

INSIGHTS INTO ATTITUDES TOWARDS FINANCIAL INNOVATIONS BY ITS USERS

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Abstract. Significant technological advances have determined the importance of FinTech firms worldwide; they attract substantial investment and put competitive pressure on banks providing traditional services. The development of financial innovations challenges users accustomed to classical financial solutions since trust in financial technologies requires risk assessment, which becomes increasingly complicated. The main participants shaping the attitude towards FinTech are investors, customers, regulators, technology developers, and risk managers. The paper aims to explore FinTech opportunities and challenges, as the public understands them. The authors used scientific sources and employed big data processing methods to evaluate social media users' attitudes towards the FinTech sector. The obtained results revealed that, despite of overall positive attitude, FinTech companies have to pay special attention to investment management and ensuring the security and privacy of clients' data.

Keywords: financial technologies (FinTech); investment; risks; regulation; consumer; public opinion; Twitter; text and sentiment analysis

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Introduction

Financial technologies (FinTech) are gaining popularity today as technologies infiltrate people's everyday lives, speeding up financial processes and facilitating corporate and personal financial planning (Chen, 2016; Al Hudithi, Siddiqui, 2021; Maâlej, 2022). The development of financial technologies depends on consumers' propensity to use them (Eickhoff, Muntermann, Weinrich, 2017). We can claim that financial technology use depends on positive and negative public opinion caused by

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the sector's opportunities and challenges (Fenwick et al., 2018; Nguyen et al., 2022; Somogyi and Nagy, 2022; Nassar and Strielkowski, 2022). Traditional methods of attitude research, such as surveys and expert evaluation, are time-consuming and usually limited to some geographical regions. Therefore, using or integrating big data analytics into already-known methodologies is very important (Koman et al., 2022; Katina et al., 2023). Huang et al. (2021) used a text mining technique and social network analysis for opinion trend analysis at a company level. Franco-Riquelme and Rubalcaba (2021) used social media analysis to investigate the attitude of Twitter users towards Sustainable Development Goals and open innovation of FinTech firms. The study aims to discover what challenges FinTech raises to society and what social network users' attitude towards these challenges is. The tasks are as follows: to describe the FinTech ecosystem, to identify opportunities and, especially, challenges; to evaluate the public's attitude towards the FinTech sector using the following research methods: analysis and synthesis of scientific literature, analysis and interpretation of statistical data, their graphic representation, text and sentiment analysis. The study of the opinions about Fintech can be instrumental for regulators while creating a safer business environment. Commercial companies must know customer perceptions, technology developers, and investors.

Literature Review

FinTech firms differ from other financial companies since they provide a unique range of services (Chan and Lee, 2005; Chen, 2016; Jagtiani and Lemieux, 2017; El-Masri, Al-Yafi and Samir Sherif, 2019). Table 1 identifies the main areas and concrete services offered by FinTech companies.

Table 1. List of central areas and concrete services provided by FinTech firms

Category	Services provided
Money transfers and payments	Online foreign exchange
	Pay via cryptocurrency
	Online digital-only banks without branches
	Nonbanks to transfer money
	Mobile phone payment at checkout
Borrowing	Lending through peer-to-peer (P2P) platforms
	Borrowing using online short-term loan providers
Insurance	Car insurance using telematics that monitors driver behaviour
	Insurance premium comparison sites
	Activity-based health insurance that tracks your exercise

Source: developed by the authors based on Gulamhuseinwala, 2015; International Finance Corporation, 2017; Jagtiani, Lemieux, 2017; KPMG, 2019, 2020a, b; Deloitte, 2022a, b)

The FinTech sector is expanding very quickly. Such expansion is driven by the most significant funding recorded throughout the existence of the FinTech sector; the abundance of services offered reduces prices and attracts new consumers and investors (European Central Bank, 2018).

The Basel Committee on Banking Supervision (2018) surveyed the most significant products and services in the FinTech sector (European Central Bank, 2018; Giudici, 2018). The responses are presented in Table 2.

Table 2. Findings of the FinTech activity survey

Per cent	Services
41%	Payments and settlement services
27%	Market support services
18%	Credit, deposit, and capital-raising services
9%	Investment management services
5%	Other services

Source: developed by the authors based on the Basel Committee on Banking Supervision, 2018

The survey conducted by the Basel Committee shows that payments and settlement services are the most popular activities in the FinTech sector (KPMG, 2019, 2020a, b; Deloitte, 2022a, b). This answer allows assuming that payments are the most developed area.

