Marketing strategies for fintech companies: text data analysis of social media posts

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Abstract

Purpose – This study aimed to present the methodology of the text data analysis to establish marketing strategies for fintech companies in a practical way. Specifically, the methodology was presented to convert customers' review data, which consisted of the text data (unstructured data), to the numerical data (structured data) by using a text mining algorithm "Global Vectors for Word Representation," abbreviated as "GloVe"; additionally, the authors presented the methodology to deploy the numerical data for marketing strategies with eliminate-reduce-raise-create (ERRC) value factor analytics.

Design/methodology/approach – First, the authors defined the background, features and contents of fintech services based on a review of related literature review. Additionally, they examined business strategies, the importance of social media for fintech services and fintech technology trends based on the literature review. Next, they analyzed the similarity between fintech-related keywords, which represent the trends in fintech services, and the text data related to fintech corporations and their services posted on Facebook and Twitter, which are two of the most popular social media globally, during the period 2017–2019. The similarity was then quantified and categorized in terms of the representative global fintech companies and the status of each fintech service sector. Furthermore, the similarity was visualized, and value elements were rebuilt using ERRC strategy analytics.

Findings – This study is meaningful in that it quantifies the degree of similarity between customers' responses, experiences and expectations regarding the rapidly growing global fintech firms' services and trends in fintech services.

Originality/value – This study suggests a practical way to apply in business by providing a method for transforming unstructured text data into structured numerical data it is measurable. It is expected that this study can be used as the basis for exploring sustainable development strategies for the fintech industry.

Keywords ERRC, Fintech, GloVe, Social media, Text data analytics

Paper type Research paper

1. Introduction

Due to the 2008 global financial crisis, people lost confidence in the financial services provided by traditional financial institutions such as commercial banks, investment banks, stock firms and insurance companies. Subsequently, the demand for transparency and security led to the development of new financial services that differed from existing financial services. In addition to this social situation, the Fourth Industrial Revolution era, driven by

the development of information and communication technology (ICT), arrived. This led to the growth of fintech, which is a combination of the terms "finance" and "technology," and the development of various fintech services based on mobile and Internet environments such as digital payments, electronic funds transfer in real time, the purchase of financial products and asset management services. These developments have significantly changed existing financial services (Alt *et al.*, 2018). Consequently, companies that provide fintech services, such as PayPal, Venmo, Fiserv, TransferWise and Grab, have begun expanding their shares in financial markets. Unlike traditional financial companies, fintech companies are transforming traditional financial markets by providing simpler and safer financial services on platforms that are based on Internet and mobile environments.

Furthermore, the use of mobile devices has become ubiquitous owing to the continuous technological developments in the field of ICT, and people's activities and living spaces have moved from offline to online environments (Flavian *et al.*, 2020). Based on this social background, it is evident that social media platforms are positioning themselves as a new marketing channel to replace traditional channels. Therefore, examining people's experiences, reactions, expectations and evaluations regarding fintech services by analyzing social media data is essential for establishing marketing strategies for fintech companies (Dootson *et al.*, 2016). It raised some important issues. How can fintech companies use social media data? How can it be used practically for business? Related to these questions, we wanted to suggest the methodology to utilize the text data on social media for business in this research by analyzing the text data about fintech services on social media, representing customers' feedback and assessments and then transforming the text data to numerical data that can be measured to use in business. For this purpose, we collected and analyzed text data derived from Facebook and Twitter posts to present the method to establish growth strategies for fintech companies.

For this study, we selected nine global fintech companies and collected text data related to the marketing activities and customer evaluations, experiences and expectations regarding the fintech services provided by each company. Next, the similarity between the keyword list data for each fintech-related topic, obtained by analyzing fintech patent data using the topic modeling method, and the text data collected from Facebook and Twitter was analyzed by using a text mining algorithm named "Global Vectors for Word Representation," abbreviated as "GloVe." Analyzing the similarity between these two data sets has considerable practical significance due to the characteristics of the fintech industry, wherein technology is directly connected to the services provided.

The high similarity score between the social media data and the keyword data for each technology topic indicates that marketing campaigns are relatively active for a fintech service, and the number of customers' feedback on these activities is high. This also means that many customers' mention the fintech service and are highly interested in it. Conversely, the low similarity score between the social media data and the keyword data for each technology topic indicates that marketing campaigns are relatively active for a fintech service, and the number of customers' feedback on these activities is low. Moreover, this means that customers do not mention the service often, and their interest in the service is also low (Li *et al.*, 2021).

After computing the similarity between the social media text data and the keyword list data for each fintech service topic and analyzing the fintech service status of each fintech company, the eliminate-reduce-raise-create (ERRC) value elements of each fintech company can be analyzed based on the computed data. The ERRC grid, proposed by Kim and Mauborgne (2005), is a strategic analytical tool used to obtain high value at low costs (Utami *et al.*, 2021). The terms "eliminate," "reduce," "raise" and "create" were combined to create the acronym "ERRC." The ERRC tool suggests that new value can be found through a strategic analysis process of "what should be eliminated?," "what should be reduced?," "what should be raised?" and "what should be created?" (Leavy, 2019).

Most of the previous research on fintech is related to mobile payment in the view of technology and function. The previous studies on fintech from a management perspective have focused on analyzing the firm's business model strategy based on case analysis or survey from users. However, this approach of existing research has limitations in suggesting a way to accurately grasp the perception of actual fintech users' preference or motivation for service usage and establish an efficient marketing strategy (Senyo and Osabutey, 2020). In order to overcome the limitations of previous studies, this study aims to derive strategies of global major fintech companies by analyzing the posts of fintech users in social media channels using text mining technique. This study also proposes a new research methodological idea by applying business analytics for unstructured data, called text mining, to the ERRC framework, which was used as a qualitative marketing strategy analysis technique in previous studies. By this approach, we present a way on how to connect user motivations based on their actual voices of other innovative technologies with firm's marketing strategies.

In this study, we analyze the similarity between fintech-related keywords, which represent the trends in fintech services, and the text data related to fintech corporations and their services posted on Facebook and Twitter, which are two of the most popular social media globally, during the period 2017–2019. The similarity is then quantified and categorized in terms of the representative global fintech companies and the status of each fintech service sector. Furthermore, the similarity is visualized, and value elements are rebuilt using ERRC strategy analytics. This study is meaningful in that it quantifies the degree of similarity between customers' responses, experiences and expectations regarding the rapidly growing global fintech firms' services and trends in fintech services. This study is also significant in that it suggests a practical way to apply in business by providing a method for transforming unstructured text data into structured numerical data – it is measurable. It is expected that this study can be used as the basis for exploring sustainable development strategies for the fintech industry.

The remainder of this study is organized as follows. Section 2 discusses the research background and the status of fintech services, along with strategic research cases based on a review of prior literature such as research papers and publications. Next, in Section 3, the similarity between the social media data related to fintech and the keyword data for each fintech service topic was analyzed. Subsequently, a marketing strategy based on text data on social media is then developed by analyzing ERRC value elements and each fintech company's status based on the similarity. Consequently, Section 4 presents the conclusion, limitations and directions for future research.

2. Literature review

"Fintech" is a compound term comprising the terms "finance" and "technology," and refers to a new type of financial industry that combines ICT with financial services, which were traditionally provided through financial companies and institutions such as banks (Puschmann, 2017). Park *et al.* (2016) discovered the concept of fintech based on a literature review as follows: the term "fintech" was defined by the UK Government Office for Science as a "financial service innovation with technology as a core element." The technologies that are referred to in fintech include mobile devices, social networks, cloud computing, big data, the Internet of Things and virtual reality. Additionally, Ernst and Young, one of the world's leading accounting companies, classified fintech into traditional and emerging fintech companies.

Traditional fintech companies, such as electronic financial business operators or subsidiary electronic financial business operators, are included within the scope of traditional financial services and play a role in enhancing the efficiency of traditional financial services. These traditional fintech companies are included in the business domain of financial companies and play the role of supporting traditional financial services in terms of

automation and efficiency via ICT. In other words, electronic financial business operators or subsidiary electronic financial business operators are responsible for improving the efficiency and convenience of traditional financial services, while traditional financial companies are still positioned at the core of the finance business (Alt *et al.*, 2018; Haddad and Hornuf, 2019).

