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From Tweets to Trends: Analyzing FinTech's Focus on Innovation and the Overlooked Sustainable Development Goals

Muhammad Khalid*, Salman Akber, Khaliq Ahmed, Abdul Khaliq, Muhammad Sohaib Naseem, Rimsha Abbas*

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Muhammad Khalid, Salman Akber, Abdul Khaliq, Muhammad Sohaib Naseem, Khaliq Ahmed, and Rimsha Abbas are currently affiliated with Greenwich, IoBM, and Iqra University Karachi, Pakistan.
Email: dr.mkhalid@greenwich.edu.pk
Email: salman.akbar@iobm.edu.pk
Email: khaliq@iqra.edu.pk
Email: khaliq@iobm.edu.pk
Email: sohaib.naseem @iobm.edu.pk
Email: rimsha.abbas@iqra.edu.pk

***Corresponding Author:**

Abstract

Businesses that are based on financial technology (FinTech) are essential for advancing new ideas and technologies in the financial sector, sustainable development, and financial inclusion. This study uses machine learning-based social media analysis (SMA) to evaluate how open innovation and the Sustainable Development Goals (SDGs) are incorporated into public conversation on the social media platforms of FinTech companies. As a result, using empirical data from 32,716 tweets, we monitored the actions of 21 businesses. The findings revealed distinct discourses depending on the operations of FinTech companies. However, it was discovered that the only domains with a sermon pertaining to novelty and, to a slighter grade, the SDGs theme are financial infrastructure, lending, and personal finance. Since FinTech has often ignored the SDGs, knowledge of sustainable goals is still far from being a pertinent concern; yet, innovation and related concepts remain a recurring theme in this field. Additionally, indications of the open innovation paradigm's application and interest in new technologies are shown, along with the promotion of various social media players and events that operate as a showcase for businesses with a Twitter presence.

Keywords: Sustainable Development Goals (SDGs), Sentiment Analysis, Natural Language Processing (NLP)

INTRODUCTION

Knowledge-intensive business services (KIBS) encompass a wide range of services mostly related to business-to-business transactions. KIBS encompasses range of actions over intermediate efforts that affect the effectiveness and quality of businesses' operations, span wide range of facilities, and stay connected to their clients' construction processes (Rath, K. C., Khang, A., et al., 2024). "Science-based firms comprise firms in sectors such as software and specialised business services," claim Lee and Miozzo (Beck, S., Bergenholtz, C., et al., 2022). Members of KIBS include consultancy, audit, transaction advice, taxes, consulting, risk advisory, and technology-oriented businesses that create, accumulate, or disseminate information for their clients' benefit (Saarikko, T., Westergren, U. H., et al., 2020). Furthermore, financial services, including as credit, savings, and investment, provide all-encompassing access to total economic capitals under the auspices of KIBS. As an illustration, consider the so-called FinTech organizations, which are businesses built on new technology and provide digital services (such digital transfers, crowdfunding, and mobile payments). These businesses are mostly start-ups that use new digital tools. "Generally speaking, FinTech companies seek to offer the most innovative financial services that, through digital technologies, can be developed and evolved to bring new benefits to end-users, individual consumers, large companies, or SMEs,"

according to Mosteanu and Faccia (Mosteanu, N. R., & Faccia, A. 2021). FinTech is wide-ranging parasol word which refers to disorderly technology in the economic facilities industry, according to (Muthukannan, P., Tan, B., et al., 2021). Given the significant role that technology plays in the FinTech corporate prototypical, the uncluttered novelty pattern is useful in encouraging interest groups to get involved in some pertinent issues through partaking stations which can result in dynamic communication between workers of these financial services. Promoting themes like sustainable energy, environmental protection, social inclusion, and poverty alleviation could draw in investors and new customers with a high level of social consciousness, even though it can take about work to maintain arcade open novelty by allowing new-fangled corporate models in a business welcoming supervisory atmosphere. In this way, chances for innovation are generated by corporate social responsibility. Furthermore, it has an impact on organisations' dedication and ability to spearhead social content projects that could provide value (AlKhalifa, H. K., & Farello, A. et al., 2021). In line with the Sustainable Development Goals (SDGs) of the United Nations (UN), FinTech companies are a major force behind digital transformation, financial inclusion, and sustainable growth.

