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From Tweets to Telecom Intelligence: Text Mining and Sentiment Analysis of Pakistan's Cellular Network Competition

Research Article

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Abstract: Social media platforms have become important sources of publicly available user-generated content that can be utilized by organizations to understand customer perceptions, monitor competitors, and support data-driven business decision-making. In highly competitive industries such as telecommunications, social media interactions provide valuable insights into customer engagement, brand visibility, service perception, and market response. This study presents a case study of competitive intelligence based on text mining and sentiment analysis using Twitter/X content from four major Pakistani cellular network companies, namely Mobilink/Jazz, Ufone, Zong, and Telenor. The study examines social media activity patterns, tweet distribution, customer interaction, and sentiment polarity to identify differences in the online presence and engagement strategies of these companies. WordStat was used to support text mining analysis, while SentiStrength was applied to classify tweet sentiment into positive, negative, and neutral categories. The findings indicate that the volume and type of tweets are closely related to customer engagement and brand interaction. Among the analyzed companies, differences were observed in tweet frequency, polarity distribution, and the level of customer response. The results show that Twitter/X can serve as a useful platform for extracting competitive intelligence, especially for understanding public sentiment and improving customer relationship strategies. This study provides practical insights for telecom companies seeking to strengthen their social media-based competitive intelligence models and enhance their responsiveness to customer needs.

Keywords: Social media intelligence, Twitter/X analysis, Sentiment analysis, Text mining, Competitive intelligence

1. Introduction

Since the early 2000s, social media has played a significant role in bringing individuals from all over the world together. As a widely available way of communicating with the rest of the world, social media has been a huge aid in getting people's voices and views heard all across the world. The number of individuals employing social media has

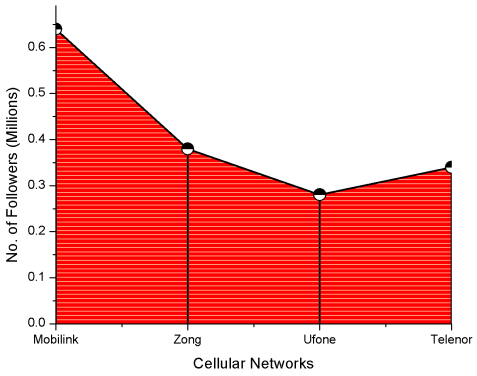

Figure 1. Comparison of Twitter/X followers between cellular networks

increased at an exponential rate since its inception in the early 2000s. All opinions, reviews, comments, likes, and dislikes help a company assess its worth among its customers [1], and as a result, today's businesses and brands rely significantly on social media to advertise themselves and cultivate a favorable reputation. With so much content generated for both organizations and clients on social media platforms, making crucial business decisions with this data is a smart idea [1, 2]. The risk of missing a critical component that might impact decision-making increases when evaluating such a large number of structured and unstructured data by hand. Automated solutions that collect data, help in efficient data visualization, promote logical business decision-making, or accurately tap into brand performance come into play here [3].

Text mining can assist increase competitive intelligence by utilizing social media as a trustworthy source of information. In all professions, all technologies are ready to exercise their true nature in a major way. This article tries to objectively and subjectively assess four cellular network companies social media accounts. Mobilink, Ufone, Zong, and Telenor are the four companies that are selected for this case study. All four work in Pakistan's cellular network industry and earn large sums of money each year. Twitter/X was chosen as the social media channel for this content. More than 338 million monthly active users of social media platforms, Twitter/X is a popular social networking platform. Furthermore, Twitter/X has a reputation for being a sophisticated social network, which is why nearly every company has a Twitter/X account. Mobilink/Jazz [4] has approximately 0.611 million followers on Twitter/X, Zong [5] has approximately 0.370 million followers, Ufone [6] has approximately 0.264 million followers, while Telenor Pakistan [7] has approximately 0.346 million followers, as shown in Figure 1. We utilize WordStat software for data mining and Senti-Strength for sentimental analysis in this paper. The following is the rest of the article's detail after the introduction: Section II summaries the literature review on social media platforms along with the competitive analysis. In section III, the structure of a competitive analysis system and its applications are given to corporate decision-making. Section IV provides a detailed case study of four cellular network companies, complete with research questions, methodology, procedures, and findings. The findings are discussed in Section V. The implications are discussed in Section VI, and the research case study is concluded in Section VII.