Unlike traditional fintech companies, emerging fintech companies do not support traditional financial services or act in a secondary position to financial services provided by financial companies, such as banks, insurance companies and credit card companies, but rather provide a new type of financial service that is completely different from the structure of traditional financial services with a completely different business model and technology (Alt *et al.*, 2018; Lee and Shin, 2018). Emerging fintech companies have different service distribution channels, up-to-date technologies and outstanding marketing strategies, and are based on innovative business models that pursue differentiation as well as provide solutions that allow customers to use financial services more conveniently and easily than traditional financial services (Gai *et al.*, 2018). For this reason, emerging fintech companies are described as disruptors that can destroy the business models and service supply channels established by traditional financial companies. Among the global fintech companies selected for this study, four companies, Fiserv, First Data, Stripe and SumUp, are classified as traditional fintech companies, while the remaining five companies, namely Affirm, PayPal, Venmo, Grab and TransferWise, are classified as emerging fintech companies.

Fintech services can be broadly classified into six types (Seok and Kim, 2019). The first type is payment and remittance services. This type of service involves facilitating payments for product purchases and the transfer of domestic and foreign funds via mobile devices and e-mail. Due to the proliferation of mobile devices like smartphones, the expansion of biometric verification technologies like fingerprint and facial recognition and the active market participation of related companies, various types of mobile payment services are used by people in their everyday lives (Flavian *et al.*, 2020). Beyond payment and remittance services, P2P loans function as an independent platform in customers' daily lives. The third type of fintech service is asset management services. This involves managing assets by analyzing the propensity of investors based on information collected by asking customers various questions and proposing a portfolio of products that best suit the propensity of customers by using big data technologies for risk and investment preference products (Gomber *et al.*, 2017). The fourth type of fintech service is the data collection and analysis service. It involves analyzing customers' activity data on social media platforms to develop customized products and build a credit rating model to provide risk management services for customers' financial assets (Gai *et al.*, 2018). The fifth type of fintech service is a platform service. This involves providing user environments for customers to access various financial services based on their strengths such as user convenience and security. Platform services can be provided through apps designed for using financial services or that can connect angel investors and startups through social networks. A new type of fintech service based on various technologies and platforms is rapidly emerging. The sixth type of fintech service is an Internet-only bank. It provides financial transaction services only online and not offline.

Consequently, Internet-only banks can provide low-cost financial services by reducing the fixed costs associated with brick-and-mortar branch offices such as operating costs and labor costs (Pinochet *et al.*, 2019). Moreover, Internet-only banks can provide support for various financial services that traditional banks could not provide, and have the significant advantage that it facilitates the use of financial services through simpler and more convenient procedures than traditional banks (Gai *et al.*, 2018). Examples of six types of fintech services are given below.

Beyond six types of fintech services, new developments have been progressing recently by using advanced technology such as machine learning and deep learning. Also, as social

media has become a new communication channel, fintech companies accumulate big data that value market research. With this situation, today, customer-friendly services are being released to the fintech market. For example, PayPal launched BNPL (Buy Now Pay Later) and cryptocurrency transaction services to keep up with market trends. The "neo banks," such as Axos, Revolut and N26, are challenging legacy banks by offering customer-friendly interfaces and employing more efficient IT processes (Boot *et al.*, 2021). Especially, Revolut, one of the outstanding fintech companies in the UK, provides stock and gold trading services with inexpensive fees.

Fintech companies are not traditional financial companies in the financial service industry, but rather financial IT companies, such as innovative ICT companies, which dominate the finance industry. Therefore, the approach of fintech companies in terms of utilizing big data accumulated from the provision of services differs from the approach adopted by traditional financial companies. Moreover, the type of accumulated big data is also differentiated from that of existing financial companies (Lee and Shin, 2018). Furthermore, fintech companies utilize social media as a channel to communicate with customers and reach not only current customers but also potential customers.

Additionally, they accumulate big data derived from financial transactions such as money transfers, loans, payment settlements and mortgage loans. For fintech companies, the voices and reactions of their customers, accumulated in real time through social media activities, are regarded as valuable assets for developing marketing strategies. With the recent media usage trend of moving from traditional media such as TV, to social media platforms such as YouTube, TikTok and Facebook, social media data have become increasingly important to fintech firms. Choi and Kim (2013) researched the public relations (PR) activities of companies using social networking services (SNS). Facebook was found to be the most common social media channel operated by companies as their official corporate PR accounts, followed by Twitter and blogs. The main characteristics of Facebook are content diversity and customer relationships, while the relevant characteristics of Twitter are dissemination, openness and accessibility. The main characteristics of blogs are content diversity, accessibility and openness. Due to these characteristics, all three social media platforms are widely used in external communication and marketing PR activities. Among the characteristics of social media, content diversity was found to have a significant effect on corporate external communication, internal communication and marketing activities, and dissemination was the factor that influenced crisis management PR activities (Dootson *et al.*, 2016).

The importance of understanding the motivation for users to use innovative technologies such as fintech is increasing (Senyo and Osabutey, 2020). According to previous studies, the motivation for an individual to use service based on specific technology was classified into external and internal motivation. The motivation for a certain action is divided into two types, extrinsic motivation and intrinsic motivation. Usefulness as an external motive and pleasure as an internal motive were presented, and the theory of motivation was based on these arguments. The usefulness of fintech motivation means the degree to which it is believed that using a specific technology or system will improve individual performance, and the pleasure of fintech motivation can be interpreted as perceiving fun and interest as using a specific technology or system (Thakor, 2020).

With the advent of smartphones in the late 2000s, consumption patterns shifted to mobile-oriented, and consumer-tailored services based on big data analysis grew rapidly in accordance with this mobile-oriented consumption trend. In addition, the non-face-to-face environment due to the recent COVID-19 pandemic has accelerated the development of fintech. Fintech is an area where technological innovation has emerged and developed. However, unlike "traditional fintech" aimed at efficiently improving existing financial services, with large IT companies and financial companies at the center, "emerging fintech" has now been centered on bypassing existing financial institutions or providing new financial

services as key elements of technology. These include simple payments, Internet banks and foreign currency remittance services that can be easily seen in everyday life. And at the heart of this emerging fintech focus on customer financing convenience is the "customer experience." Social media is an important tool for understating customer experience. Social media is the best way to build trust with customers. Firms can communicate with users in person (quickly and kindly), and do best to communicate with one person. As competition in the fintech industry intensifies, the importance of social media channels that understand customer experiences and identify consumers' internal and external motives is increasing.

In this way, the practical use of social media and its data could significantly impact fintech companies in terms of improving their service reputations via customer communication and undertaking marketing activities for sustainable service development, maintenance and expansion of market shares, and risk management. Social media has been positioned as a key element of corporate activities (Micu et al., 2017). Thus, in this study, we investigate how fintech companies utilize social media in their business activities using the examples of the global fintech companies analyzed in this study. fintech companies operate Facebook and Twitter accounts and continuously post information regarding business management aspects such as corporate vision, customer promotions and corporate mergers, as well as the services they provide. The use of social media by fintech firms emphasizes transparency in their activities and communication with customers, and active promotion of marketing activities by responding to the posts and comments posted by customers.

Previous studies have shown that the collection and analysis of various big data, such as financial transaction data, is an important factor in establishing a business model and marketing strategy for fintech services. In particular, the feedback of customers that is continuously supplied via social media and data regarding customer experiences can be effectively used to communicate with customers in the future and establish a continuous marketing strategy. Anh et al. (2016) analyzed the trends of fintech services and mobile payment services in Korea using a text mining method. Specifically, topics were identified using a method of mining text data on social media. They performed their analysis by focusing on the new relationships between topics and keywords. In other words, they utilized keyword network analysis to improve their intuitive understanding of the relationship between topics and keywords. Using topic extraction and keyword network analysis, Anh et al. (2016) analyzed unstructured data on social media by period and found the relationships and reactions between keywords belonging to the main topics.

Therefore, by analyzing and visualizing the hidden relationships between the keywords for each topic, they obtained differentiated value by identifying a differentiated strategy for a mobile payment service. Moreover, by applying sentiment analysis, the expectations and feedback of online consumers were quantified, and based on this quantification, Kakao Pay and Samsung Pay, which are mobile payment services in Korea, were compared. In other words, through emotional analysis, the customer opinions generated by service attributes were quantified. In addition, Geum et al. (2021) used network analysis and topic modeling to analyze the trends of fintech. They created a new fintech terminology list, and the co-classification analysis and network analysis were conducted to identify the technological trends of patent classification. Topic modeling was conducted to identify the trends of fintech and to analyze the contents of fintech.