Comparing how members of the FinTech industry digitally communicate with one another on innovation may therefore be interesting in order to comprehend their circumstances. In fact, the UN recognised that innovation (Kukulska-Hulme, A., Beirne, E., et a., 2020) is crucial to achieving the SDGs. Furthermore, because the SDGs necessitate a significant amount of money flows, investments, and fund redistribution, the financial sector is essential to their implementation. Social media gives FinTech organisations new ways to communicate with their clients and partners by providing them with information about their products and services. Still, not very FinTech corporation's usage public media. Info technology has a tremendous impact on business and innovation (Lagna, A., & Ravishankar, M. N. et al., 2022), and it has been seen to be crucial to learn as of info that is accessible on their community media stations. But vast array of technological potentials also brings with it new difficulties in comprehending the corporations' discourse on particular subjects. For instance, initiatives utilising social media data are concentrating on campaign performance and new product development to identify customer patterns and preferences. Furthermore, by utilising digital communication and community tools, social media has been steadily expanding as a business strategy in innovation-driven enterprises, taking into account the open innovation framework (Srisathan, W. A., Ketkaew, C., et al., 2023).

The corporate world's culture is always changing, and social issues and FinTech's difficulties are no exception. Social media is an essential way for businesses adopting the open innovation paradigm to communicate and get useful information. The "data deluge" produced by the new technology offers intriguing insights from enormous amounts of data (Nadeem, G., Rehman, Y., et al., 2023). A great setting for creating a agenda which can speed up info recovery to help study and organization of big data on public media is the well-known microblogging site Twitter and other social media platforms. In addition, businesses must increase their commercial value by integrating social topics into their social media conversations, engaging with customers, and promoting their goods and services, among other things. This is mostly because Twitter is a major platform for communication where people are interested in forming communities and fostering an online space where ideas can freely circulate. In fact, public of performers interrelating with FinTech firms is exclusive structure to generate inter-firm brooks of sustainable novelty and commercial behaviour, and Twitter can be seen as a

component of the entrepreneurial innovation ecosystem (Addo, A. et al., 2022). The purpose of this study is to ascertain how FinTech companies' public conversation on social media incorporates the themes of innovation and SDGs. Thus, the following research issue is intended to be addressed by this work: Based on their social media activity, how do Fintech companies integrate innovation and SDGs into their public discourse? Therefore, language related to these pertinent subjects was explored through the discourse of the FinTech ecosystem, which includes unripe novelty and related tools. This study implemented a complete social media analysis (SMA) using a measureable technique built on data analysis on social media platform.

We conducted an exploratory study named "Industry, Innovation, and Infrastructure," with a focus on the ninth SDG, which is related to "Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation." However, we totaled novelty independently after other SDG exploration phrases by order to distinguish the firms' focus. Furthermore, we performed a general scrape of phrases that mention the SDGs, also using this shortening or else important positions like sustainability goals. The structure of this article is as follows. The backdrop of the pertinent subjects taken into consideration for this study is provided in Section 2, and they mostly pertain to social media, financial technologies, novelty (counting built-up invention then related novel tools), then SDGs. The mockups of the ML approaches used on twitter data assembly are described in Segment 3. The results are shown in Section 4. The final portion presents a conversation of the findings, the decision, and future research.

BACKGROUND

The Digital Financial Sector and Social Media

Social media use is crucial for the digital company growth process, whether it is aimed at advertising, info exploration, commercial networking, or mass funding, according to a recent literature analysis by (Olanrewaju, A. S. T., Hossain, M. A., et al., 2020). They pointed out that this study intends to fill two research gaps: (i) to investigate how SMA and collective interaction traits foster creativity; and (ii) to determine how these implicit or explicit interactions vary among various FinTech firm types. Social media is one of the aspects that needs more study, especially in relation to the ideas used in digital finance technologies and business. The usage of various AI methods, such as semantic similarity, basic text mining, sentiment analysis, information extraction, topic modelling, linguistic and text analytics, expression count, ML, and web data rasping, in digital business research has been identified as a key data science method (Ahmed, H., Haque, M. F. U., et al., 2024).