It has to be noted that traditional financial companies, such as banks and insurance companies, use some FinTech solutions (Puschmann and Alt, 2016; Puschmann, 2017). The competition triggers the development of the banking sector (Haddad and Hornuf, 2016; Mention, 2019). Some financial institutions invest in new FinTech startups; others cooperate in developing new services (Yan, Schulte and Lee Kuo Chuen, 2018; Mention, 2019). Anyway, the popularity of FinTech companies continues to grow. Gulamhuseinwala and Lewis (2015) studied why consumers use FinTech online services.

According to the authors, almost half of the respondents claimed that the most attractive feature offered by FinTech firms is an easy way to create an account (43.40 %); 15.40 % of the respondents considered an advantage of lower fees for services compared to those charged by traditional financial institutions. In comparison, 10.3-12.4 % of the respondents deemed easy access to various products and services as the main advantage and better quality and functionality. The survey findings suggest that FinTech products and services are expanding and gaining popularity due to positive consumer feedback.

To summarise, the most popular service FinTech firms provides is “payments and settlement services”; most consumers use these services because of the possibility of creating an account quickly.

Despite FinTech companies' conveniences, customers must be prepared to encounter challenges. The first challenge is related to the lack of security for private data. Gai, Qiu, Sun and Zhao (2017) claim that users may experience malicious behaviour and financial attacks. FinTech applications require critical personal information that can be stored on mobile devices, and the devices may be lost or stolen. The security of the devices may also be compromised through payment applications (KPMG, 2019, 2020a, b; Deloitte. 2022a, b).

Another challenge concerns FinTech companies' regulation peculiarities (Basel Committee on Banking Supervision, 2018). In the FinTech sector, there is an extensive choice of where to lend and buy or sell; therefore, this is often done domestically and in other countries. Inconsistencies between national regulatory regimes create additional risks in protecting consumer rights.

The third significant challenge is related to investment risk, which users may face. FinTech businesses may have to take potentially serious responsibilities for losses due to the algorithmic failure of the robo-advisors (European Central Bank, 2018; Guudici, 2018; Lee and Shin, 2018).

Thus, a person participating in FinTech activities faces multiple risks related to personal data security, law inconsistencies, and investment automation. Using financial technologies, the public undertake potential risks and decides whether a newly developed service provided through technology is worth taking these risks.

A review of the literature provided above shows the following gap: it still has to be answered how users of FinTech perceive advantages and challenges brought by financial innovations. Our research aims to fill this gap by studying users' opinions on social media.

Research Methodology

Data reflecting FinTech users' attitudes are collected by searching public posts on Twitter ('Tweets'). For that, purposefully chosen keywords were used. The obtained data on consumer opinion is later processed with MATLAB (2022 a,b) application, which uses the methods of text analysis and sentiment analysis. The research focused on consumers' views on FinTech challenges. The study was carried out in three stages.

The first stage is data mining

Social network analysis allows us to extract consumer opinions from texts they created. Social networks are usually classified according to the users' needs, e.g. communication, community, and innovative networks. Communication networks are intended for exchanging information of interest and are not restricted by territory, profession, etc. Communication networks embrace Twitter, where the data for this study was obtained. The authors extracted records containing phrases of interest (see Table 3 below). Data were processed using Sentiment Visualization (2019) application.

Table 3. Keywords used for sentiment analysis concerning FinTech challenges

Investment management	Consumer management	Regulation	Technology integration	Security and privacy	Risk management
'FinTech investment'	'Smart lending'	'Govtech'	'Artificial intelligence	'Cyber security	'Fintech risk management
	'Fintech lending'	'Financial regulations'	'Big data technology	'Fintech privacy'	'Fintech sandbox'
			'Digital bank'		

Source: developed by the authors

All Tweets containing at least one keyword from the whole phrase were collected for analysis (insignificant and irrelevant comments are omitted). Words with hashtags were removed from the data lines. To avoid the language barrier, the selected Tweets are in English. The place of a comment, i.e. its location, should have been considered. Hence, the comments chosen for analysis were posted in English (November 2020–November 2021) worldwide and are related to FinTech.

The second stage is data analysis

Selected Twitter phrases generated an Excel file from which the application extracted sentiments for analysis. Using MATLAB codes for text analysis MATLAB (2019a) and sentiment analysis MATLAB (2019b), queries were sent to analyse phrases reflecting positive and negative sentiments.