Sahai et al. (2018) researched the usage of the Indian fintech service, TruePay, and found that social media played a significant role in TruePay's success. In particular, Facebook's TruePay page showed the largest traffic compared to other marketing channels. In other words, the research results showed that social media became the basis for TruePay's success in the Indian market. Breidbach and Ranjan (2017) analyzed the data posted on Twitter, a popular social media platform, to determine how an online P2P loan service platform can create value among other fintech services. According to their analysis of Twitter data related

to P2P loan services, an online P2P loan service platform must have the following features: First, it should promote value creation through the active interaction between customers and companies, education and information provision. Second, an online P2P loan service platform should provide the same customer value regardless of the customers' economic status. Third, an online P2P loan service platform should ensure that its business naturally operates within the range of common sense and the regulations regarding loan services during the process of value creation (Gomber *et al.*, 2018). Based on these examples of previous studies, we found that social media is an important marketing channel for communicating with customers that cannot be ignored in fintech services. Therefore, the impact of social media platforms, such as Facebook and Twitter, on fintech services has been studied not only in Korea but also in India and Australia. Thus, the current study also examined the current status and strategies of fintech firms by analyzing their text data posted on Facebook and Twitter.

3. Method
3.1 Analytical procedure
We collected and analyzed fintech-related data posted on Facebook and Twitter among other social media by using a data crawling software named ScrapeStorm, an AI-powered visual web scraping tool. The collected text data were composed of just one sentence or a plurality of sentences. Figure 1 presents the analytical procedure or research flow of the study.

Among the fintech services, categorized into the above six types, nine companies that represent payment and remittance services, data collection and analysis services and Internet-only banking services were selected for this study. Moreover, the US, which is recognized as the cradle of fintech services, the UK, which has government-led fintech companies, and Southeast Asia, which has great growth potential for fintech services, were also selected for this study. The specific background of the above selection is as follows. The first research subject "Affirm" analyzes customers' credit ratings and provides a service wherein goods can be purchased in installments without a credit card, which is a representative case of a data collection and analysis service among the six types of fintech services.

The second research subject "First Data" is the world's leading electronic payment service company, which is classified as a payment service among the various fintech service types. The third subject "Fiserv," as the world's largest fintech company that provides bank-related financial service solutions, was classified as an Internet-only banking service among the different fintech service types. The fourth research subject "PayPal" was classified as a

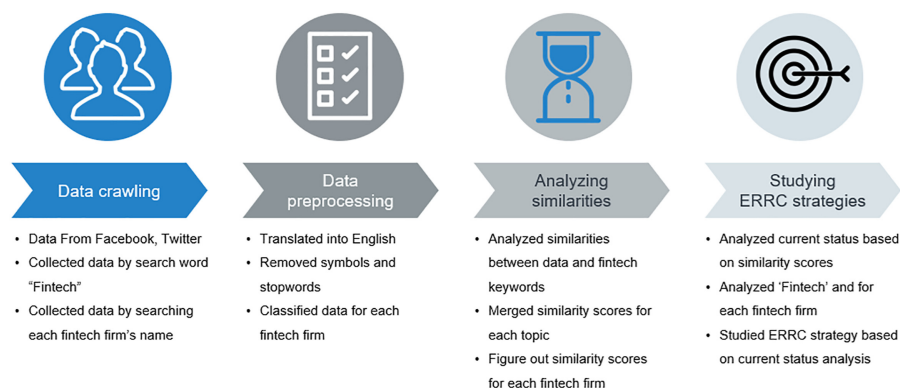| Data crawling	Data preprocessing	Analyzing similarities	Studying ERRC strategies
• Data From Facebook, Twitter • Collected data by search word "Fintech" • Collected data by searching each fintech firm's name	• Translated into English • Removed symbols and stopwords • Classified data for each fintech firm	• Analyzed similarities between data and fintech keywords • Merged similarity scores for each topic • Figure out similarity scores for each fintech firm	• Analyzed current status based on similarity scores • Analyzed 'Fintech' and for each fintech firm • Studied ERRC strategy based on current status analysis

Figure 1.
Analytical procedure

leading fintech company in the US that had a great influence on the business models of China's Alipay and WeChat Pay, and other global fintech companies. The fifth subject, Stripe, provides fraud detection services based on big data analysis and provides a fintech service development platform. Thus, it was classified as a data collection service, an analysis service and a platform service among the various fintech service types. The sixth research subject "SumUp" was classified as a representative fintech company related to payment services in the UK that actively fosters the fintech industry at the national level. The seventh subject "TransferWise" was classified as a foreign money transfer service among the various fintech service types. The eighth research subject "Venmo" was classified as a domestic money transfer service among the various fintech service types. The ninth research subject "Grab" was classified as a company representing Southeast Asia with a high potential market value in the fintech industry.

Additionally, the text data on Facebook and Twitter that were collected for this study were composed of English and languages other than English. To improve the efficiency of data analysis, the data were needed to convert into one language. Moreover, since the list of trend keywords for fintech services by topic, as defined by Kim *et al.* (2016b), was also in English, the text data that were collected from Facebook and Twitter were all translated into English by using Google Translator Service. After being translated into English, the symbols and stopwords included in the text data were removed to prevent unnecessary errors from occurring when computing the similarity between the text data on social media and the fintech service trend keywords by topic. Stopwords refer to common words that are included in natural language and do not have any specific meaning themselves. NLTK, a Python package for natural language processing, and the regular expression, a Python package for data cleaning, were used to remove stopwords and symbols. Typical stopwords include "is" and "the."

Based on the refined text data, which had been translated into English and wherein symbols and stopwords were removed, the similarity between the text data on social media and the fintech service trend keywords by topic was computed. In this study, the fundamental reason for finding the similarity between each text data and the fintech service trend keywords for each topic is that it is difficult to establish marketing strategies and set the business direction of a company by grasping customers' feedback, thoughts and brand awareness regarding fintech services from a lot of text data. Since the text data cannot be expressed as a measurable number on its own, it cannot be used as it is in its original form to identify strengths and weaknesses, areas that have to be abandoned due to incompetence and areas that provide opportunities for new business and new services. In this regard, the text data can be analyzed using WordCloud, a visualization method that shows words with a higher frequency of occurrence based on the number of occurrences of a specific word, and the frequency of occurrence of the words included in the text data is quantified to enable it to be graphically visualized individually. However, if the text data are simply analyzed based on the occurrence frequency of words, there is a risk that an error may occur wherein words that are not important but are frequently used by people may be assigned greater weightage. Due to these reasons, in this study, based on important keywords of each fintech service topic identified via previous research regarding text data analysis, the similarity between each text data posted on social media, which is considered an important channel used for communication with customers and the basis of marketing strategies, and each keyword of each fintech service topic was analyzed, and then similarity scores were calculated for each fintech service topic. The collected similarity score was then classified again according to the fintech companies selected as the subjects of this study, and not only the fintech company standards but also the similarity scores for the text data presented when the search term "fintech" was entered on Facebook and Twitter were collected for each fintech service topic.

Based on the similarity data of each fintech service topic to the general fintech service and the similarity data for each of the selected fintech companies, the general feedback, thoughts

and evaluations of customers regarding fintech services were analyzed for each topic. Additionally, we analyzed the current status of each fintech service topic for each fintech company. Based on the analyzed status, the general status of the current fintech service was determined, and the strengths and weaknesses of each fintech company were analyzed to classify areas that must be reduced, increasingly raised and decreasingly reduced, and the area that must be created as they provide new business opportunities to study ERRC strategies. Based on the classified data, we determine the ERRC strategy that must be pursued by each company. The basic ERRC classification criteria are as follows. First, the area that had low similarity scores and was not related to the current business of the company was classified as "eliminate." Second, the area that had low similarity scores and was currently related to the fintech company's business was classified as "reduce." Third, the area that had high similarity scores and was highly relevant to the current business was classified as "raise." Fourth, the area that had high similarity scores and low relevance to the current business was classified as "create."

3.2 Data
In fintech services, social media platforms have been mainly used by individuals who have financial inclusion and can use existing financial services as well as the financially underprivileged individuals who do not have a stable income and cannot use existing financial services due to their low credit scores. For this reason, social media is a fundamental element in analyzing the market status of fintech services and provides important data for determining the marketing strategy and business strategy directions for each fintech company. In this regard, not only traditional fintech companies that develop financial services and provide fintech services by collaborating with traditional financial companies and institutions, such as Fiserv, First Data, Stripe and SumUp, but also emerging fintech companies, such as Affirm, PayPal, Venmo, Grab and TransferWise, that provide new types of financial services with a clear differentiation from traditional financial companies operate their respective homepages on Facebook and Twitter. They communicate with customers in real time while providing important information, such as corporate mergers and acquisitions for investor relations (IR), each company's vision, major business activities, social activities, marketing activities and the services they provide.