They point out that because of the nature of the enormous amount of data produced by blogs, web pages, Facebook, Instagram, LinkedIn, Twitter, and the intricacy of the algorithms employed, these methods can call for specialised data processing, accessibility, and storage. Managers may utilise social media to advertise their goods and services and make sure they get chosen throughout the screening process. In the last phase of the project wealth procedure, public media indirectly aids in grabbing investors' attention during talks. Furthermore, social media aids in identifying the personalities of people (such as managers, employees, and entrepreneurs) through their tweets, enabling cross-comparison of entrepreneurial traits (Fraccastoro, S., Gabrielsson, M., et al., 2021) to comprehend how their strategies are implemented. "FinTech managers should use social media and increase the involvement of competent and influential

figures in public conversations on social media about FinTech,". Given that businesspersons and additional performers have profited after adopting FinTech rewards and assuming a technology niche to create their own firm, the significance of this communication channel cannot be overlooked. Finance, expenses, allegiance plans, risk organization, asset organization, assurance (InsurTechs), interactions, supervisory technology (RegTech), and other commercial operations are the nine categories into which divide FinTech companies (Zhang-Zhang, Y., Rohlfer, S., et al., 2020). Founded on the classification developed via the various start-up actions, these categories are similar to persons of the Finnovating FinTech chart (Finnovating is Spanish plan consultancy concentrating on sweeping novelty and the FinTech business). In 2019 FinTech Spanish plot variety identified 358 ideas under the subsequent categories: personal economics, "neobanks," exchanges, trade economics, equity economics, investment, expenditures, tax and accounting solutions, financial infrastructure, lending, and financial products distribution. Fresh studies have found that FinTech business actions typically occur in exact physical areas recognized as start-up or FinTech hubs (Lai, K. P., & Samers, M. et al., 2021), notwithstanding the tendency towards structural destruction and the advantages of digitalisation to admittance globalized bases of information and backing.

Social Media and Open Innovation's Contribution to FinTechs' Competitive Advantage

FinTech businesses that want to use social media necessity discourse the exposed revolution approach in order to increase their competences. Organisations might change their company depending on SMA because of the significance of the opportunities and challenges. "Open innovation is growing rapidly as the emergence of social media technologies," according to (Wu, L., Sun, L., et al., 2022). Furthermore, public media is a crucial component of skill timepiece, a novelty organization strategy that is used in various models to give technological companies sustainable advantages. Open innovation has been propelled by social media, which allocates capitals to improve a company's sustainability alignment and incorporates it with the process of developing novel products; in other words, open innovation is required at a strategic level. However, in order for innovation actions to be implemented, operational innovation management tools are required. FinTech companies must take advantage of social media's ability to give them access to new information about consumer requirements and undiscovered technology solutions.

As businesses get access to fresh market information and cutting-edge technology solutions, including social media input could, in fact, improve the success of innovation projects. Additionally, studying the conversation on Twitter could yield useful information. It seems that organisations are eager to develop approach that highlights the involvement of resources innovation, allotment idea and areas, and offering a suitable framework for change once the relative benefits of social media and open innovation in the FinTech space are established (Alaassar, A., Mention, A. L., et al., 2023). FinTech companies and open innovation combine to provide a disruptive business model that has the potential to upend established financial markets. In order to support innovation and business performance, how to leverage novel apparatuses to obtain material by clients, further public media operators, then external actors. The adoption of FinTech entrepreneurship has also been envisaged by big businesses (like Goldman Sachs and JP Morgan Chase), who have organised sides then persons to support novel initiatives over open novelty then information sharing with ideas and additional investors.

Twitter: An Extensive Source for Social Media Research

Users participate in the production, sharing, and distribution of material on social media platforms. Furthermore, businesses, politicians, artists, and regular people have seized this new situation, enabling new kinds of communication, sharing ideas, and presenting goods and services, issues, and even business plans. Social media also includes virtual gaming worlds, virtual collective worlds, blogs, and networking sites for content communities. Up-to-date connected communal then technology schemes are causing significant changes in conventional interacting patterns then how connect by one another, which is necessary to evaluate the function of communal media then its effects over the association among businesses and workers (Zhang, H., Gupta, S., et al., 2020). As a result, people have been more active on sites like YouTube, Facebook, Instagram, LinkedIn, and Twitter in recent years. Among Twitter's many features and attributes are its vast public network and the ability for tweets to use hashtags (#), which link a post to a certain subject and make it possible to identify individuals who share or disagree with the message. Furthermore, a retweet (rt) is a way to reprint messages from other users, making it a potent tool for information exchange.