1.1. Social Media Platforms

Social media platforms [8] are defined as "computing technologies that allow individuals to share and produce a wide range of expressions in real time on the internet" . Social media platforms are classified into six categories: social media (for example, Facebook and LinkedIn), news (for example, Reddit), microblogging (for example, Twitter/X), media sharing websites (for example, Youtube, Instagram, and Dailymotion), bookmarks, and forums [9]. Figure 2 shows different categories of social media networks.

As well as being a tool for narrowing the gap between individuals, social media has evolved into a strong company marketing tool. Public, on the other hand, think that companies are not utilizing social media effectively as seen in Figure 3.

Positive and favorable remarks on company social media platforms send positive energy to the firm, but dislikes and negative feedback have a major negative impact [10]. Social media platforms enabled businesses to communicate with their customers in a two-way rather than one-way as in conventional media. They [11] have underlined the need of changing the market's perception of social media in a business's favor. Businesses must utilize social media platforms for marketing and company promotion rather than just to use for communication purposes. They [12] have emphasized on how social network platforms may be utilized to forecast real-world consequences. They have placed a special emphasis on Twitter/X as a source of sentiment analysis. In article [13] they created a prediction model with an estimated accuracy of 85 percent that maps the interaction of social media platforms to tie strength. Several studies have confirmed the relevance of social media in the effective growth and marketing of any business. Table 1 compares two of the most

Figure 2. Categories of social media

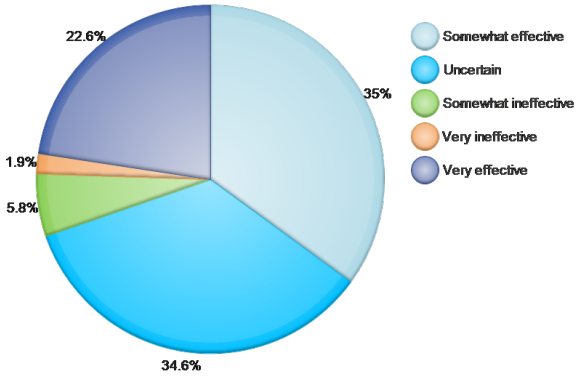

Figure 3. Effectiveness of social media

popular social media platforms (Facebook and Twitter/X).

1.2. Social Media Competitive Analysis

Business information is essential for staying ahead of the competition. A business monitors the growth, trends, and plans of competitors for future movement. Competitive analysis is a similar method that is extensively utilized in business industries. The traditional competitive analysis had its own set of challenges. Data was gathered from a variety of hard and soft sources, both organized and unstructured. Authentication from a variety of sources seemed doubtful, and then correctly evaluating the data in such a short amount of time was also a tough task. However, organizations digital presence on social media has made these duties very straightforward. First, authentic data is collected and evaluated in real time in competitive analytics. This search has benefited greatly from machine learning algorithms and data mining tools, and the results are astounding. When it comes to product information, customer service, promotions, and new releases, brands must be proactive in their communications with customers [14]. According to the report, not only can a business use social media to monitor behavior of customers. Consumers, on the other hand, may use social media to compare items from the same region and voice their thoughts on them. Because these opinions have such a big impact on other customers' purchase decisions, businesses must constantly monitor consumer behavior in order to establish risk management policies and enhance company strategies in comparison to their competitors. In terms of low-cost productivity, companies who use social media technology beat the competition [15]. Because social media is such a strong weapon, it may boost a competitor's social media performance, visibility, and activity. It must also be monitored in order to make smart decisions in an emergency. They [16] implemented such methods, and the results demonstrated how useful social media is for competitive intelligence. They [17] also analyzed social media platform data and text mining techniques to assess how important competitive performance is in social media intelligence. It also illustrates the impact of the competitor's marketing and its impact on the consumer's sentiments. In more studies, text mining techniques are employed for competitive intelligence.