Additionally, as Choi and Kim (2013) found, through a study on corporate PR activities using social media, Facebook was the most common social media operated by companies as official PR account, followed by Twitter and blogs. Furthermore, studies on the degree of customer acceptance and awareness toward fintech services, customer's feedback and satisfaction with fintech service quality and so forth were limited, in that collecting data via surveys in certain regions like Jeju Island and certain countries, such as China and Korea, to examine the current status of fintech services that are used and growing around the world as well as global companies that provide the fintech services and their impact on corporate activities was not suitable for business strategy research. To supplement these facts and the limitations of precedent studies, in this study, global fintech companies that conduct their business in various markets, not in specific countries, were designated as research targets. Moreover, Facebook and Twitter, which are used worldwide, were designated as social media for data collection.

In this regard, we examined text data regarding people's general thoughts, feedback, experiences and expectations related to fintech services using the search term "fintech" on Facebook and Twitter. Additionally, we collected text data about the marketing activities of each fintech company and the customer's feedback to them, text data on customer's experiences and expectations when using each company's fintech service, in-progress or completed mergers and acquisitions of each fintech company, and new service launches that

were obtained by searching for the names of global fintech companies designated as research targets, namely, Fiserv, First Data, Stripe, SumUp, Affirm, PayPal, Venmo, Grab and TransferWise. The data collected in this way were not limited to a specific country or region, and therefore could be used to study the awareness, opinions and reactions of general people regarding fintech services. These data were also used to study ongoing marketing activities, the current status of the fintech services provided by each company, customer awareness of each fintech company and customer feedback on the fintech services provided by each company.

The data were collected through Facebook and Twitter based on the fact that Facebook and Twitter support various languages and that fintech companies, which are the subject of this study, are global companies that operate in the global market. Thus, the text data were from various languages such as Korean, Hindi, Japanese, Spanish, German, Chinese, Arabic and Thai. Additionally, some parts of the data were expressed in letters due to the nature of social media, while other parts were composed of specific pictures or special symbols, not letters.

When text data are composed of multiple languages, a data set is created for each language by classifying the data, and the created data sets are analyzed and studied separately by applying word dictionary data for each language. This takes more time than analyzing a data set that comprises a single language, and accordingly, the overall research time increased considerably. Moreover, since the efficiency of research decreases with the increased research time, it was necessary to unify the text data comprising several languages into one language. Thus the collected text data were translated into English, which is the language that is the most studied and commonly used in text data research. Moreover, the text data needed to be translated into English to proceed with this study, because the word dictionary data used to refer to the similarity values between each text data and the fintech service trend keywords by topic in this study were also converted into English. To translate text data composed of languages other than English into English, we used the Google Translator API through Python as shown in Figure 2.

Text data composed of languages other than English were translated into English to ensure that the text data comprised only one language, English. After unifying the language in English, the next step was to remove the text comprising symbols and pictures that are not language as well as stopwords, such as "is," "am," "the," "a," "an," "do," "was," "will," "were," "I," "you," "we," "he," "she," "did," "does," "on," "in," "at," commonly used in the language but that have no meaning by themselves. Symbols and stopwords were removed from text data translated into English. The detailed process is as follows. When computing the similarity between each text data and the fintech service trend keywords for each topic since Python recognizes uppercase and lowercase English letters as different objects, the accuracy of similarity may be reduced if uppercase letters are grouped with lowercase letters. For this reason, all uppercase letters were converted to lowercase letters. Abbreviations, such as "what's," "cannot," "I'm," "n,t," "ve," "re" and "ll," were all converted to their original form as

Figure 2.
Using Google
Translator API
through Python

```
# Use Google Translator API
from googletrans import Translator
translator = Translator()
tr_result = []
tr_list = translator.translate(str(line), dest='en')
tr_result.append(tr_list.text)
```

"what is," "cannot," "I am," "not," "have," "are" and "will," and all special symbols such as "!, +, =, −, /, ?, ^" were removed. Additionally, symbols such as commas, quotation marks and periods were removed. In the process of extracting similarity between text data, English stopwords, such as be verbs and prepositions, were removed through the process of converting uppercase letters to lowercase letters and abbreviations to original forms so that the risk of reducing the accuracy of similarity was decreased.

Through the above process, the preprocessed and cleaned data were distinguished from the original text data, and the similarity analysis between the text data and the fintech service trend keywords was performed. The data processed in the data collection and in the data preprocessing process were text data posted on Facebook and Twitter for the period 2017–2019, valid as of November 2019, which were retrieved with search terms of "Fintech," "Affirm," "PayPal," "Venmo," "Fiserv," "First Data," "Stripe," "Grab," "Grabpay," "SumUp" and "TransferWise" that are the names of the companies subject to this study. After preprocessing the text data, the total quantity of cleansed text data used in this study was 32,671 documents. The data collection and data preprocessing process is summarized as shown in Figure 3.

3.3 Similarity analysis with fintech service trends

3.3.1 Topic of fintech service trend. To analyze the preprocessed text data, the similarity between the text data and keywords for each topic was analyzed using keywords of topics related to fintech services. For this purpose, the list of keywords for each fintech technology trend topic, established by Kim *et al.* (2016b) in their "Analysis of Fintech Technology Trends Using Topic Modeling," was used in this study. The related background is as follows. The fintech industry ostensibly developed financial-related services and provides them to customers. However, the fintech industry is different from the traditional financial industry in terms of the starting point of the industry, as described earlier in the definition and background of fintech services, the types of fintech services and the difference between existing services. Banks, securities companies, insurance companies, capital companies and credit card companies, which are representative of the traditional financial industry, were established to provide services such as storage, management, loan and investment of financial assets. For this reason, technology plays an auxiliary role in the provision of financial services in existing financial companies and institutions and has developed in line to improve existing businesses and develop new businesses.
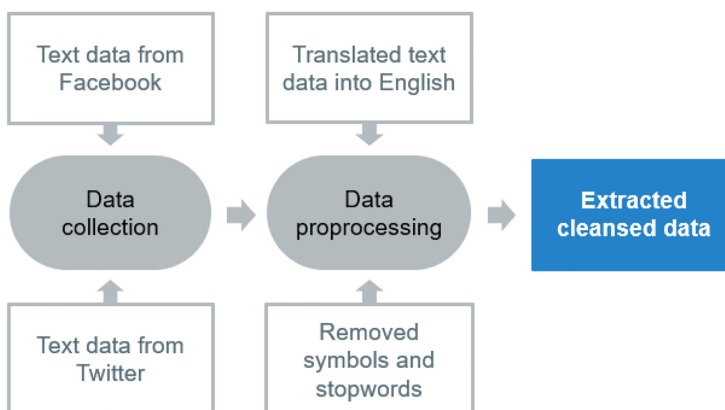

Figure 3.
Data collection and
preprocessing

However, in fintech companies, technology plays a subjective role, and financial services are created based on the technology possessed by each fintech company. This is supported by the fact that fintech companies are not financial companies and institutions, but rather ICT companies that are armed with financial technologies such as PayPal, Venmo and Grab. Thus, fintech technology itself becomes a service for fintech companies, as mentioned in the features and contents of fintech service technology, among the introduction, the features and contents of fintech service. Mobile payment technologies can be implemented with mobile payment services, such as Apple Pay and Samsung Pay, while NFC is a two-way communication technology that is directly connected to targeting marketing services for each customer.

Financial data management and analysis technology can be implemented as a financial product recommendation service for each customer. Display technology makes it possible to provide more convenient and simpler fintech services than traditional financial services via mobile applications. Credit card payment technology is directly connected to a token-type payment service and a QR code payment service. Security technology is an essential element of all fintech services. Internet-only banking technology refers to a fintech company that is in itself an Internet-only bank and only provides online services. With this background, in the fintech industry, the technology possessed by each fintech company is soon implemented as a fintech service. For reference, there are different researches to study fintech companies with social media analysis. Franco-Riquelme and Rubalcaba (2021) studied the correlation between selected Spanish fintech companies and UN SDGs by analyzing text data on Twitter and implementing a topic modeling methodology. Son et al. (2020) derived the elements for fintech companies and, focused on the asset management service through topic modeling by analyzing text data on the app store.

