

Sentiment Analysis to Explore User Perception of Teleworking in Saudi Arabia

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Abstract—Due to the emergence of the COVID-19 pandemic in 2019, many public and private organizations from different sectors in Saudi Arabia were forced to enforce teleworking as the main work arrangement. This paper seeks to understand the experience and attitude of the public toward remote work by analyzing Twitter data from March 2020 to July 2021 by using "Mazajak" the online Arabic analyzer. A corpus of 39,523 tweets with hashtags mentioning the teleworking program in Saudi Arabia was obtained. The results indicate that neutrality was the most prevalent sentiment with 58.21%, followed by positive sentiment with 30.67%. Thematic analysis was used to identify themes in the tweets with positive and negative sentiment. Flexibility, teamwork, teleworking preference, and learning were the major themes related to positive sentiment, while themes related to negative sentiment were private sector, companies, and fake.

Keywords—Mazajak; sentiment analysis; thematic analysis; telework; remote work

I. INTRODUCTION

Recently, the concept of teleworking or work from home (WFH) has been gaining in popularity due to the advancement in information technology and the emerging tools and applications for communication and task management. There are many definitions of teleworking, one of which views teleworking as a type of "work arrangement with high flexibility in which employees perform all or a substantial part of their work physically separated from the location of their employer, using IT for communication and operations" [1].

In 2020, a global public health crisis emerged due to the spread of the COVID-19 virus. The ensuing pandemic forced many national governments worldwide to adopt lockdown policies. Social distancing became mandatory, which compelled organizations to transition their employees away from regular work and toward telework, the aim being to protect employees and reduce the societal impact of the virus. These radical changes in the work environment have had both advantages and disadvantages. Ipsen et al. investigated the advantages and disadvantages of teleworking during the pandemic in Europe, classifying them into the following six categories: work-life balance, work efficiency, and work control (as the advantages), and home office constraints, work uncertainties, and inadequate tools (as the disadvantages) [2].

Before the COVID-19 pandemic in Saudi Arabia, firms from different sectors had limited experience with teleworking as a work arrangement. However, the situation after the pandemic in Saudi Arabia was – and continues to be – similar

to other countries around the world. In March 2020, teleworking was enforced on firms and organizations from different sectors as part of the precautionary measures to combat the COVID-19 pandemic. As a result, the pandemic gave rise to a forced experiment that led to significant changes in work methods across Saudi Arabia.

Several years before the pandemic, in 2016, the Saudi Ministry of Human Resources and Social Development launched a teleworking initiative [3], the aim of which was to fill the geographical gap between employers and job seekers based on the use of electronic work environment [4]. Despite the initiation of this teleworking program, teleworking was not popular prior to the pandemic. Understandably, its popularity has increased dramatically in Saudi Arabia in the wake of the ongoing pandemic.

In this research, we conducted a preliminary study in which 187 employees were targeted from different sectors. The sample consisted of 79.8% females and 20.2% males, 68.6% of whom were aged between 20 and 40 years. 30.3% of the sample was aged 41 to 60 years, and only 1% were older than 60. The majority of the participants (68.6%) held a bachelor's degree and 19.1% have a master's degree. The sectors represented in the sample were the educational sector (37.2%), public sector (32.4%), private sector (26.1%), and healthcare sector (4.3%). The results of this study show that 63.8% of the participants had never tried teleworking before the pandemic, which indicates that the teleworking concept is regarded as a relatively novel concept in the Saudi labor market.

This study's preliminary results suggest that the pandemic has prompted Saudi organizations to implement teleworking as a way of adapting to the global changes. These changes in the work dynamics around the world can be characterized as a double-edged sword in that they may affect both organizations and employees positively or negatively. This can cause different perspectives on the impact of teleworking.

Studying Public perspectives on the teleworking experience during the pandemic is an important factor for analyzing the overall experience and learning how to improve it. Furthermore, knowing the reasons behind the negative or the positive perspective of workforces is expected to aid businesses in utilizing teleworking to maximize its benefits. One way to analyze people's opinions toward a topic is through sentiment analysis. Sentiment is defined as the emotion behind a mention of a certain topic, brand, or service in the social universe. It is a way of gaining an understanding

of the feeling surrounding a topic, brand, or service [4]. A popular way to analyze sentiment toward a subject is by analyzing their social media posts, such as tweets, Facebook posts, and Instagram posts. Although there are several social media platforms for posting and sharing comments, Twitter was targeted in this paper. Twitter is an informal microblogging social media platform that allows users to share posts of up to 280 characters called “tweets” [5]. It provides an accessible and large amount of data, particularly given that there was an average of 206 million daily active users in 2021 [6]. Consequently, the large, timely, rich, and easily accessible data available on Twitter were the reasons for choosing this social media platform as the data source for this paper.