Table 1. Facebook and Twitter/X Comparison

Social Media Network	Followers	Focus	Per day content share	Age 35+ users/year	Male	Female
Facebook	1.15 B	Networks People	2.5 B	65%	40%	60%
Twitter/X	560+ M	Networks Ideas	4.5 B	55%	40%	60%

1.3. Text Mining

Text mining [18] is a technology-based method for extracting information from both structured and unstructured sources. Text mining's goal is to extract relevant content from a set of social media texts and then transfer that content to data mining algorithms to provide analyzable findings [19]. The majority of these breakthroughs have been applied to different learning models like supervised and predictive models. Opinions are classified as top objects that, when coupled with data mining techniques and methodologies, may greatly help decision-making systems for individuals who value their opinions [3]. Analysis of social networks via text mining has expanded so fast that social networks research in media intelligence is already a well-known practice. It has successfully expanded its range of applications from academia to the corporate sector [20]. Both the texts and the links are good for obtaining concrete findings from social networks analysis. Instead of working with a single path, a technique has been described that attempts to employ a mix of text and link mining to generate a more detailed analysis for future decisions [21]. Consumer habits patterns toward multinational companies are investigated using text mining tools. Twitter/X, according to several studies, is a more trustworthy source for determining client opinions about multinational businesses. Research also generates suggestions for restructuring marketing campaigns and promotional activities for global corporations [22]. In [23], a case study of two UK-based businesses that gathered and used personalized Twitter/X evaluations to track performance. The usage of text mining on Facebook and Twitter/X is being investigated to see whether there are any substantial issues with consumer-generated processes [24]. Many famous methods like natural processing language (NLP), computational linguistics, and information retrieval (IR) along with data mining are used for business intelligence by extracting content from unstructured data [25].

Table 2. Comparison of sentimental analysis studies

Paper	**Application**	**Dataset**	**Language**	**Discussion**
[27]	Online documents	IMDb	English	They use sentiment analysis to check whether a movie review is positive or negative
[28]	Warehouse management system	Grocery Stores in Taiwan	English	They proposed an approach to find the optimal storage assignment for newly delivered products
[29]	Stock market	Twitter/X dataset	English	They investigated whether measurements of collective mood states derived from Twitter/X feeds are correlated to the value of DIJA
[30]	Airline sentiment analysis	Twitter/X dataset	English	They proposed DICE to address language ambiguity and removes noise by performing spell correction, sentiment aware tokenization
[31]	Natural disasters	Twitter/X dataset	Spanish	They investigated the natural disasters and social movement problems using sentimental analysis
[32]	Twitter/X insight	Twitter/X dataset	English	They deeply investigated current research topics in Twitter/X focusing on structure of social graph, sentimental analysis and threats
[33]	COVID-19 outbreak	Twitter/X dataset	English	They investigated how people, government organizations and media agencies broadcast the COVID-19 situation

2. Related Work

2.1. Sentiment Analysis

Sentiment analysis is a text mining technique that aims to determine the positive and negative aspects of a text. Some texts fall into the neutral sentiments, in addition to being positive or negative. The three texts may be detected with millimeter precision using sentiment analysis. Sentiment analysis's power is equally evident in the business. In [26], authors used IMDB dataset and applied sentiment analysis on movie reviews. In [27], authors applied sentiment analysis on grocery stores in Taiwan to find optimal product storage. Recently, sentiment analysis algorithms have been applied to derive ideas from gathered product reviews [28]. These evaluations were divided into two categories: negative and positive. Many earlier publications have employed sentimental analysis, such as categorizing a movie review as "thumbs

Figure 4. Text mining process for social media content

up" or "thumbs down." Concentrating on subjective aspects of the content and use methods to identify minimum gaps in visuals. Sentimental analysis are also used to forecast airlines performances [29]. In addition, sentimental analysis also used to detect natural critical disasters [30]. Moreover, businesses may utilize social network postings to deduce general consumer behavior toward their products, services, and use this knowledge to strengthen customer interactions. The average population on Twitter/X may also have a significant influence on any company's performance [31, 32]. In the study [33], data-sets from over 1 lac 50 thousand tweets were studied, and their findings were that neutral tweets are retweeted less and more slowly than emotional tweets, which are likely to be retweeted more rapidly.

3. Competitive Analysis Structure

A methodology for doing text-based competitive analysis on social media is shown in Figure 4. In this structure multiple approaches are used like content analysis, text mining, sentiment analysis, statistical analysis, and social media analysis [34]. These techniques are sophisticated and come from a variety of disciplines, including computer science, social science, statistics, and computational linguistics. All of these approaches have been evaluated in several studies and have shown their usefulness and efficacy each time. A hybrid approach can also be employed to do a more robust analysis, as long as the precision does not drop. Various ways may be utilized to make advantage of the data accessible on social media sites. Most popular social networking platforms, such as Twitter/X, Facebook, Instagram, and YouTube, now allow you to access your data through their application programming interfaces (APIs). These APIs are integrated into your application and allow you to transmit data from one platform to another, such as data tracking. It is the most efficient method of data transmission. Any business that uses these APIs may track data and find the information they need quickly and simply. However, many other platforms, such as blogging websites and social forums, do not provide APIs for data tracking. Some of these systems offer a very basic syndication feed (RSS) that is very easy to use. These feeds are easily accessible using Google Reader and Yahoo. On blogging and social forum websites that do not provide RSS feeds, manual HTML copying and parsing techniques can be utilized.