According to the view that the fintech technology is almost the same as fintech services, 20 topics related to fintech services and keywords for each topic, defined by Kim et al. (2016b), were appropriate indicators to analyze text data regarding people's general feedback and experiences to fintech registered on Facebook and Twitter, and customers' feedback, expectations and experiences for each global fintech company and service. By extracting the keywords for each topic related to fintech service and examining the similarity between these keywords and the text data, the topic parts with high similarity indicate that people's interest, experience, expectations and responses to fintech services are high. This can be interpreted to mean that a fintech company has vigorous marketing activities for a service related to a topic with high similarity, and the importance of strategy to the related business is high. It can also mean that the experiences, feedback and expectations of customers toward the service are high. Conversely, the topic parts extracted with low similarity indicate that people's interests, experiences, expectations and feedback on fintech services are relatively low, and each fintech company is engaged in marketing activities related to the topic part extracted with low similarity. This could be interpreted to mean that the importance of the strategy for the related businesses is inferior and that the customer's experiences, responses and expectations for the service are relatively low.

According to the above background, using the 20 topics related to fintech services and keywords for each topic, defined by Kim et al. (2016b), the list of fintech service keywords for this study is shown in Table 1. The similarity was calculated by comparing the words included in each text data which is composed of sentences, with keywords classified for each topic, from the beginning to the end of the text data. The similarity data were aggregated by matching all keywords for each topic individually with each text data to extract the similarity and summing similarity scores for each extracted text data for each topic.

3.3.2 Similarity analysis by GloVe method. To identify the similarity between the keywords included in each topic, classified by fintech service type, and each text data, text analysis is

Topic	Topic word
ATM	transfer, account, send, machine, ATM, automate, machine, device, money, bank
Transaction/exchange	trade, order, price, market, exchange, product, trader, match, rate, value
NFC	module, mobile, payment, card, NFC, chip, function, device, equip, phone
Financial data management	CPO, identified, offer, provide, control, accept, financial, plan, customer, manage
Financial software	network, secure, support, access, module, embodied, compute, software, online, program
Mortgage loan	loan, amount, guarantee, mortgage, lend, borrow, home, income, benefit, rate
Display	display, interface, image, machine, plural, graphic, screen, configure, type, view
Asset management	customer, service, provide, investment, option, allocation, analyze, monetary, bill, database
Security	authentication, secure, identification, password, biometric, verification, device, disclose, code, encrypt
Internet banking	payment, mobile, bank, phone, terminal, online, Internet, service, account, deposit
Auction/bid	seller, buyer, purchase, bid, auction, online, negotiation, tax, merchant, commerce
Financial risk management	risk, financial, determine, estimate, predict, forecast, select, policies, portfolio, model
Mobile payments	mobile, payment, device, payee, payer, send, wireless, SMS, contactless, wallet
Credit card payments	card, credit, purchase, merchant, provide, account, service, issue, cardholder, check
Financial data analytics	financial, analysis, process, currency, database, verify, datum, memory, insurance, plan
Platform	request, online, platform, control, server, service, access, environment, function, protocol
Mobile transportation card	device, wireless, mobile, signal, magnet, reader, card, RFID, tag, vehicle
Bank account management	payment, account, receive, request, deposit, bank, electron, payee, withdrawal, check
Stocks and funds	invest, asset, fund, manage, investor, bond, companies, stock, option, properties
E-commerce	store, online, shop, customer, phone, sale, marketplace, vendor, purchase, product

Table 1.
Data collection and
pre-processing

required to determine the similarity between words and other English words. For the purpose of this study, the GloVe method was used to analyze the similarity between keywords and each topic's text data.

There are some text analysis methods other than GloVe. The word cloud is a visualization method that shows words with a higher frequency of appearance in a larger size based on the number of times a specific word appears in a text (Öztürk and Ayvaz, 2018). However, this method is not appropriate for this study because it is not possible to simply attribute significant meaning to certain words with a high frequency of appearance, and the data cannot be analyzed and extracted in a measurable form. Another data analysis method, term frequency – inverse document frequency (TF-IDF), is based on the frequency of occurrence of a specific word, that is, the total amount of text data in which a specific word appears is considered as a variable, and the commonly used words that appear frequently in other text data while having a high frequency of appearance are not classified as important words (Qaiser and Ali, 2018). Unlike the simple method of measuring the frequency of occurrence of words, TF-IDF is a text data analysis method that calculates the word appearance frequency (or term frequency, TF) and inverse document frequency (IDF) values and assigns a high score to words that do not appear in other text data but appear frequently in a specific text data. In other words, after checking the importance of a word according to its frequency of occurrence in text data comprising one sentence or two or more sentences, a word or word bundle weighting based on the frequency of occurrence is extracted from the entire text data

set. Then, the importance score for each word or word bundle is calculated by multiplying the reciprocal of the number of text data, including a specific word or word bundle, by the frequency of occurrence of each word or word bundle (Saran and Shokouhyar, 2021).

The importance of each word or word bundle calculated in this way has higher reliability than simple frequency analysis because of the basic proposition that reliability is proportional to the number of occurrences but inversely proportional to the total number of text data mentioned (Kim *et al.*, 2018). However, when this TF-IDF method is applied to Facebook and Twitter text data, words and keywords that can define fintech services, established through precedent research, may not be extracted, and words or word bundles that are irrelevant or have low relevance to the fintech service may be extracted. Thus, the TF-IDF method is not suitable for this study due to its limitations.

Word2Vec is a method of analyzing text data in a way that predicts words with high relevance to specific words and is not based on the occurrence frequency of specific words. Word2Vec is an algorithm that implements the method proposed by Google and is a machine-learning-based text data analysis method that was released in 2013 (Kim *et al.*, 2016a). Word2Vec learns via text data and learns other words that appear adjacent to a specific word as related words. In other words, as the order of words become closer and appears frequently, words will have similar vector values, that is, higher similarity values. This method is meaningful in that it extracts words in a measurable form as a vector value and considers the distribution of words located before and after a specific word, rather than simply measuring the importance of words based on their frequency of occurrence in a text data set. Thus, Word2Vec is a text data analysis method that predicts which words will appear before and after a specific word by learning the word (Kim *et al.*, 2016a). It is an excellent method that predicts the most likely word by learning text data without analyzing the data based on the simple frequency of occurrence of a word or group of words. However, since the predicted range of word appearance is limited to a local context, it is not possible to analyze the statistics information of the global context. Therefore, Word2Vec is not suitable for this study because the statistics information of the global context is needed to analyze a variety of documents (several customers' review data) and to figure out ERRC value elements.

For these reasons, GloVe was used as a text data analysis method in this study. GloVe is a text analysis method developed by Stanford University in the US in 2014, as a methodology that utilizes both a method based on the frequency of a specific word's occurrence and Word2Vec, which predicts which words will appear before and after a specific word in a text data analysis (Pennington *et al.*, 2014). Among the existing text analysis methods, the text data analysis method, based on the frequency of occurrence of a specific word or word bundle, and Word2Vec, based on prediction, both have their own advantages and disadvantages. Although the text data analysis method based on the frequency of a word's occurrence considers the overall statistical information of the text data set, the analog task of understanding the word's meaning is impossible. Word2Vec involves a prediction-based inference of words that is superior to the text analysis method based on the frequency of occurrence of words; however, it does not reflect the overall statistical information of the text data set because it considers surrounding words only within a limited range of a specific sentence or number of learning. GloVe addresses the limitations of each of these existing methods and uses both the word-occurrence-frequency-based text analysis method and the prediction-based method, that is, the mechanism of Word2Vec, wherein a word is vectorized by calculating the co-occurrence probability between words. For example, given the word "ice," there is a higher probability that the word "solid" will appear rather than the word "gas." Thus, GloVe is a text analysis method that can be used to determine the probability that specific words can appear together at the same time and that continuously learns to vectorize words (Pennington *et al.*, 2014). We determined that GloVe, which incorporates the strengths of both the text data analysis method based on word occurrence frequency and the

analysis method based on predicting the occurrence of specific words, can extract the most accurate similarity values. For these reasons, GloVe was used as a data analysis method in this study. In this regard, similarity values were extracted for the keywords in topics that were classified by fintech service types, as shown in Table 2 Subsequently, text data related to fintech and fintech companies were cleansed via a preprocessing step. In this process, a vectorized English word similarity dictionary (Pennington *et al.*, 2014) for 400,000 English words registered on Wikipedia in 2014 was used for the GloVe method's learning. Figure 4 presents how to extract similarity values between keywords and text data.