Text analysis is a method of analysing big data that identifies a field of interest associated with selected keywords. The main steps of this technology are as follows:

- data collection, unification of file extensions;
- the creation of a matrix of documents and keywords. This step results in finding the most repetitive word in the selected document set;
- extraction of information. The information collected about the most commonly used words in the social network reflects the network users' opinions and the chosen topic's main highlights.

Sentiment analysis relies on an opinion lexicon, which consists of a list of approximately 6,800 positive and negative words. Hu and Liu (2004) were the first to describe this method of using an opinion lexicon. The sentiment analysis steps are as follows:

- data collection, unification of file extensions;
- objectivity-subjectivity analysis classifies texts into neutral and sentimental;
- positivity-negativity classification divides texts containing sentiments into positive and negative;
- interpretation of results allows assessment of dossier sentiments.

The obtained information reflects the opinion of social network users on the chosen topic.

The third stage is the interpretation of the findings

The findings are presented in a word cloud, which is made up of the most frequently used words. Words are classified as positive and negative and are presented in separate charts. The colour and size of the terms are not accidental: more frequently used words are more significant and thicker (see Figure 2 below).

Textual Analysis of Public Opinion on the Development of Financial Technologies

A survey of FinTech firms shows that the number of businesses is expected to grow. The question arises as to whether FinTech firms generate high incomes and act according to public expectations. Customers use such services because it is new, innovative, and fashionable, not because they trust FinTech services, just like standard financial solutions. Text and sentiment analysis of public opinion on the FinTech sector was conducted to reveal public opinion.

Text analysis

12 essential phrases relating to FinTech challenges have been selected to perform text analysis each week of the year:

- ‘Fintech investment’ – the phrase repeated in average 217 tweets per week;
- ‘Smart lending’ – the phrase repeated in average 49 tweets per week;
- ‘Fintech lending’ – the phrase repeated in average 201 tweets per week;
- ‘Govtech’ – the phrase repeated in average 239 tweets per week;
- ‘Financial regulations’ – the phrase repeated in average 263 tweets per week;
- ‘Artificial intelligence’ – the phrase repeated in average 269 tweets per week;
- ‘Big data technology’ – the phrase repeated in average 93 tweets per week;
- ‘Digital bank’ – the phrase repeated in average 221 tweets per week;
- ‘Cyber security’ – the phrase repeated in average 257 tweets per week;
- ‘Fintech privacy’ – the phrase repeated in average 122 tweets per week;
- ‘Fintech risk management’ – the phrase repeated in average 43 tweets per week;
- ‘Fintech sandbox’ – the phrase repeated in average 50 tweets per week;
- ‘Financial technology’ – the phrase repeated in average 161 tweets per week.

The number of keywords reflects the popularity and relevance of specific topics during the study period. The most discussed social network topics are artificial intelligence, financial regulations, and cyber security and the least about FinTech risk management, smart lending, and FinTech sandbox. For text analysis, a MATLAB (2022a) algorithm was selected to analyse the selected Tweets. The resulting data cloud is presented in Figure 2.



Figure 2: Text analysis using the keyword ‘FinTech’

Source: developed by the authors

An analysis of the phrases shows that it is not the word 'FinTech' that was used most times, but it is the word "investment". In our initial data analysis, we found that a large proportion of Tweets links to RTs. 'RT' is a global news network, a news agency that usually posts Tweets on the topic of FinTech. This shows that most posts on FinTech are written by a news agency interested in this area. The news agency itself, as well as individuals talking about FinTech, are also interested in banks, finance, technology digitisation, security, and regulation. It turned out to be interesting whether opinion makers like RT change the results of textual and sentiment analysis. Figure 3 plots the eight most frequently used words from the complete data set (left) and the data set in which the RT entries are eliminated (right).