These ways can be time taking but this is the only way left behind in case of no API or RSS feed. The commonly used applications tools used for data collection from the Twitter/X platform are DD-CSS, Netlytic, Twitonomy, and Tweepy [36]. For Facebook Digital-footprints and SocalMediaMineR are used. Whereas, SnoopReport and All My Plus are used for Instagram.

Once gathered, the data is kept in the back-end repository before being collected for analysis. In addition, the platform makes it simple to store competitive data on social media. We may continually monitor and evaluate the actions of our competitors on social media platforms based on the data gathered, in order to build software systems that collect, process, and analyze data. The analysis results is utilized to produce competitive reports. Reports can be generated on a daily, weekly, or monthly basis to track competitor market positions, customer satisfaction, marketing techniques, and supply chain capabilities. According to studies, a business may enhance efficient customer service to attract consumers when competitors lack effective customer service. In the stock market, competitor performance patterns may also be examined to improve strategies and stock performance. Table 2 shows the comparison of sentimental analysis studies.

4. Cellular Networks Case Study

4.1. Research Questions

This case study looks at four Pakistan cellular network companies that compete in the same sector. The companies are Mobilink, Zong, Ufone, and Telenor. This research looked at their Twitter/X page and used text mining and sentiment analysis to evaluate unstructured text material. The study specifically seeks to answer the following questions:

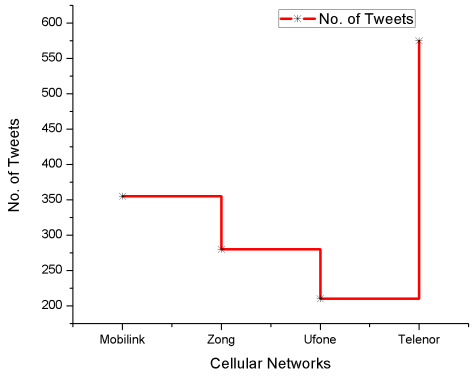

Figure 5. No. of Tweets in March–August 2021 for the four cellular networks

- What patterns can be found from their Twitter/X site?
- What are the primary differences between patterns?

4.2. Methodology

4.2.1. Context of the study

The telecom sector in Pakistan is one of the fastest expanding areas of the economy and a significant enabler. There are an estimated more than 100 million cellular customers, and the industry employs roughly 1.36 million people directly or indirectly [35]. Currently, in Pakistan, four cellular networks are popular among the public named as Mobilink/Jazz, Zong, Ufone, and Telenor. Many of these businesses continue to promote their products using traditional techniques. However, a large number of these businesses have adopted the technology and, as a consequence, are active on the main networking platforms like Facebook, Twitter/X, and Instagram. Among them Facebook and Twitter/X are most popular social media networks. All four businesses have a sizeable social media following, but little research has been conducted on how they use social media for commercial reasons. As a result, the focus of this article is on the social networks competitive study of four Pakistani cellular networks based on their Twitter/X presence. Right now, according to their public presence and Twitter/X followers, Mobilink/Jazz is in the first place, Telenor is in second, Zong is in third, while Ufone stands last in fourth place. Table 3 retains the historical subscriber counts from 2016 to 2025.

Table 3. Cellular network subscriber history and latest PTA subscriber market-share snapshot [35]

Network	2016-17	2017-18	2018-19	2019-20	2020-2025
Mobilink/Jazz	52,470,638	55,469,118	59,470,721	62,808,245	75 Million
Ufone	18,397,981	20,314,686	22,616,449	22,323,713	29 Million
Zong	28,084,677	30,890,633	34,713,311	36,712,560	54.67 Million
Telenor	40,804,820	43,564,216	44,221,147	45,424,353	43 Million

4.2.2. Procedure

To address the research questions, we conducted a social media competitive analysis in two phases for the Twitter/X site of the four cellular networks of Pakistan. First, we manually gather quantitative information from their Twitter/X accounts, such as the number of followers, tweets, retweets, comments, shares, and likes, as well as the frequency of tweets. The data was largely collected from tweets sent between March 2021 to August 2021. Following the completion of the data collection, different analytical methods, such as sentiment analysis and text mining, were used to better understand the businesses of these organizations. The analytic method assisted us in comprehending commercial arrangement's and provided a clearer understanding of the social media practices that follow brands. The data for this study was collected from March 1, 2021, to August 10, 2021. All of the data was compiled into an Excel (.xls) file for analysis.