Users of Twitter can look for content like breaking news, celebrity postings, and user comments (e.g., corporations, people). Therefore, it is a perfect place to find information on broad viewpoints and society interests. It may also be used by academics to examine how consumers and FinTech businesses interact, as well as the networking activities of these organisations. For instance, research methods such as web scraping, network analytics, community projection, and flow maps were used to identify American entrepreneurial networks from Twitter data, emphasising the value of interactions between businesses with comparable socioeconomic and demographic profiles (Kerr, W. R., & Mandorff, M. et al., 2023). Twitter communications, often known as "tweets," are 280 characters long and visible to a user's followers. Tweets, especially favorited tweets and retweets in some contexts, have piqued the interest of researchers as a means of expressing people's feelings. One kind of metric that may be helpful for examining Twitter users and their network activity is the tweet. Based on the vast amounts of data that can be swiftly accessed and analysed, Twitter offers a substantial capacity for this research in order to examine the behaviour of the FinTech ecology and work by big data submissions to get keywords.

METHODOLOGICAL FRAMEWORK

This section provides a thorough introduction to the methods involved in implementing SMA in order to comprehend the public conversation about FinTech on social media. The approach was created to cover pertinent subjects like the UN Sustainable Development Goals and the realm of innovation, which includes open innovation and cutting-edge associated technologies. An overview of the study methodology and framework used in this work is shown in Figure 1, which also offers a technique for gathering information messages from social media. First, 358 FinTech start-ups are identified, and each sample's Twitter activity is analysed using a minimum tweet threshold for further modelling implementation. The group of pamphlets (JSON files) be treated in accordance with the tweet variables is obtained by filtering based on hashtags once the businesses (21 firms) have been chosen within the allotted time. NLP claims, that include data cleaning, data packing, data training, and investigative analysis for clarification, are part of pre-processing stage following document collection (Principe,

V. A., de Souza Vale, R. G., et al., 2022). In order to verify the results of unigrams resulting procedures, such as BOW and subject modelling applications, which are chiefly cast-off for revealing concealed constructions in group of writings, the text examination and cataloging are finally collected in a Twitter cloud. In fact, our study's goal is to extract the conversation that takes place on social media.