Among the 20 fintech service topics, keywords included in the first topic were compared with each text data and the similarity is extracted. Then, the similarity value was applied in the extraction process by referring to the similarity value between specific words registered in the English word similarity dictionary, vectorized by the learning of the aforementioned GloVe method. The similarity value was computed by comparing the first text data from the first keyword to the last keyword in the first topic and then summing the computed value. When the comparison of the first text data and similarity values was all computed and the

| No.	Type		Service examples
1	Payment and remittance	-	Transfer money, order food, purchase coupons
		-	subscribe to insurance products
2	P2P loans	-	calculating the interest rate with both financial and nonfinancial data
3	Asset management	-	Robo-advisor services with a low commission
4	Data collection and analysis	-	Analyzing data from social media such as Facebook and Twitter
5	Platform	-	Connect angel investors and start-ups (Angel List)
		-	Mediate P2P loans (Lending Club)
6	Internet-only bank	-	Provide higher saving interest rates than direct banks

Table 2.
Examples of fintech
services
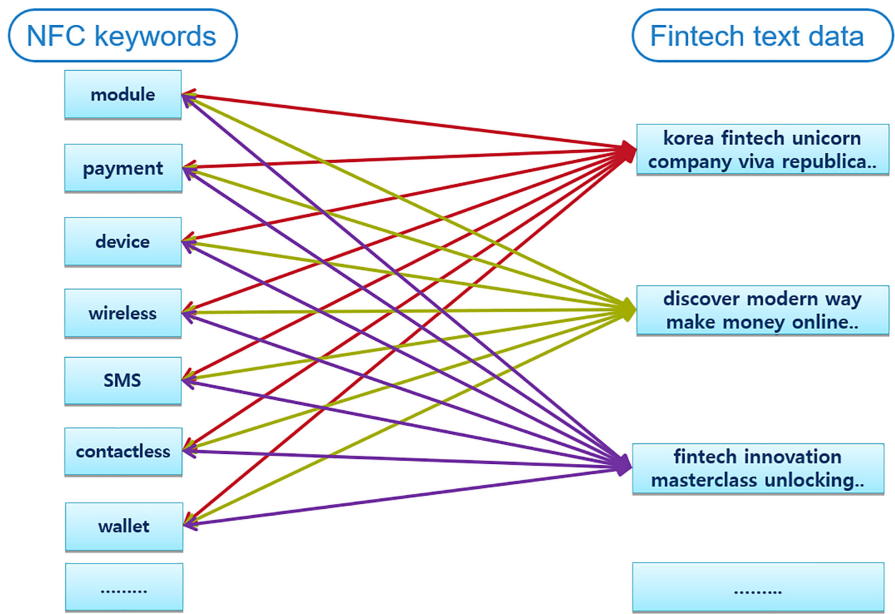
Figure 4.
Method for similarity
test between topics
keywords and text data

summation was completed, the similarity value of the second text data was computed in the same way as the first text data, and the computed values were summed. When the similarity value computation and summation between the first topic and all text data was completed, the same process was repeated for the second topic to complete the computation and summation of the similarity values for all text data. This process was repeated until the computation and summation of values were completed for the last topic. The similarity scores were computed in this way for the general "fintech," and the similarity scores for each topic based on the name of each fintech company were also computed. Consequently, the current status of each fintech service topic for general "fintech" was identified, and the current status of each fintech service topic for each fintech company as well as ERRC strategies for each fintech company was studied.

3.3.3 Similarity score analysis results. Table 3 presents the results regarding similarity scores between the text data on fintech and fintech companies collected from Facebook and Twitter and keywords for each fintech-service trend topic.

Based on the overall similarity score, it was found that topics of "Transaction/Exchange," "Financial Data Management," "Stocks/Funds," "Internet Banking," "Credit Card Payments," "Asset Management" and "Financial Risk Management" constitute the upper group. Also, topics of "E-Commerce," "Mortgage Loan," "Platform," "Financial Software," "Financial Data Analytics," "Auction/Bid," "ATM" constituted the middle group. Topics of "Bank Account Management," "Display," "NFC," "Mobile Transportation Card," "Security" and "Mobile Payments" constituted the lower group. As a result, we examined the general awareness, expectation and reaction of people about "fintech." First, looking at the topics distributed in the upper group with a high overall similarity score, we observed that financial transactions including payments and settlements based on fintech services were highly recognized. In other words, since people had a lot of experience in conducting financial transactions through fintech services, the perception of fintech services was strongly linked to financial transactions and payment transactions using credit cards.

Additionally, people's feedback and expectations regarding financial asset management services, such as financial data management, asset management and financial list management through fintech services, were high. Moreover, we found that people were interested in transactions related to stocks and funds as well as Internet banking through fintech services. Based on the above data analysis results and prior research on fintech services, we found that people recognized "fintech services" as financial transaction services and expected that a stable asset management service would be available through fintech services. Additionally, we found that there was a high level of interest in more convenient services linked to fintech in terms of traditional financial services such as stocks and funds, and banking services.

Though topics such as "E-commerce," "platform" and "financial data analytics" were in the middle group, it was analyzed that people's experiences, reactions and interests in traditional fintech services are constant. The reason for the above analysis was that fintech service, which developed financial services provided by electronic financial business operators or subsidiary electronic financial business operators, is highly related to topics such as "e-commerce," "mortgage loan," "platform," "financial software," "financial data analytics," "auction/bid" and "ATM." In addition, through the current status of the lower group including topics such as mobile payment and security, it was analyzed that people's interest in "security," "NFC," "mobile payments" and "display," which belongs to the original technology from which fintech services were born, declined. The fact that people's interest in basic fintech services is low means that fintech services are positioned familiarly in people's daily lives.

Furthermore, we figured out pairs of similar fintech companies by comparing the similarity score ratio by topic of each company. First Data and Fiserv consisted of similar

Topic/category	Fintech	Affirm	First data	Fiserv	PayPal	Stripe	SumUp	TransferWise	Venmo	Grab
ATM	75,684	9,233	106,825	221,612	201,832	94,914	299,963	168,451	103,596	66,366
Transaction/Exchange	94,291	11,044	130,160	277,401	233,726	110,053	357,646	200,740	120,287	78,840
NFC	67,974	8,137	97,326	203,771	181,539	84,654	274,677	147,247	90,418	60,316
Financial data management	91,962	11,247	129,641	265,537	231,309	114,825	359,980	201,569	120,714	77,939
Financial software	79,582	9,424	113,922	235,173	199,868	96,974	312,932	167,309	101,055	66,236
Mortgage loan	85,973	10,525	117,258	244,657	223,597	102,667	323,669	190,861	115,519	73,994
Display	68,322	8,351	99,517	201,968	176,879	88,157	276,591	145,637	91,386	58,881
Asset management	86,625	10,317	121,800	251,698	215,126	105,128	332,249	186,231	109,505	71,812
Security	53,090	6,567	78,559	157,682	144,697	71,323	218,161	119,444	69,577	47,705
Internet banking	88,381	10,485	124,793	261,912	233,271	107,004	345,729	191,220	115,822	75,989
Auction/Bid	77,617	9,239	107,799	227,800	200,044	90,963	297,904	164,975	100,730	65,386
Financial risk management	86,489	10,107	119,783	248,757	205,767	102,585	324,043	182,348	107,301	69,508
Mobile payments	46,443	5,674	66,554	141,513	133,737	59,474	191,274	103,794	64,959	43,332
Credit card payments	88,172	10,834	125,514	259,894	233,024	109,043	348,044	195,300	118,062	77,086
Financial data analytics	78,280	9,215	109,641	227,949	191,986	95,392	297,835	167,465	97,544	63,770
Platform	85,791	10,109	123,128	254,011	214,220	106,472	338,945	182,268	108,167	71,578
Mobile transportation card	66,938	7,910	96,175	200,041	177,007	83,062	271,495	142,648	88,604	58,880
Bank account management	72,459	8,915	101,614	210,599	198,561	92,001	284,871	165,589	99,078	64,972
Stocks/funds	89,165	10,338	119,722	259,377	215,932	101,577	328,692	186,357	110,537	72,147
E-commerce	86,194	10,543	123,210	256,756	230,936	104,293	342,748	184,936	117,185	75,237

Table 3.
Similarity score by
fintech service topic

score ratios due to these two companies merging in 2019, and it was analyzed that people recognized these companies are the same company. PayPal and Grab consisted of similar score ratios. Each company is a representative fintech company in North America and Southeast Asia, respectively, and their main business is commonly a credit card payment service. Related to it, it was derived that people's awareness of each company is similar. Also, it was found that TransferWise and Venmo consisted of similar score ratios. These companies' common and main business is the remittance business. Therefore, we could derive that if fintech companies had a similar or common business, people's awareness might also be no different for them.

