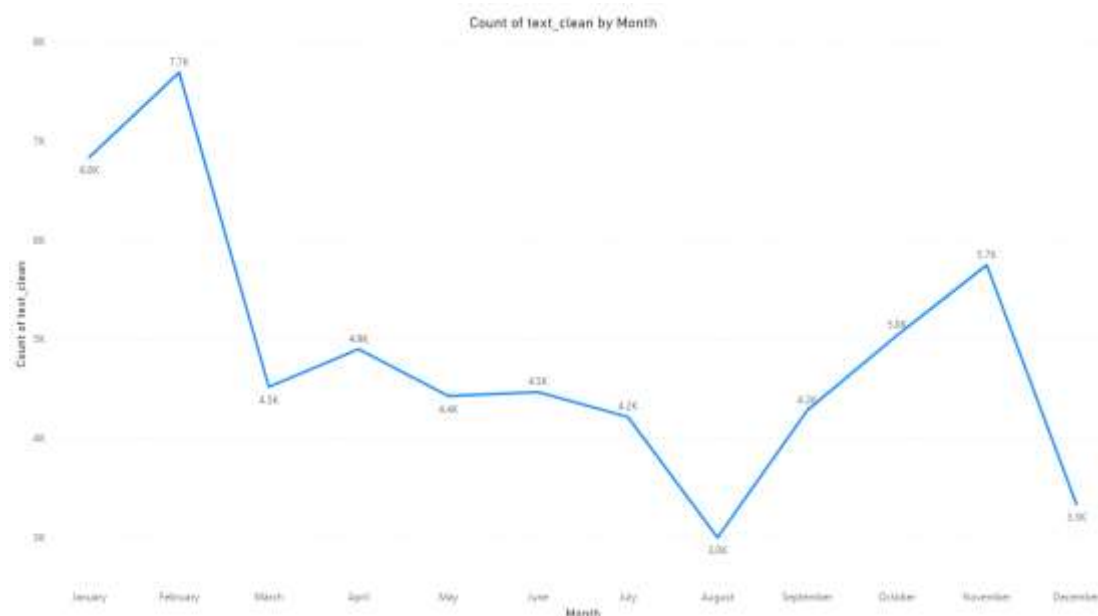
RESULT AND ANALYSIS

Result

Social media has had a significant impact on the everyday lives of individuals (Machova et al., 2021). About 48 percent of the world's population uses social media in some capacity, whether for communication, the sharing of content, the marketing of enterprises, etc. Important to note is that each social networking

platform has its unique particulars. However, the most interesting for commercial enterprises are relationship networks like Twitter, Facebook, and others like them. One of the advantages of using Twitter is active brand monitoring, which entails identifying negative company sentiment and receiving feedback. As a result, this research made use of a tool called the Interactive Tweet Sentiment Visualization in order to figure out how social media users feel about the subject of sustainable finance.

In recent years, the topic of sustainable finance has received a growing amount of the public's attention. The section that follows provides the author's interpretation of the development of tweets pertaining to sustainable finance throughout 2022. Despite the unpredictability of the number of tweets pertinent to this topic, the current patterns indicate an increase in public perception, particularly among tweet users. February 2022 saw 7,7 thousand tweets, making it the period with the highest number of tweets as measured. After conducting additional research, it was determined that the number of tweets became significantly more unpredictable as the year moved to an end.



A word cloud is one of the most frequent forms of research conducted on text-based datasets. This form of analysis displays the most frequently employed terms. It provides a straightforward method for rapidly summarizing the content of tweets and graphically

displays the most frequently used words. Figure 1 depicts a word cloud of the tweets contained in the database on sustainable finance. The figure shows the most frequently used positive and negative terms in tweets.



In addition to this, we were interested to observe which countries were brought up more frequently than others in our data. We identified and ranked the nations that were discussed in the tweets by using the geograpy

package in Python. This library allowed us to go through huge data consisting of more than 10,000 data points. The top five countries that were referenced in the tweets are listed in Table 2.

No	Location	Total
1	London, England	4174
2	Italy	3095
3	Brussels, Belgium	1487
4	Luxembourg	889
5	New York, NY	889

The public's perceptions of sustainable finance were examined using sentiment analysis. Negative and positive word categories are predetermined as a result of sentiment analysis (Hassan et al., 2021). Then, machine

learning evaluates the sample textual data using this predefined list. In the context of this study, here are 10 examples of tweets containing textual data.