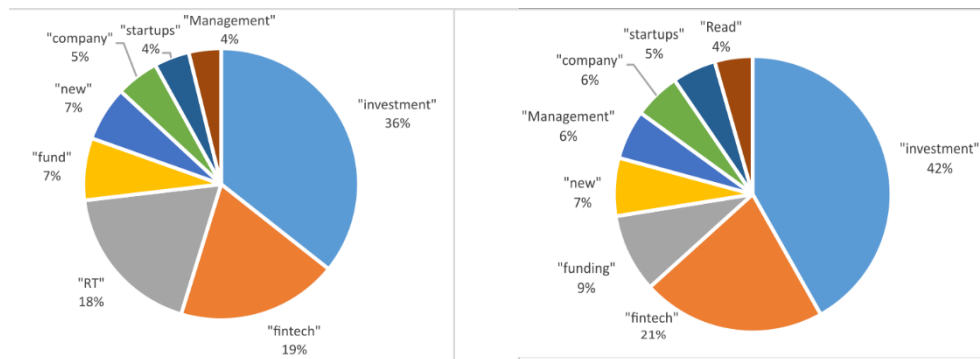


Figure 3: Words most frequently used in text analysis (on the left complete data set is used, and on the right RT entries are eliminated from the entire data set).

Source: developed by the authors

The list of most popular words did not change significantly after the RT messages of the opinion maker were eliminated. Text analysis allows us to understand what people write and are interested in when discussing Fintech. Text analysis also allows us to interpret people's interests and offer ad hoc services accordingly. Presently, Tweets about FinTech are mostly related to the global news network, which is closely linked to investment. Investors are a very active community that shares their insights on social media.

Textual analysis reveals only the mathematical distribution of the most frequently used words. Still, to know about the mood prevailing in the research area, it is necessary to evaluate the positivity and negativity of the messages.

Sentiment analysis

Sentiment analysis is performed using a MATLAB (2022b) algorithm to examine public opinion about FinTech. Financial technology activities face challenges that complicate the sector's development and hinder its growth. The present research analyses critical phrases related to these challenges. Positive and negative feedback from consumers will reveal what drives FinTech development, provides expansion opportunities, and what poses significant challenges based on public opinion.

Sentiment analysis reveals the public's view of different challenges in the FinTech sector. Table 4 presents all the results obtained from sentiment analysis for six other challenges. The database for analysing public opinion comprises key phrases for Tweets, which reflect the challenges facing the FinTech sector:

- the investment management challenge is defined by FinTech investment;
- the consumer management challenge is determined by intelligent lending and FinTech lending;
- regulation is defined by 'govtech' and financial regulations;
- the technology integration challenge is represented by artificial intelligence, big data technology and digital bank;

- the security and privacy challenge is defined by cyber security and FinTech privacy;
- the risk management challenge is determined by the phrases 'fintech risk management' and 'fintech sandbox'.

A MATLAB (2022b) algorithm was employed to divide public opinion into positive and negative comments for sentiment analysis. Firstly, Table 4 presents a general view of investment management in the FinTech sector. The most powerful words are written in bigger and thicker letters. It is visible that negative sentiments are more important. The public thinks investment management needs to be addressed and addressed, disrupted and weak. However, positive emotions are less critical and are not used as often as negative ones.

The negative side is more critical in this sentiment analysis of public opinion on consumer management in the FinTech sector. The public sees consumer management as an affordable service and talks the most about it, though it emphasises that it is inefficient and outdated. This creates people's mistrust that risks will not be contained and FinTech consumer management cannot be trusted.

Public opinion on regulation in the FinTech sector was the next investigated topic. The most significant advantage that the public sees is FinTech being personable. Consumers are satisfied with current rules and feel secure when using technologies. Moreover, regulation is informative, as the public can easily access information which is of concern to it. As regards negative sentiments, the public thinks that law is mismanaged and accuses it. According to the created word clouds, personability outweighs negative attitudes.

The study of public opinion on technology integration in the FinTech sector shows that positive sentiments are more important. The public sees technology integration as a partnering, a goal achieved, a well-guided area. The biggest problem in the area of technology integration that concerns consumers is the threat. While technologies are supported and viewed positively, the danger remains, and the public feels it.

Public opinion on security and privacy in the FinTech sector is relatively positive. The public considers that security and privacy are customised for safe use and is thankful to FinTech for its ambition to contain these two risks. The public views encroachment and malfunctioning as negative security and privacy challenges.

The negative side prevails in the study of public opinion on risk management in the FinTech sector; since FinTech is defined as facing risks, there exists mistrust of cryptocurrencies. One of the more significant benefits is that the public perceives the risks as seamlessly resolved. Table 4. presents the most significant positive and negative sentiments related to challenges faced by the FinTech sector.