Despite the importance of analyzing the teleworking experience, the situation in Saudi Arabia has not been studied, to the best of the researcher's knowledge. This study aims to fill this gap by answering the following question: What is society's perspective and the public's opinion toward the teleworking experience in Saudi Arabia? In addition, this study seeks to achieve the following objectives:

- To investigate the teleworking experience in Saudi Arabia from the societal perspective.
- To explore the themes that correlate with positive and negative opinions using sentiment analysis, visualization, and thematic analysis.

The remainder of this paper is organized as follows. Section 2 presents related work in the form of a literature review. Section 3 introduces the methodology used in this paper to collect and analyze data. Section 4 discusses the results of the sentiment and thematic analysis. Section 5 discusses the results and presents recommendations. Lastly, Section 6 draws concluding remarks for this study.

II. LITERATURE REVIEW

Previous studies on the concept of telework or WFH were mostly performed before the COVID-19 outbreak. More recent studies on the concept cover the impact of COVID-19 on teleworking using different techniques, including sentiment analysis. In this section, a review of the literature is given focusing on the concepts of telework, sentiment analysis, and Arabic sentiment analysis.

A. Telework

In 1973, Nilles [7] coined the term “telework”. The author identified telework as a work arrangement that “includes all work-related substitutions of telecommunications and related information technologies for travel”. The evolution of teleworking has since progressed through three generations [8]. The first generation is the home office, where employees exclusively work from home. The second generation is the mobile office, where working hours were partially replaced with teleworking. The third generation is the virtual office, which refers to an informal work arrangement that has fewer regulations than the usual work arrangement. Currently, with the use of smartphones and advanced technologies, organizations are part of the third generation of teleworking. Employees who work from home (i.e., teleworkers) are classified into three main types, according to Vries et al [1].

The first type is home-based teleworkers, where employees perform their tasks at home. The second type is teleworking from remote offices, where employees perform their tasks in an office that is remote from the main office. The third type is mobile telework, which includes employees who need to travel or visit customers as part of their job. Briefly, teleworking is a spectrum of practices, not a homogeneous entity [9].

The negative and positive effects of telework have been the subject of many research projects. Teleworking can impact employees, management, and the organization as a whole. Telework can affect employees' effectiveness as well as their personal life. For example, Adamovic [10] conducted a study to investigate the effect of teleworking on job stress and telework effectiveness. The study's hypotheses were tested using a three-phase survey targeting 604 teleworkers from different countries and a variety of organizations in different sectors. The survey measured cultural values, beliefs toward telework, and job stress. The results showed that telework only reduces job stress when employees do not believe that teleworking leads to social isolation. Furthermore, the results indicated that employees with high power distance scores typically held negative beliefs about telework, whereas employees with high individualism scores tended to have strongly positive beliefs regarding the effectiveness of telework.

An equally significant aspect of teleworking is its impact on employees' quality of life, which was studied by Nedelcu in [11]. Nedelcu conducted a survey with 261 employed undergraduate and graduate students from Nicolae Titulescu University in Bucharest. The results showed that telework can positively impact the quality of employees' personal and professional life due to the following factors: reduction of work-related stress, increasing employee autonomy, reducing costs related to work, and increasing motivation and commitment. Conversely, the study indicated that 73% of dissatisfied employees agreed that their dissatisfaction with telework experience was because they were unable to separate their personal time from their professional time. Moreover, 86% of the respondents agreed that their dissatisfaction was related to the loss of social interactions and team spirit. Similarly, Golden in [12] stated that telework can affect employees' commitment, exhaustion, and turnover intention. The researcher used a sample of 393 teleworkers in a large firm in the USA. The results indicated that teleworking increases employees' commitment and lowers turnover intention.

While many previous studies have targeted employees from all levels, Silva et al. [13] focused on managers and their attitudes toward telework. The study used the technology acceptance model (TAM) as a theoretical framework and the collected data were analyzed using structural equation modeling (SEM). The results showed that the attitude of managers toward telework adoption was influenced by improvements in information security tools, employees' self-efficacy beliefs, and managerial practices.