3.3.4 Text analysis results: fintech firms and ERRC. Based on the text analysis results, we proposed marketing strategies for the global fintech companies that are the subjects of this study to align with the ERRC framework. Interestingly, the text analysis results said that all nine companies should eliminate "Action/Bid" and gradually reduce "NFC" for marketing strategies commonly. It meant that people are not interested in or do not expect services related to "Action/Bid." Besides, it was derived that marketing strategies for "NFC" are no longer effective. In this section, we selected three out of the nine companies to demonstrate how the ERRC framework can be applied based on text analysis results. The companies to be analyzed are PayPal, Stripe and TransferWise.

PayPal is a global leading fintech company that succeeded by developing an escrow business model for the online payment business, which is currently conducted by most fintech companies worldwide. It was the first company to provide an online payment service in the US while supporting online remittance, and provided a fintech service that processes remittances with one click without revealing customers' bank account or credit card details to counterparties. PayPal had a significant amount of influence on fintech companies of the next generation. Figure 5 shows the current status of each fintech service topic for PayPal.

Based on the analysis results regarding the overall similarity score, the topics "transaction/exchange," "Internet banking," "credit card payments," "financial data management," "e-commerce," "mortgage loan" and "stocks/funds" were identified and included in the upper group. The topics "asset management," "platform," "financial risk management," "ATM," "auction/bid," "financial software" and "bank account management"
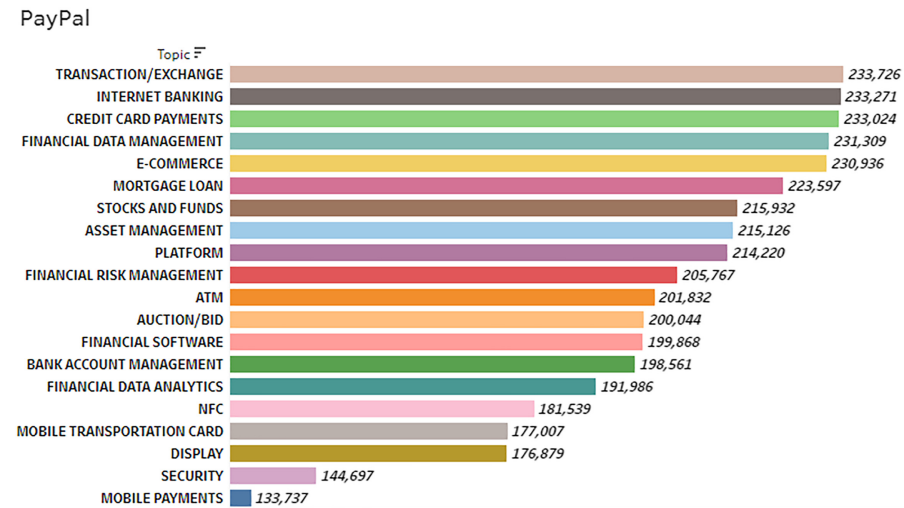

Figure 5.
Fintech service topic similarity score of PayPal

were included in the middle group, while the topics "financial data analytics," "display," "NFC," "mobile transportation card," "security" and "mobile payments" were added to the lower group. Table 4 presents the ERRC value elements for PayPal's marketing strategy analyzed based on these data analysis results.

Stripe provides fintech services that are targeted toward merchants and companies that develop payment solutions for merchants and provide basic payment devices and solutions using credit cards and mobile devices. Additionally, it provides a payment solution application development environment (or application programming interface, API). Stripe also provides fraud detection services based on machine learning. Moreover, it provides start-up support services like providing funding for start-ups around the world to enter the US fintech market and is currently expanding its range of fintech services. Recently, Stripe reached a valuation of 95 billion USD. Figure 6 shows the current status of each fintech service topic for Stripe.

Based on the analysis results regarding the overall similarity score, the topics "financial data management," "transaction/exchange," "credit card payments," "Internet banking," "platform," "asset management" and "e-commerce" were included in the upper group, while the topics "mortgage loan," "financial risk management," "stocks/funds," "financial

Eliminate	Raise
Auction/bid	Credit card payments
Mobile transportation card	Financial software
Display	Financial data analytics
Financial risk management	Financial data management
Bank account management	E-commerce
Reduce	Create
Mobile payments	Asset management
Platform	Internet banking
Security	Stocks/funds
Transaction/exchange	ATM
NFC	Mortgage loan

Table 4.
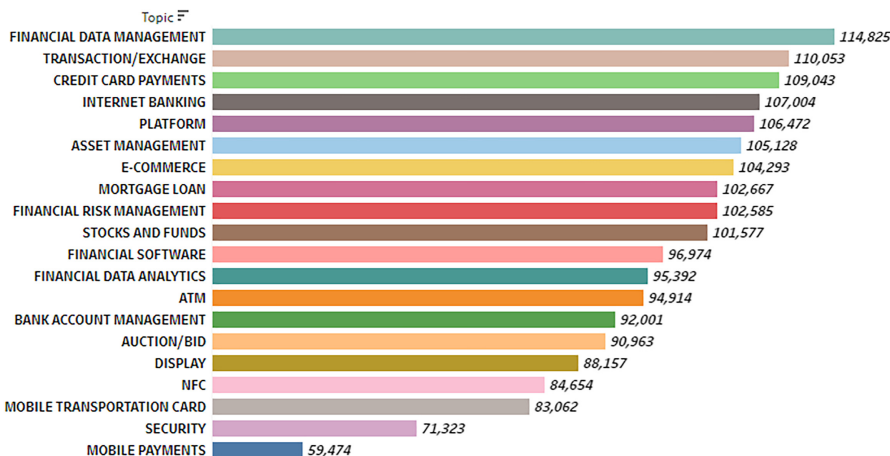The ERRC analysis of
PayPal

Figure 6.
Fintech service topic
similarity score of
Stripe

software," "financial data analytics," "ATM" and "bank account management" were included in the middle group. Additionally, similar to other fintech companies, the topic "auction/bid," which was not related to the fintech services provided by Stripe, was included in the lower group along with "display," "NFC," "mobile transportation card," "security" and "mobile payments."

Table 5 presents the ERRC value elements for Stripe derived from the above data analysis results. First, the marketing strategies for "auction/bid," "mobile transportation card," "bank account management," "stocks/funds" and "ATM" are less related to Stripe's main business, that is, credit cards and mobile payment solution services, should be eliminated. Second, as with the eliminated factors, the marketing strategies for "financial data analytics," "financial data management," "transaction/exchange" and "e-commerce," which were not related to Stripe's business, should be reduced, and since "NFC" technology is widely used in the electronic payment field, it is difficult to differentiate it in the marketing strategy, so it must also be reduced. Third, it is necessary to develop marketing strategies related to Stripe's major fintech services, such as "credit card payments," "financial software," "display," "mobile payments" and "security" topics, which have been previously provided and prepare a sustainable development strategy. Fourth, it is necessary to establish a business expansion marketing strategy by creating a business similar to that of Capital, which is based on providing investment support for fintech-related start-ups.

TransferWise is a UK fintech company that combines foreign currency remittances, which were typically only provided by traditional banks, with fintech technology to provide financial services. Unlike traditional banks, there is no actual financial institution that relays foreign currency remittances, so it does not use the money transfer networks of international financial institutions for overseas remittances. For this reason, TransferWise can provide overseas remittance services at low fees. Figure 7 presents the status of each fintech service topic for TransferWise.

Based on the analysis results regarding the overall similarity score, the topics "financial data management," "transaction/exchange," "credit card payments," "Internet banking," "mortgage loan," "stocks/funds" and "asset management" were included in the upper group, while "e-commerce," "financial risk management," "platform," "ATM," "financial data analytics," "financial software" and "bank account management" were added to the middle group. The topics "auction/bid," "display," "NFC," "mobile transportation card," "security" and "mobile payments" were included in the lower group.