The analysis in this case study has been extended to include qualitative data. Text mining software was utilized to analyses text data, and sentiment analysis was performed to uncover core categories and insights in order to gain a better understanding of possible patterns for future study. WordStat [36] is utilized in this work as a text mining technique. WordStat is a popular text mining program that combines a number of machine learning algorithms to analyze user interfaces for data mining jobs. WordStat has been used in several studies on data preprocessing, classification, and regression along with data mining. Sentiment analysis is utilized in this case study to gather information about a brand's reputation among competitors and consumers. It also emphasizes the ability to comprehend consumers' sentiments,

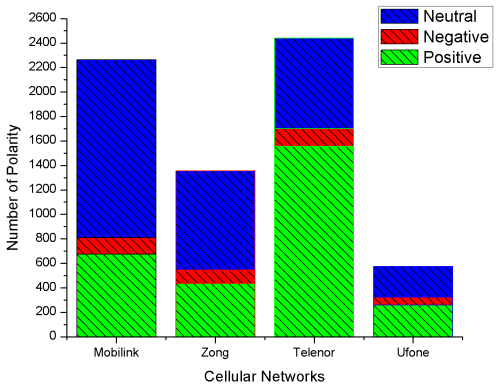

Figure 6. Number of tweets comparison

attitudes, and points of view about a certain brand. Sentiment analysis was carried out using the Sentistrength tool [37]. This popular tool analyses the intensity of positive, negative, and neutral polarities in tweets from Mobilink, Zong, Ufone, and Telenor's Twitter/X accounts. The data was extensively examined and studied in order to identify hidden trends and create actionable feedback and suggestions in term of results. The results of the analysis are outlined below.

4.3. Findings

The qualitative data collected manually from the four businesses Twitter/X accounts, including the number of comments, likes followers, tweets, and retweets, was examined. In this research, the data from each business was from March to August 2021, and the comparative interaction with clients or followers was considered.

The following shows a pattern of tweet counts for the major four cellular networks of Pakistan from March 2021 to August 2021: Twitter/X accounts for Mobilink [4], Zong [5] , Ufone [6], and Telenor [7]. In all, one thousand four hundred twenty (1420) original tweet posts were gathered from the four Twitter/X sites. The Telenor Twitter/X site received the most original tweet posts, with 575 messages placed on their site. Mobilink had 355 messages, Zong had 280 messages, and Ufone had 210 messages. Figure 5 depicts the number of original tweets posted on four Twitter/X sites on various days from March 2021 till August 2021. For sentiment analysis, these original posts were further processed into polarity-coded text units; therefore, the totals in Table 4 refer to polarity instances extracted from the tweet text rather than to the number of original tweet posts.

As seen in Figure 5, the peak period for tweets does not occur at the same time. One explanation for the variance is that the four cellular network companies offered various events and special offers on different days, such as deals, discounts, and incentives.

After that tweets were examined in greater depth in terms of positivity, negativity, and neutrality while the polarity of the tweets is shown in Figure 7. Moreover, Table 4 displays the distribution of tweets with respect to polarity. Figure 6 demonstrates that Telenor has the most tweets, and hence has the most positive, negative, and neutral tweets of any company. Following a comparative analysis, Figure 7 depicts the results of individual company. In Figure 7(a) and Figure 7(d), neutral polarity of Zong and Mobilink/Jazz tweet's are greater than positive and negative polarity. While in Figure 7(c) and Figure 7(d), positive polarity of Telenor as well as Ufone tweet's are greater than neutral and negative polarity. In the March-August 2021 timeline, there were 1557 polarity-coded text units from Mobilink/Jazz, 1356 from Zong, 3145 from Telenor, and 575 from Ufone, respectively. In Figure 7, it is clearly seen that Telenor has more polarity-coded text units w.r.t to positive, negative, and neutral and it is mainly due to large number of tweet-derived text units from Telenor. Moreover, the quantity of tweets differs greatly among the four firms, hence, it is impossible to establish a fair comparison. The ideal solution would be to adjust the amount of tweets such that they are equivalent. This may be accomplished by taking a proportion of each other's positive, negative, and neutral tweets.