Although many studies have investigated the effect of telework on different aspects of organizations and employees,

several recent studies have examined teleworking during the COVID-19 pandemic. For example, Belzunegui-Eraso et al. [14] and Ipsen et al. [2] both found that telework working conditions during the COVID-19 pandemic have mostly been positive. According to these researchers, the principal advantages of teleworking during the COVID-19 pandemic are work-life balance, work efficiency, and work control.

B. Sentiment Analysis

To the best of the researcher's knowledge, sentiment analysis has only been applied in two studies focusing on telework, both of which were undertaken during the time of the COVID-19 pandemic. The first study, Zhang et al. [15], aimed to understand the attitudes of the general public toward teleworking by analyzing tweets using natural language processing (NLP) techniques. The results uncovered themes among tweets including mental health, teamwork, leadership, and work-life balance. The other study was conducted by Goyal and Malhotra [16], and while it was similar to [15] regarding its objective and the use of tweets as the data source, the main difference is that [16] used the R programming language as the method for sentiment analysis. Both studies showed that public attitudes toward working from home have generally been positive.

C. Arabic Sentiment Analysis

Sentiment analysis for the Arabic language is different from English. One of the main reasons for this is that the Arabic language is more complex than English, richer in terms of its morphology, and has different dialects. In each dialect, the meaning of the words can be very different, which makes sentiment analysis for the Arabic language more challenging. The literature on Arabic sentiment analysis offers many ways to handle the challenging aspects of analyzing the Arabic language.

In [17], the researchers introduced an aspect-based sentiment analysis system for Arabic reviews of hotels. They implemented a deep recurrent neural network (RNN) along with a support vector machine (SVM) approach, and the results showed that the SVM approach outperformed the deep RNN approach. Moreover, in [18], Alayba, Palade, et al built a system for sentiment analysis based on the integration of convolutional neural networks (CNNs) and long short-term memory (LSTM) networks. The hybrid model was tested on two Arabic datasets and achieved high classification accuracy.

In a more recent study, Al-Alfy & Al-Azany in [19] had two goals: first, to compare the performance of machine learning algorithms in discovering the polarity of Arabic tweets using neural word embedding as the feature extractor; and second, to examine the effect of different oversampling techniques in handling the imbalanced nature of the data. The paper's findings were that the geometric mean (GM) attained its highest value when the stochastic gradient descent (SGD) classifier was used with oversampling. The GM improved in all cases when combined with oversampling except for the Gaussian naïve Bayes (GNB) and random forest (RF) classifiers.

A notable tool for Arabic sentiment analysis is Mazajak, which is the first online Arabic sentiment analyzer. In [20],

Abu Farah & M proposed this online system, which analyzes Arabic sentiment using a deep learning model. Mazajak achieved state-of-the-art results on many Arabic dialects. The system's results are based on the benchmark of three Arabic datasets: the SemEval 2017 task, ArSAS, and ASTD. Given that Mazajak has outperformed all other Arabic sentiment analysis systems, this paper utilizes the Mazajak system as a tool for sentiment analysis, as described in the next section.

III. METHODOLOGY

This section present the research methodology, which consisted of four phases: data collection and preparation, data analysis and performance evaluation.

A. Data Collection and Preparation

In this study, a dataset consisting of 39,523 tweets was retrieved from three hashtags (#_تعلیق_العمل, #_تعلیق_العمل_في_السعودية, #_العمل_عن_بعد). In addition to the hashtags, the tweets from the telework program account mention were retrieved for the period from January 2019 to July 2021. The details of the retrieved data are shown in Table I.

TABLE I. TWEET CLASSIFICATION

Sources	Number of Retrieved Tweets
@TeleworksKSA mention	8,235 tweets
#Telework	17,018 tweets
#Work_suspension_SaudiArabia	3,611 tweets
#Work-Susbension	10,659 tweets

Data preprocessing was conducted using RapidMiner, a Java-based open-source software that provides several operators for text processing. These operators include tokenization, stemming, and stopword filtering [21]. Furthermore, RapidMiner supports multiple languages, one of which is Arabic.