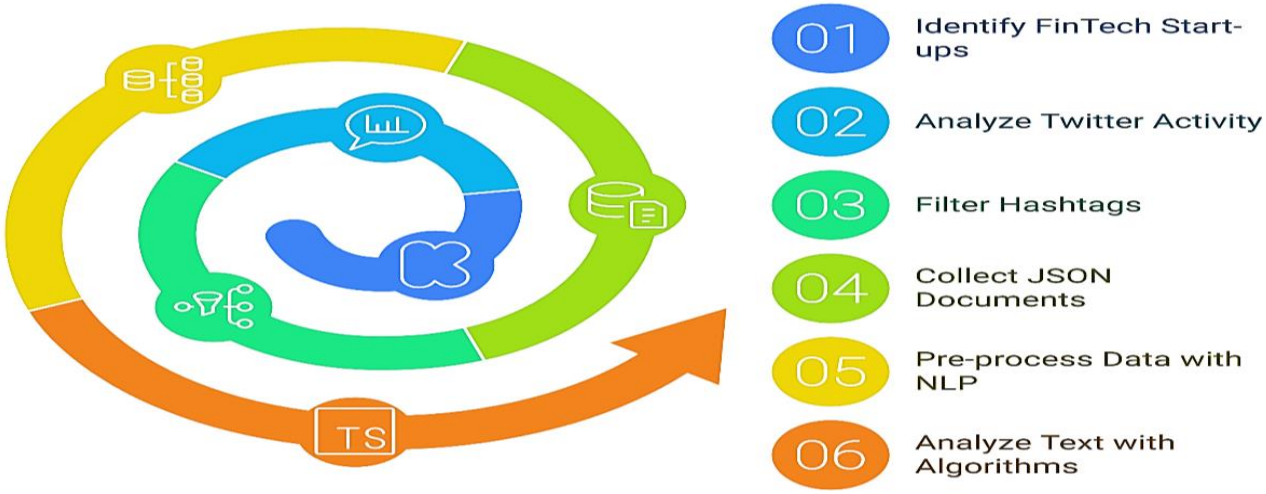

Figure 1.
Methodological Framework

Data Retrieval and Preparation

Figure 1, which offers useful classification accurately identifies the activity group in that the FinTech, we chose these businesses: advancing, distribution of financial products, personal finance, monies, equity economics, speculation, and expenditures. SMA took place from January to August of 2019 and lasted for eight months. We then looked at 358 businesses in total to see which ones had consistently used this type of social networking. The Twitter accounts of FinTech companies with their headquarters mostly in Spain as well as start-ups with international presences were included in this study (Murinde, V., Rizopoulos, E., et al., 2022). This phase's main objective is to choose the ideas based on their financial action, including the most active ones on Twitter Figure 2. Consequently, in order to acquire insights from machine learning implementations, the necessary samples must set realistic criteria and produce significant results, as long as those that contain a sufficient number of tweets are processed appropriately. Next, we set a selection criterion for those who sent out more than 400 tweets throughout the time frame chosen for this study.

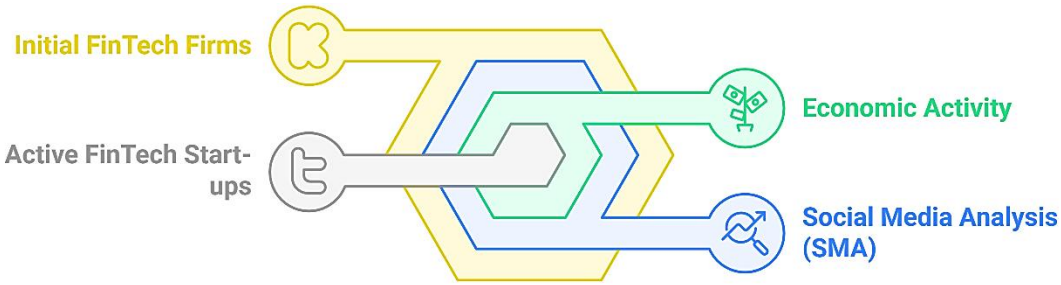

Figure 2.
FinTech Start-up Selection Process

In order to ensure that this sample is sufficiently resilient to support the proper operation of machine learning algorithms later on, a minimum number of tweets per organisation has been established. 32,716 tweets that were obtained provided the data. reached on January 30, 2020. By extracting data from each examined firm's Twitter account, the study aimed to highlight the conversation around the SDGs, innovation, and associated filtering keywords. In the SMA that was conducted. In light of this, we looked at how Twitter and its users generally recognised the discourse around these subjects—that is, 9thGoal—in conjunction by the terms associated with #Innovation. A Twitter database including JSON (JavaScript Object Notation) files from each company's account served as the basis for the data collecting.

Pre-Processing Stage

Tweet dates were selected to establish the research periods in order to do text mining. As seen in Figure 3, the text was the next area of emphasis, from which we gleaned all the data for our research. The NLP technique was used to create the text corpus, which is a gathering of texts that are indicative of specific NLP, and to clean the text from the tweet database (Dogra, V., Verma, S., et al., 2022). The following NLP procedures were used to establish the pre-processing phase: extracting the regular expressions (RE), the common notation used to describe textual sequences; normalisation, wherein same phrases are used consistently while being published in several languages or forms; tokenisation, wherein sentences, white spaces, and specific types of punctuation are used to divide words; filtering, which includes deleting odd characters, hashtags, Twitter waffle; additional pre-processing, that includes subordinate errands like deleting characters or words that are used repeatedly, numbers, and blank spaces; and, lastly, fixing any grammar mistakes in support.