Figure 8 depicts the proportion of these companies positive, negative, and neutral tweets using pie charts. It can be seen that Telenor has the fewest negative tweets (4.29 percent), followed by Zong, which has approximately 8.04 percent, Mobilink/Jazz has about 9.18 percent, and Ufone has the highest negative tweets about 11.65 percent.

5. Discussion

Positive customer experiences may entice customers to become active brand ambassadors, improve brand loyalty and recommendations, and, eventually, increase revenue and profitability. According to a recent study [38], "one out of every three participants satisfied with the suggestion of a friend obtained through a social network platform such as Facebook or Twitter/X." As a result, it is acceptable to declare that the emergence of social media platforms has increased the power of customers [39]. Our case study provides first-hand evidence to confirm [40] argument that social networks are

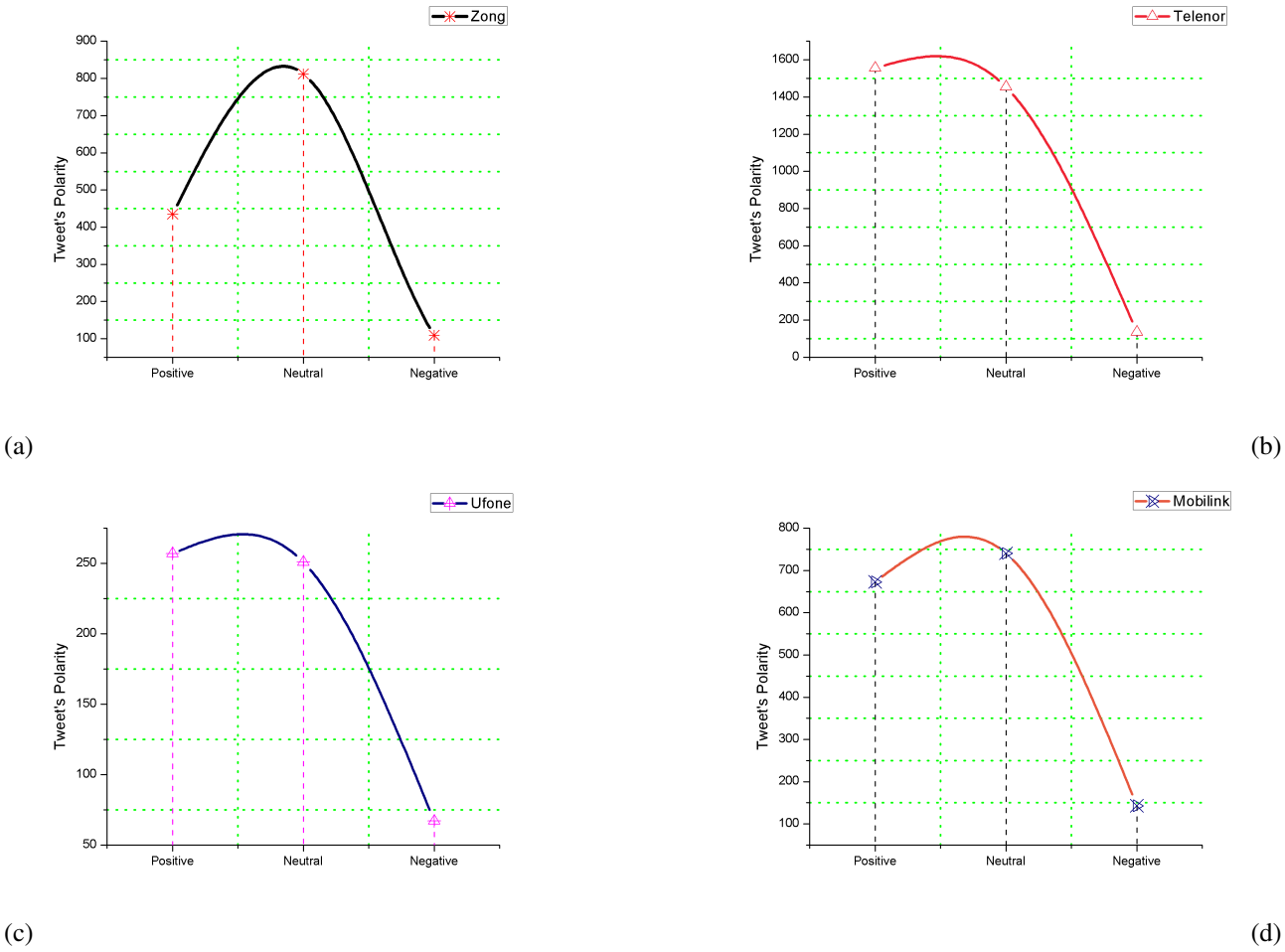

Figure 7. Cellular Network Tweet's Polarity

Table 4. Distribution of polarity-coded text units w.r.t polarity

Network	Positive	Negative	Neutral	Total
Mobilink/Jazz	673	143	741	1557
Zong	435	109	812	1356
Telenor	1556	135	1454	3145
Ufone	257	67	251	575

transforming the customer service sector and forcing more companies, such as cellular network providers, to enhance their client services. The findings show that the four main cellular network companies are active on Twitter/X site and have invested significant resources in their social media activities. According to the data we studied they were committed to giving its clients a good experience. For example, if issues could not be answered right away, their customer Service personnel were quick to apologize and refer clients to a toll-free number or customer service for additional assistance. On the other hand, we've seen that level of engagement and commitment differ among organizations and social networking applications. Through the amount of tweets and user comments on social media, Telenor displayed a higher level of consumer engagement and participation than the other three companies. According to the PTA 2025 snapshot, Telenor's mobile subscriber market share was 21.9%, below Mobilink/Jazz's 37.3% and Zong's 26.2%, but above Ufone's 13.6% [35]; therefore, its social media initiatives are particularly noteworthy. During our review period, we saw that Telenor responded to user comments more efficiently, which demonstrates their dedication to monitoring and managing their social media activities. As per case study, the four main cellular network operators have invested heavily in social media to increase customer contact and create identities in online communities. Customers have been assigned specific staff people to engage with them and monitor the content they post on their social media applications. They have adopted social media as an extra communication and customer service tool to gather information about consumers' interests, preferences, issues, and actions in order to help them. For example, they used social media to poll consumers and seek their feedback and thoughts on topics such as call packages, data packages, 4G coverage regions, and new package ideas. Client ideas and suggestions have been utilized to improve the quality and coverage of the cellular network. Prior to the introduction of social media, consumers may express their gratitude or concerns by calling, emailing, faxing,