The first step was to integrate the four datasets shown in Table I into one large dataset. Following this, a data reduction phase was performed to reduce or eliminate noisy data (e.g., meaningless or irrelevant tweets). its involved scanning the data for specific words and deleting any tweets containing these words. For example:

Offers- designs- IELTS-CV-Marriage

الفاتورة – مسيار – ايلتس- سيرة ذاتية – تصميم – منتجات – عروض

After this step, the dataset was reduced to 22,587 tweets. To prepare the data, several data cleaning techniques were used such as normalization, transformation, tokenization, and stopword filtering. First, RapidMiner was used to clean the data in terms of links, http tags, and other symbols such as @, #, and [] using the Replac operator. The next process was data normalization, the goal of which is to reduce the complexity of a text and transform it into a simpler form. For example, the letters (ا , و , ي) were converted to (آ , و , ي). In turn, data transformation was applied. According to [22], in this preprocessing step, the data is converted so that the mining process result can be applied in a more efficient way. In the process of filtering stopwords, unimportant words such

as (أيضا, إلى, ثم) are removed from the data. RapidMiner supports this function for the Arabic language. The second process was tokenization, wherein each sentence is split into several words called tokens.

After tokenization, an operator for filtering tokens by length was used to filter any words with fewer than 4 characters or more than 25 characters. Stemming is considered an important step in the transformation process for English data to convert the words into their roots. This step was not used in this research since the dataset was in Arabic and stemming can negatively affect the classifier's overall performance and accuracy [23]. Instead of stemming, another technique was used to improve sentiment prediction: namely, replacing synonyms with a single word that have the same meaning. This improved the prediction because it made the dataset more unified and easier to process. An example is replacing the phrase "what is the solution", which is "وَشِ الحَلُّ / ما هو الحل" in Arabic with the word "problem", which is "مشكلة". Another example is replacing the Arabic phrase for "useless", which is "لا فائدة" with the word "عبث", which is the one-word Arabic synonym of the phrase.

B. Data Analysis

Sentiment analysis, also called opinion mining, is "a field of study that analyzes people's opinions, attitudes, emotions, and sentiments toward topics, events, products, or services, and their attributes" [24]. Sentiment analysis is a term used interchangeably with opinion extraction, sentiment mining, emotion analysis, and affect analysis. Sentiment analysis includes several steps and the final step is finding the polarity of the data [25]. A popular way to analyze people's sentiment toward a subject is by analyzing their social media posts. There are three main methods for analyzing sentiment in social media content: the machine learning approach, the lexicon approach, and the hybrid approach. The machine learning approach is divided into supervised learning and unsupervised learning, while the lexicon approach is divided into the dictionary-based approach and corpus-based approach. In supervised learning, classification models are used such as the naïve Bayes, Bayesian network, SVM, artificial neural network (ANN), and decision tree [26].

This study leveraged the existence of Mazajak, an online Arabic sentiment analyzer, due to its remarkable performance and state-of-the-art results [27]. Mazajak uses NLP and machine learning to classify tweets into three categories: positive, negative, or neutral. The model used in the system was built on a Convolutional Neural Network (CNN) that works as the feature extractor, after which the embeddings are fed into the max-pooling layer. In turn, the extracted features are fed into an Long Short Term Memory network (LSTM), taking into consideration the context and order of the words. The LSTM is followed by a softmax layer, which produces the output classes [20].

C. Performance Evaluation

To evaluate the performance of the online tool, we used three performance parameters: accuracy, precision, and recall.

Accuracy is calculated as the correct classifications divided by all classifications. In this study, it was calculated using Equation (1).

$$Accuracy = \frac{TP+TN+TNe}{TP+TN+TNe+FP+FN+FNe} \quad (1)$$

In the numerator of Equation (1), TP is the number of true positive predictions, TN is the number of true negative predictions, and TNe is the number of true neutral predictions. In addition, in the denominator, FP is the number of false positive predictions, FN is the number of false negative predictions, and FNe is the number of false neutral predictions.

The second measure is precision, which is also known as the positive predictive value. It measures the classifier's performance in predicting the true polarity of the test dataset [28]. Precision was calculated in this study as shown in Equation (2).

$$Precision = \frac{TP}{TP+FP} \quad (2)$$

The third measure is recall, which measures the sensitivity of the classifier. This was calculated using Equation (3).

$$Recall = \frac{TP}{TP+FN} \quad (3)$$

The results of the previous measures were high. In particular, the value of the accuracy was 88.04%, which indicates a high accuracy rate for the tool. Moreover, the precision and recall values were high at 0.97 and 0.88, respectively. Hence, the tool can be used to analyze the data.