No	Text Clean	VADER label clean	Retweet Count	Like Count
1	As a climate responsible developing country, India welcomes partners to create templates of sustainable development in India. This can also help other developing countries who need affordable access to green finance and clean tech. - PM narendramodi	positive	312	1111
2	The blockchain and digital asset industry will play a critical role in building a sustainable future for global finance. Learn more from Ripple's Shae Wang at dscTranslators2021	positive	288	1375
3	An International Arbitration will be setup in GIFT city for timely settlement of disputes under international jurisprudence. Services for global capital for sustainable and climate finance will be facilitated in GIFT cities. AatmanirbharBharatKaBudget	positive	280	454

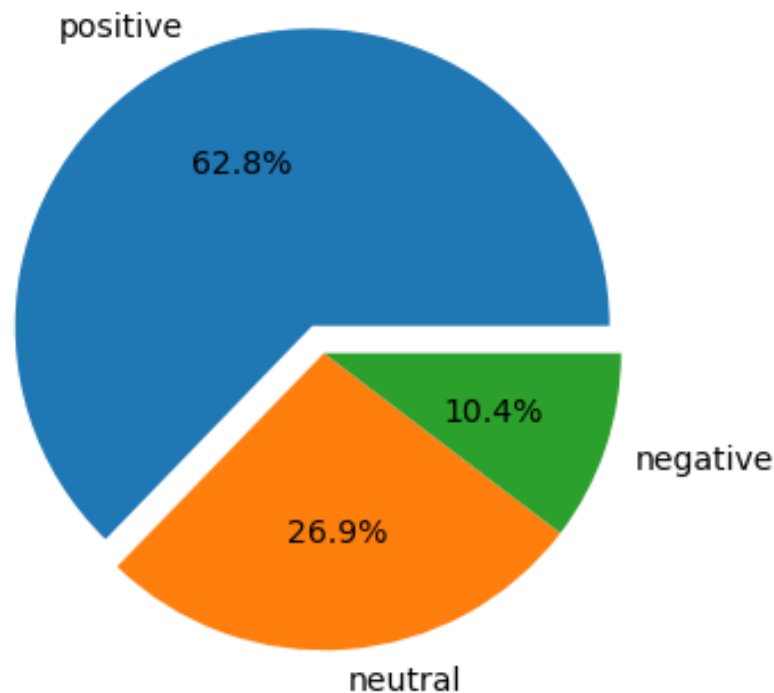
No	Text Clean	VADER label clean	Retweet Count	Like Count
4	Boom Finance About Boomfinance is a DeFi protocol on the Binance Smart Chain that enables users to stake their balance and Earn Reward Boom finance is bridging the gap between Cloud and Blockchain,sustainable and connected world.	positive	259	353
5	Today, the WorldBank Group announced its new ClimateChange Action Plan. MIGA calls on investors & lenders to finance sustainable infrastructure projects & chart out pathways for countries to integrate ClimateAction 🌿 into their development agendas.	neutral	92	281
6	XDC Foundation(XDC_Foundation), in collaboration with LeewayHertz, is set to transform the Global Trade and Finance space with sustainable blockchain products. XinFin_Official	neutral	76	229
7	BREAKING: We're taking action against the EU_Commission for unlawfully labelling bioenergy, bio-based plastics and chemicals used to make plastics as "sustainable" in the EU sustainable finance rules.	neutral	73	171
8	🔹 New listing 🔄 \$FISH(Polycat Finance) will be listed on LBank PolycatFinance Polycat is a value-oriented, economically sustainable and decentralized hybrid yield optimizer running on the Polygon blockchain. 📖 Details: crypto polygon Defi	negative	104	171
9	How can financial institutions join the global fight against climate change? It starts with sustainable finance. That's Africanacity. AfricaExpertise	negative	95	1888
10	Most protocols have problems with counterparty vulnerabilities and/or ignore individual privacy. Portal addresses that through: <ul style="list-style-type: none"> ◇ Fairness: Fair pricing for everyone ◇ Facilitation: Sustainable and economic incentivization ◇ Trust: Self-executed transactions DeFiOnBitcoin	negative	83	181

Sentiment Analysis on Sustainable Finance

This study attempts to analyze the sentiment of tweets posted by Twitter users discussing sustainable finance. This study was conducted using the vader library for the Python programming language. Vader is

used to classifying data into three distinct categories: positive, neutral, and negative. Classification is achieved by evaluating the worth of every phrase. The results of the sentiment analysis are shown in the diagram below.

Sentiment Polarity on Tweets Data



According to the results presented above, the purpose of this study was to determine the level of sentiment present in tweets that were relevant to sustainable finance. The findings indicate that a neutral sentiment was held by as much as 26.9% of users, while positive sentiment was held by 62.8% of users. In addition to that, the findings of the classification show that there was a negative sentiment in the amount of 10.4%.

DISCUSSION

Interest in investment assets with sustainability features continues to grow, this is demonstrated by public perception presentations with high results. The increasing popularity of sustainable financial instruments has the potential to gather the necessary financial resources in the future, which is vital for financing the transition towards a sustainable economy (Hidalgo-oñate et al., 2023). Numerous financial institutions have already been motivated to participate in sustainable finance activities as a result of the appeal of these instruments, which are mostly driven by the concerns that people all over the world have over climate change. In a similar manner, investors today have a greater interest in ESG and socially responsible investment funds, and they are instructing fund managers to screen and seek out funds for impact investing (Archer, 2022; Rodrigo-González et al., 2021).

In order to fuel the flames of innovation and keep up with the ever-changing demands for sustainable financing, a constant stream of new insights is necessary.