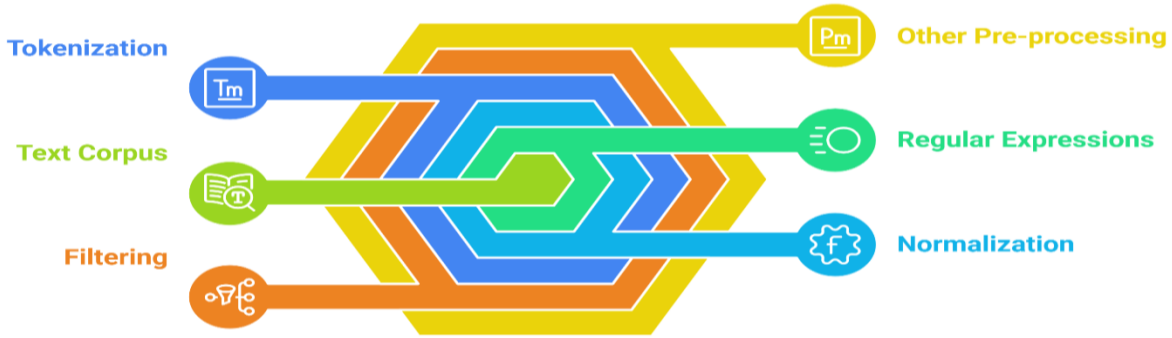

Figure 3.
NLP Pre-processing Steps for Text Mining

Text Analysis and Classification

Text classification, often referred to as categorisation, establishes a text's class and integrates text sources according to subject. In dialectology and prospect, an N-gram is a continuous of N words of text (Ahmed, H., Haque, M. F. U., et al., 2024). Sentences are made up of words. Here, we outline the primary activities carried out in our quantitative method for data feature extraction. For term frequencies, this method began with unigrams, which are representations of a single word. The IR technique begins with text analysis, which is best illustrated succinctly with text analysis tools. Designed is carried out by calculating a TDM by the script database or the text corpus. Using punctuation or spaces, the document's sentences are divided into a group of words.

Theme Modeling

Topic modelling is a ML approach learns the topic organisation by large text deprived of human management by assuming that a document is a collection of subjects. It has been crucial to many text mining jobs since its initial publication, including those in digital humanities, bioinformatics, and social and political science. Finding nonconcrete in a sizable gathering of leaflets, in this study's instance, a database of tweets—is accomplished using statistical modelling. In order to find important unknown information in a given text corpus, topic modelling is frequently employed as a combination of text withdrawal. An unproven ML method for finding buried matter in huge document sets is the latent Dirichlet allocation (LDA) algorithm. Using a BoW methodology, LDA treats every document as a vector of word counts. A probability distribution over a few subjects is used to represent each document, and a probability distribution over a number of words is used to represent each topic. Using an enhanced generalisation, LDA, a Bayesian variant of probabilistic latent semantic analysis, employs Dirichlet priors for document or word subjects (Ihou, K. E., Bouguila, N., et al., 2021).

RESULTS

By applying the suggested practice to Twitter file, we were able to associate and gather visions on the discourse of companies, revealing opinions about how they interact with their clients and the topics that were highlighted according to their activity type.

Discourse Grouped & Examination by Activities & Firms

The following are findings from homily analysis by company: The primary subjects for Kantox were currencies, Barcelona as a place, work, teamwork, start-ups, and a reference to Brexit. Regarding Onyze, they focused the conversation on digital, startups, banks, blockchain, cryptocurrencies, and the financial industry. Investment, initiatives, platforms and entrepreneurs, possibilities, and crowdfunding were among the themes discussed by Fellow Funders. Ideas, asset circles, undertaking wealth, possibilities, and crowd backing were among the fundamental subjects for The Crowd Angel. The conversation around Ariadnext focused on digital identification, French tech, innovation, CEOs, and places like Paris Cyber Week and Rennes. The Eurobits corporation mentioned Spain, open banking, and innovation on Twitter. It included people like Arturo McDowell and businesses like IBM.

Fintonic cited a name, Lupina Iturriaga, and discussed applications and costs. Along with "WealthTech" and "InsurTech," Livetopic also discussed savings, money, and a person named Antonio Casal. Sonect's primary subjects were innovation, finance, Swiss, and start-ups. Knowledge, blockchain, electronic accounts, firms, seminars, and individuals like Brais Mendez were all topics covered in Docuten's tweets. The topics of discussion on the Quaderno App included e-commerce, Amazon, business, and sales tax. Based on the text classification, three categories of FinTech companies were selected based on their operations and the percentages of phrases that appeared. We chose three of these groups to serve as the study's boundaries because they had a high prevalence of innovation and SDG-related subjects. All of the terms associated with keywords, including inventive, open innovation, unique, new, and disruptive, are included in the "Innovation" column. All phrases pertaining to objectives reference to the SDGs in over-all are included in "SDGs" column. The outcomes of BoW application remained broken down by

activity, beginning where the phrases mostly alluded to digital, "RegTech" (i.e., regulatory technology), innovation, Finnovating Hub, and CEO (i.e., the acronym for Chief Executive Officer). Three terms—campaign, finance, and crowdfunding—were highlighted after the loan group, highlighting the significance of the activities in this area. The Spanish football team Rayo, also known as Rayo Vallecano, e-commerce, and documentaries were also emphasized.