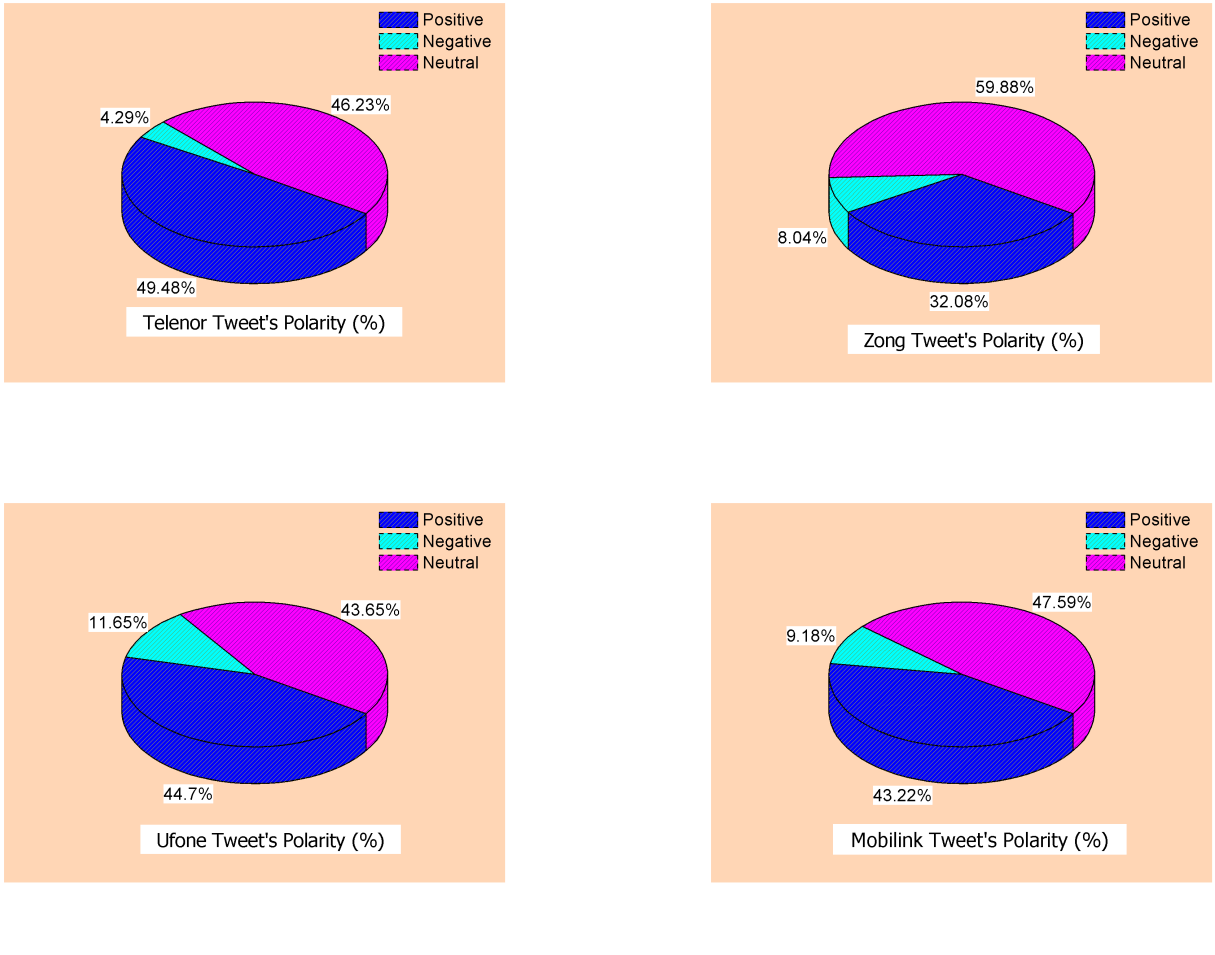

Figure 8. Cellular Network Polarity Percentage

or visiting the actual franchise and by doing this interactions occurred solely between a consumer and a seller. The communications were personal and could only be accessed by the company, and the content and quality of customer service were not made public. As a result, customers have little capacity to see or affect the interactions of other customers with a company. Customers may now openly publish their messages via social networking platforms, and the content of the communications is no longer confidential. Conversations between consumers and cellular network companies might attract the attention of other social network users who are not necessarily current customers of the company. Customers may also watch what other customers are saying about a company on social media networks, and they can follow how a company handles customer complaints on social media networks [41]. As a result, instead of serving a single client, a cellular network company's customer service becomes globally visible to a variety of users. Because social networking platforms enable consumers to speak with one another, managers have no control over the content, timing, or intensity of these discussions [42]. The influence of four cellular network companies social media (Twitter/X sites) on customer service is presented in this case study. Social media applications such as Facebook and Twitter/X, to some extent, serve as "a massive word-of-mouth machine that facilitates and accelerates the spread of information" [43]. As a result, businesses must actively watch social media in order to observe consumer discussions that cooperate them in order to respond to customer complaints and concerns in a timely way, to avoid and resolve any public image or brand disasters.

6. Conclusion and Future Work

This case study demonstrates that Twitter/X activity provides useful competitive intelligence for telecom companies, especially for understanding customer engagement and sentiment patterns. By combining text mining with sentiment analysis, the study shows that Pakistan's major cellular network companies actively use Twitter/X not only for promotion but also for customer interaction and service-related communication. The comparative findings indicate that tweet volume, polarity-coded text units, and engagement patterns can help firms monitor competitor activity and identify opportunities to strengthen customer relationships.

Future work may extend this analysis to additional platforms such as Facebook, Instagram, and YouTube, and may incorporate visual content, hashtags, comments, likes, complaints, and customer feedback. Storing such data in cloud-based systems could also support real-time tracking of consumer behavior and provide a deeper understanding of customer

expectations.

Declarations

Author Contributions Statement

Zupash Awais: conceptualization, methodology, validation. **Madiha Awais**: supervision, writing-original draft. **Ayesha Iftikhar**: writing-review and editing.

Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this article.

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Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Declaration of Generative AI in Scholarly Writing

During the preparation of this work, no AI tools were used.

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