On the other hand, the negative perspective maintains that investors have the choice of deciding whether or not to provide financial support to companies that are engaging in practices that are economically unsound with regard to the interests of future generations or, in certain circumstances, the choice to simply choose to boycott companies that are engaging in practices that are harmful with regard to the interests of future generations (Kumar et al., 2022). Both of these options are available to investors. A large number of companies participate in greenwashing practices, which involve using ESG criteria and other methods to create the impression that their products and services are environmentally conscious (Hidalgo-oñate et al., 2023). However, in reality, these products and services are either not at all as environmentally friendly as they claim to be or are significantly less environmentally friendly than they claim to be. Greenwashing is a form of marketing that misleads consumers into thinking that a product or service is more environmentally friendly than it actually is (Quatrini, 2021).

Another aspect of sustainable finance is the willingness of investors to design investment strategies that have the potential to alter the paradigm of how

businesses conduct themselves in the future. Investors, as participants in sustainable finance, have access to a number of potent instruments, one of which is the ability to direct their investment flows toward economic sectors that have the potential to bring about the required change (Chiu, 2022). Performing impact investments, which can generate action areas dedicated to accomplishing positive impacts in the future while also generating a small profit, could be an alternative way for investors to formulate their plans. Thus, investors can view themselves as important constituents and actors in sustainable finance. In this scenario, the profit plays a subordinate role, and investors will place a heightened emphasis on the extent to which the previously outlined impacts materialize (Seabrooke & Stenström, 2022). When these types of investments are effective, the desired effect will be realized as evidence.

According to this viewpoint, the concept of responsible investment can be viewed as the optimal use of resources, which is predicated on a caring and concerned attitude toward the community and the environment (Chow 2011). In recent years, investors have become increasingly aware of the social performance of corporations. Nevertheless, there is a trend in which small investors are attracted to businesses whose strengths are associated with social performance in the community, issues of corporative governance and human rights, and labor relations (Rakotomavo 2011). These issues pertain to the concerns of investors as they confront and manage the complexity of sustainability issues. In the absence of effective institutional governance, it becomes difficult to harmonize the outcomes of multiple dimensions (Hachigian & McGill 2012).

The financial industry must be included in any mechanism devised to deal with environmental, social, and governance (ESG) problems for the long term (Archer, 2022). More specifically, institutional investors that manage assets and obligations with a long-term perspective can contribute to choosing investments that will take chances while avoiding dangers and potential issues if they have a long-term vision. It is essential to emphasize that long-term investments entail significant uncertainties that can affect investor and market behavior. In this context, the long-term influence of sustainable elements on financial market dynamics is complex. The development of the skills and capacities of institutional investors with respect to concepts of sustainability can aid in avoiding unintended consequences and mitigating problems. Therefore, it is

crucial that shareholders understand concepts of sustainability (Nedopil Wang et al., 2022).

A solution that is related to the level of disclosures would be to improve the information that is available to the market in such a way that it would become mandatory to disseminate widely available data on sustainability. In addition to this, it will be required to raise awareness among market participants about the significance of sustainability and its consequences in assessing the performance of businesses (Keenan et al., 2021).

CONCLUSION

In this study, we assessed the utility of Twitter sentiment in guiding investors to consider environmental, social, and economic considerations during the investment targeting or decision-making process. Our study's findings also indicate to institutions the significance of designing sustainable finance initiatives through sustainable projects. In this phase, knowledge of sustainable finance is essential for implementing the concept of sustainable development, which resists conventional consumption patterns in favor of a more sustainable paradigm. Understanding which topics in the field of sustainable finance are relevant to investors appears to be essential for businesses and institutions pursuing sustainable development goals. Companies can use this information not only to better meet customer requirements, but also to do so in an environmentally responsible manner.

In addition to this, the financial markets are always on the lookout for innovative sustainable finance instruments that they can leverage to meet economic demands while also making impactful contributions toward sustainability and sustainable development, particularly in regard to the achievement of the Sustainable Development Goals (SDGs) and the reduction of carbon footprint in accordance with the Paris agreement. This is because the financial markets recognize that they have an opportunity to meet economic demands while also making impactful contributions toward sustainability and sustainable development. In similar circumstances, investors in the modern era are demonstrating a stronger interest in Sustainable and socially responsible investment funds, issuing orders to fund managers requiring them to screen and seek funds for impact investing.

Implementation of sustainable finance in business, financial institutions, financial markets, and regulatory bodies has been and will continue to be relevant. Notably, both developed and developing

countries are increasingly seen to be mandating Sustainable Development Goal attainments through sustainable finance such as carbon, climate, and green financing. The importance of sustainable finance is likely to magnify post the COVID-19 pandemic because the pandemic has inflicted setbacks on the world.

The recommendations in this paper are built on the premise that sustainable finance initiatives are vital to the environment, social, and economic landscapes. To address the complexities of national and subnational development strategies, policies, and budgets; to build partnerships between the public, private, and finance sectors; and to strengthen institutions, a strategic and integrated approach to enhancing sustainable finance initiatives is necessary. This process will be time-consuming, but the implications will never be greater.

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