Table 4. General sentiment analysis of challenges faced by the FinTech sector

Challenge	Positive attitude	Negative attitude	Prevailing public attitude
Investment management	Enhancing Achieved Congrats Valued Insights	Ignored Disrupted Weakness Busted Expiry	Negative
Consumer management	Affordable Partnering Achieved Thanks Scalable	Inefficiencies Outdated Eurozone Slammed Caused	Negative
Regulation	Personable Thanks Informative Congrats	Mismanagement Blaming Warns Bureaucratic Underfunded	Positive
Technology integration	Partnering Guided Achieved Thanks Partnered	Threatened Warned Outdated Overuse	Positive
Security and privacy	Customised Thanks Achieve Achieving	Blacklists Encroaching Malfunctioning Doxing Outdated	Positive
Risk management	Seamlessly Provide Helps Ensure Partnership	Baltic Facing Tactics Cryptocurrency Face	Negative

Source: developed by the authors

When comparing all sentiments, the public singles out such FinTech advantages as collaboration and achievability. The users are optimistic about regulation, technology integration, security and privacy.

The reasons that prevent the public from using financial technologies are an investment, consumer and risk management. Those are challenges faced by users; they hamper FinTech development.

FinTech shortcomings must be eliminated because if the public does not trust consumer management and relies on the assumption that risks are insufficiently

controlled, this will result in the non-use of technology and hinder financial technology development and growth.

Conclusion

The research allowed identifying attitudes of users towards FinTech services. Anyway, it has own limitations. The study sample includes only people who discuss on social networks; just textual information on Twitter was examined. The users are concerned about use of artificial intelligence, differing financial regulations in various countries, and lack of cyber security; the least discussed topics are FinTech risk management, innovative lending, and FinTech sandbox. The study led to novel insights, revealing that the development of financial technologies is hampered by the sector's challenges in the areas of investment management, consumer management, regulation, technology integration, lack of security and privacy. Those areas require special attention of FinTech companies in their activity. Revealed FinTech gaps need to be taken into account in order to ensure that the users develops confidence. The greatest challenge and opportunity for the development of FinTech firms are positive attitude of the public. Therefore, users' opinions have to be monitored and studied. The obtained results may be instrumental for policy makers, investors and financial services developers.

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WGLĄD W POSTAWY UŻYTKOWNIKÓW WOBEC INNOWACYJNOŚCI FINANSOWYCH

Streszczenie: Znaczące postępy technologiczne zdeterminowały znaczenie firm FinTech na całym świecie; przyciągają znaczne inwestycje i wywierają presję konkurencyjną na banki świadczące tradycyjne usługi. Rozwój innowacji finansowych stanowi wyzwanie dla

użytkowników przyzwyczajonych do klasycznych rozwiązań finansowych, ponieważ zaufanie do technologii finansowych wymaga oceny ryzyka, która staje się coraz bardziej skomplikowana. Głównymi uczestnikami kształtującymi podejście do FinTech są inwestorzy, klienci, organy regulacyjne, twórcy technologii i menedżerowie ryzyka. Artykuł ma na celu zbadanie możliwości i wyzwań FinTech, tak jak rozumie je opinia publiczna. Autorzy wykorzystali źródła naukowe i zastosowali metody przetwarzania dużych zbiorów danych, aby ocenić nastawienie użytkowników mediów społecznościowych do sektora FinTech. Uzyskane wyniki pokazały, że pomimo ogólnie pozytywnego nastawienia, firmy FinTech muszą zwracać szczególną uwagę na zarządzanie inwestycjami oraz zapewnienie bezpieczeństwa i prywatności danych klientów.

Słowa kluczowe: technologie finansowe (FinTech); inwestycja; ryzyko; rozporządzenie; konsument; opinia publiczna; Twitter; analiza tekstu i nastrojów

洞察用户对金融创新的态度

抽象的。重大的技术进步决定了全球金融科技公司的重要性:它们吸引大量投资并对提供传统服务的银行施加竞争压力。金融创新的发展对习惯于传统金融解决方案的用户提出了挑战,因为对金融技术的信任需要风险评估,这变得越来越复杂。塑造对金融科技态度的主要参与者是投资者、客户、监管机构、技术开发商和风险管理者。本文旨在探索金融科技的机遇和挑战,正如公众所理解的那样。作者使用科学资源并采用大数据处理方法来评估社交媒体用户对金融科技行业的态度。获得的结果表明,尽管总体态度积极,但金融科技公司必须特别注意投资管理并确保客户数据的安全和隐私。

关键词: 金融科技 (FinTech) ; 投资; 风险; 规定; 消费者; 舆论; 推特; 文本和情感分析