DISCUSSION

Some ideas are put out to direct future studies companies and community conversation on social media, based on the debate that follows:

Proposition 1. A useful framework for comprehending Fintech's public conversation on open innovation and SDGs is social media. With an emphasis on Twitter, the current study offers a better understanding of how FinTech companies interact with online social media. According to the analysis, this platform might aid in the synthesis, tracing, and comprehension of pertinent conversation issues. As demonstrated in other research, interactions show the rising threat of businesses adopting innovation-driven strategies and taking use of dynamic utilities within the FinTech ecosystem. The present research gaps concerning social media, open innovation, and digital business that have been noted by academics are also covered in this work (Sosa, I., & Montes, Ó. Et al., 2022).

Proposition 2. Twitter is an appropriate medium for calibrating algorithms required for machine learning analysis of information extraction in FinTech. The BoW model's activity-based grouping results in the following synthesis of each group's focus: More terms pertaining to innovation and technology are used by the financial infrastructure group. The perspective offered by topic modelling, which is described in the paragraph that follows, differs somewhat from this one. Campaigns with Spanish football teams to encourage crowdsourcing finance are the loan group's main emphasis. Words pertaining to their business strategy, including the effective use of applications for personal savings, are also included in the personal finance category. Thus, as these subjects suggest, the present problem is to figure out how to take use We were able to determine which conversation was most pertinent to each FinTech activity by using topic modelling.

Proposition 3. Twitter's FinTech ecosystem serves as an example of how open innovation and tech business models are used. Given the disruptive nature of the monetary technology manufacturing, the mentions of actors and skill types in several tweets suggest that the examined FinTech companies might be open to collaboration (implying the implementation of open innovation) with the visualisation of innovative business models, provided that social media feedback is continuous and subsequently followed up on. Reviews or meetings with bosses and CEOs of participating companies should be used to verify the information's limits about the adoption of new open innovation initiatives. This last aspect is outside the purview of this study.

CONCLUSIONS AND FUTURE WORK

It may be inferred from their social media conversations that companies aren't entirely engaged in raising SDGs. Through social media, novelty is openly marketed theme which might be included in an exposed novelty strategy, giving existing and future clients more opportunities to engage and share fresh concepts and opinions. Including SDGs in the conversation about innovation would be one way to improve these exchanges.

However, a lot of these companies overlook the value of social media, especially Twitter, in supporting start-ups, sustainable enterprises, and high-tech innovative services. The study's findings highlight several forms of external actor collaboration and subjects pertaining to the adoption of open innovation in certain businesses. Promoting sustainable aims and encouraging collaboration under the auspices of the open innovation approach might also be a smart way to draw in new kinds of customers and investors. Based on the most recent research, this study helps to understand the discourse around innovation and the SDGs' role in FinTech companies' operations. It also demonstrates different methods to discourse in public information streams. Twitter's low usage suggests that these potent media platforms may be utilised more frequently, for example, in campaigns promoting renewable energy, financial inclusion, and innovative business models. But it seems that this channel isn't being used to its full potential. The geographical approach is another drawback; comparing the findings across many nations or areas would be one way to enhance this study.

However, given that many of the enterprises under analysis are also present in other nations, our findings can be generalised to other locations. New strategies should take into account the incorporation of other pertinent subjects including media impact, social responsibility, company reputation, and bot activity. Longitudinal studies could be used as another topic to evaluate how social media affects networking, performance, communication, and engagement in entrepreneurial activities. This is important. Furthermore, other analytical methods like deep learning, natural language comprehension, and other trend topic linkages might be used in future research to support our SMA thesis. In conclusion, it would be interesting to look at the ways that large and SME businesses have different entrepreneurial discourses about innovation and SDGs. Examining the ways in which social media facilitates the entrepreneurial process might also be beneficial.

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Consent to Participate: Yes
Consent for publication and Ethical approval: Because this study does not include human or animal data, ethical approval is not required for publication. All authors have given their consent.

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