Table 6 presents the ERRC value elements of TransferWise based on the above data analysis results. First, marketing strategies for the topics "auction/bid," "mobile transportation card," "bank account management," "financial software," "display," and "credit card payments" are not significantly related to the major services provided by

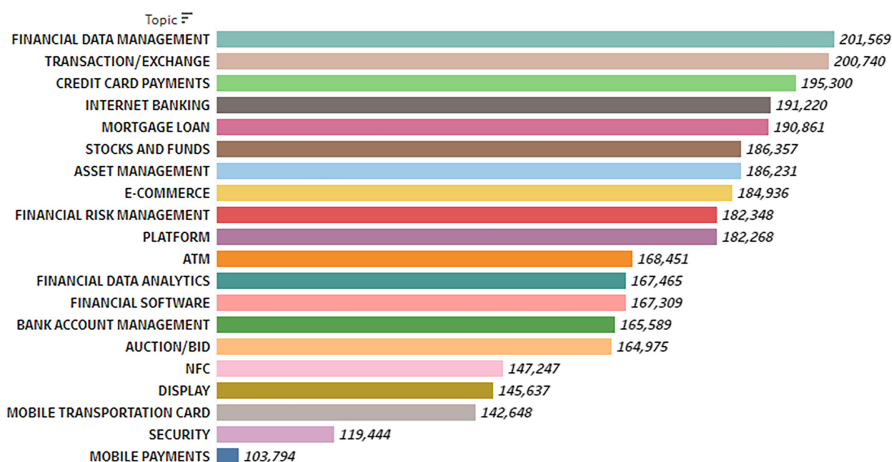|	
Eliminate	*Raise*
Auction/Bid	Credit card payments
Mobile transportation card	Financial software
Bank account management	Display
Stocks/funds	Mobile payments
ATM	Security
Reduce	*Create*
Financial data analytics	Asset management
Financial data management	Internet banking
Transaction/Exchange	Financial risk management
NFC	Mortgage loan
E-commerce	Platform

Table 5.
The ERRC analysis of Stripe

Figure 7.
Fintech service topic
similarity score of
TransferWise

Eliminate	Raise
Auction/Bid	Financial data management
Mobile transportation card	Platform
Financial software	Mobile payments
Display	Security
Credit card payments	Bank account management
Reduce	*Create*
Financial data analytics	Asset management
Transaction/Exchange	Internet banking
Financial risk management	ATM
NFC	Stocks/funds
E-commerce	Mortgage loan

Table 6.
The ERRC analysis of
TransferWise

TransferWise should be eliminated. Second, similar to the eliminated topics, parts related to the topics "financial data analytics," "financial risk management," "NFC" and "e-commerce," which have low relevance to TransferWise's business and do not provide a competitive edge over other fintech companies, should also be removed. Additionally, since the topic "transaction/exchange" is a common characteristic of fintech services, the marketing strategy should be reduced. Third, the feedback and awareness of customers toward the topics "financial data management," "platform," "mobile payments," "security" and "bank account management," which are highly related to the overseas remittance fintech services provided by TransferWise, were relatively high compared to other topics. This was revealed through the results of the comprehensive similarity score analysis. Thus, it is necessary to continuously develop marketing strategies to increase customer awareness and establish additional strategies for sustainable development in the overseas remittance area. Fourth, a marketing strategy should be developed to provide Internet banking services related to the topics "asset management," "Internet banking," "ATM," "stocks/funds" and "mortgage loan" to expand the scope of TransferWise's business in the same direction as its current range of major fintech services. In this way, new business opportunities can be generated.

4. Conclusion
4.1 Implications
This study aimed to examine global fintech companies that are active in the fintech industry, which has grown rapidly in the last decade, and subsequently analyze text data regarding fintech and fintech companies posted on Facebook and Twitter. The strategies that must be pursued by fintech companies were identified using ERRC value element analysis (Leavy, 2019). Prior to the text data analysis and the ERRC value element analysis, the definition, background, characteristics and components of fintech services were examined based on a literature review. Since the global financial crisis in 2008, fintech services have emerged as a new type of industry due to the increased demand for new financial services that were safer and more reliable than traditional financial services combined with information and communication technology. Due to this background, fintech companies, unlike traditional financial companies, provide financial services that are driven by fintech technologies and ICT.

This provides differentiated fintech services that facilitate the use of financial services by the financially underprivileged, out-of-the business operation framework of traditional financial companies. fintech services can be classified into six types: payment and remittance services, P2P loan services, asset management services, data collection and analysis services, platform services and Internet banking services. Additionally, social media platforms, such as Facebook and Twitter, have been increasingly used as marketing channels to communicate with customers and conduct marketing activities. Therefore, financial transaction data, as well as big data accumulated via social media, are essential assets for fintech companies to understand market conditions, establish marketing strategies and create new business opportunities.

In this study, we analyzed the definition and main characteristics of fintech services and the current statuses of fintech companies. Moreover, we examined previous studies on fintech service market trends, business models and strategies, as well as previous studies on fintech service strategies through social media. Additionally, since fintech services were included in the large financial services category, these services have become an important financial management business in each country, and each government's policies and promotion strategies have gained greater importance. In this regard, previous studies on fintech service policies and strategies were analyzed, and previous studies on fintech technology trend analysis, which significantly influenced text data analysis methods, were analyzed and utilized in this study. According to previous research, the marketing activities of fintech companies and customer experience regarding the fintech services provided by each fintech company had a significant influence on customer satisfaction and perception.

Marketing strategies were found to be important in that they provide customers with fintech services that are easy to use, have excellent security and can be used without time constraints. In this regard, transparency and credibility must be utilized as the basis for establishing a proper marketing strategy. We found that social media is important as a marketing channel to fintech companies in terms of discovering not only current customers but also potential customers. Moreover, prior research showed that social media can be used to develop marketing strategies by analyzing the text data posted on social media, and based on prior research on the fintech technology trend analysis, we studied an index for the analysis of fintech service status.

4.2 Discussion
Based on previous research regarding the definition and characteristics of fintech services as well as the establishment of fintech service marketing strategies, we selected the direction and methodology for this study. The study was conducted as follows. We collected 32,671

Facebook and Twitter text data related to fintech and global fintech companies, such as Affirm, PayPal, Venmo, Fiserv, First Data, Stripe, Grab, SumUp and TransferWise, for the period 2017–2019, and analyzed their similarity to fintech service trends classified into 20 topics. Based on the analyzed similarity scores, the current status of each fintech company was analyzed. Based on their current status, the ERRC value factors of each fintech company were analyzed to determine the marketing strategy direction. Based on the similarity analysis of the social media text data and fintech services trend topics, we found that the topics with a low similarity score for each fintech company were often not related to the flagship business of each fintech company. In contrast, topics with high similarity scores were often highly related to the main business of each fintech company.

Therefore, when analyzing the ERRC value factor for each fintech company, topics with low similarity scores were classified as areas to be ignored. Moreover, although their similarity scores were low, topics related to the ongoing business of a fintech company were classified as areas in which marketing focus should be reduced because competitors were equally serviced in the market. Among the topics with high similarity scores, topics that were highly related to the main business were classified as those that needed to be targeted continuously by marketing strategies. Furthermore, topics that were not related to the main business were classified as new business activities that should be created based on customer expectations. Thus, the analysis of social media text data proved to be an important factor in establishing marketing strategies for each fintech company.

This study derives strategies of global major fintech companies by analyzing the posts of fintech users in social media channels using text mining technique. This study also proposes a new research methodological idea by applying business analytics for unstructured data called text mining to the ERRC framework, which was used as a qualitative marketing strategy analysis technique in previous studies. Based on this approach, we present a way on how to connect user motivations based on their actual voices of other innovative technologies with firm's marketing strategies.

This study is meaningful in that it quantifies the degree of similarity between customers' responses, experiences and expectations regarding the rapidly growing global fintech firms' services and trends in fintech services. This study is also significant in that it suggests a practical way to apply in business by providing a method for transforming unstructured text data into structured numerical data – it is measurable. It is expected that this study can be used as the basis for exploring sustainable development strategies for the fintech industry.

In this study, we suggested a new methodology of the text data analysis with a text mining algorithm "GloVe" to convert the text data(unstructured data) to numerical data(structured data), and we found that the converted data could be meaningful for fintech companies. The converted data, which were measurable, were then applied to the ERRC grid, which is a corporate strategy analysis tool, to determine a method for establishing marketing strategies. Moreover, this method is meaningful in that it helped to analyze the current status and marketing strategies of fintech companies by targeting companies that provide fintech services in the global market, not companies that provide fintech services locally. It is expected that the text data analysis and marketing strategy establishment methodology used in this study can be effectively used in the future for the development of marketing strategies for fintech companies.

4.3 Limitations and future directions

The limitations of this study are as follows. This study only analyzed currently valid text data posted on social media in the past years. In other words, data posted in the past but already deleted from social media at the time of data extraction were not collected. Therefore, this study has a limitation in that it was necessary to collect and analyze social media data in

real time to detect and examine changes in market conditions and trends in real time. To overcome this limitation, further research is needed to develop a method of collecting and accumulating social media data in real time and reflecting it in the text data analysis. Additionally, in this study, the similarity between social media text data and fintech service topics was extracted, and the current status of each fintech topic was analyzed based on their topic scores to categorize them into areas of high and low customer response and interest. There is a limit that cannot be distinguished. Therefore, future research should analyze whether text data are positive or negative.

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