IV. FINDINGS

A. Sentiment Analysis

The results of the sentiment analysis indicate that 58.4% of the tweets were classified as neutral. The percentage of positive tweets exceeded the negative tweets by more than the double, with 30.76% positive and 11.15% negative, as shown in Fig. 1.

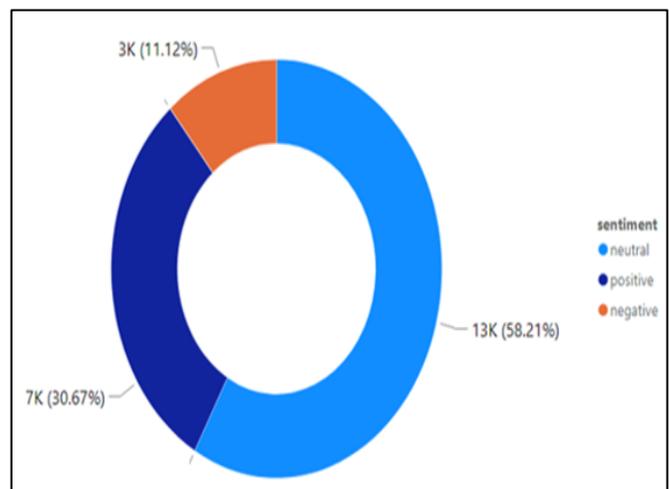


Fig. 1. Data Polarity.

"As a teleworker, I think that work standards and accomplishments are better when teleworking – it's the right option for a better environment, and in the future, teleworking will be part of the digital transformation."

"Teleworking reduces costs and gives organizations an opportunity to hire better employees regardless of where they live."

The word "learning" was another common word used in the positive dataset. Teleworking was a new experience for many employees during the COVID 19 pandemic, which forced them to learn about new technologies and applications. Thus, "technology" was also a common word. Examples include the following:

"Teleworking has many advantages such as flexibility and productivity, and it is a great opportunity to learn new habits and skills."

"We are forced to go through this experience and we need patience and creativity to use it to learn."

"The teleworking experience is an enriching experience that has given us the opportunity to learn new technologies."

The word "team" was a popular word in the positive dataset. Tweets mentioning this word talked positively about the creativity of the team arising from telework, as well as trust and communication. The following are examples of this theme:

"A successful team during the period of telework is marked by trust, respect, and helping each other."

"Teleworking experience is fun and special, especially when you have the technology and tools to help and, most importantly, a creative and passionate team."

"A lesson we can learn from the teleworking experience is that building trust in your team is the greatest incentive for productivity."

"Your creative and professional team is the most important asset – communicate with them and encourage them to maintain their efficiency and productivity during working from home."

Lastly, working with flexible hours correlated with positive opinions about teleworking as it is considered one of the advantages of this work arrangement. Some of the tweets that mentioned flexibility are the following:

"Teleworking is flexible, which makes employees more productive and happier; it opens a new gateway to opportunities."

"The flexibility of teleworking gives us a better work-life balance."

"The idea of working from home is so much better and more flexible, which makes it easier."

"Having flexible working hours contributes to better health and life quality for employees."

On the other hand, two of the most common words in the negative dataset were "private" and "sector", which occurred

in 24.58% of the tweets in the negative dataset. Most of these tweets highlighted how the private sector continued to work as normal during the pandemic, whereas employees in the public sector were teleworking. In addition, the word "companies" (or "company") was mentioned frequently in negative tweets. Some examples are given as follows:

"The company that I work for misunderstands the concept of teleworking. Managers ask us to hold meetings and perform tasks all day – even at night – and on top of that, they've cut our salaries."

"Why are private-sector employees being forced to go into the office during the pandemic? We are humans too and we can get sick."

"Why doesn't the work suspension apply to private-sector employees? We can also get the virus and put our families in danger."

In addition, words such as "fake", "failed", and "problem" were common in the negative tweets, especially in tweets that mentioned the teleworking program. Specifically, the words "Fake", "Lie", and "Problem" were present in 14.09% of the negative dataset, and 12.52% explicitly mentioned the teleworking program.

In the tweets that mentioned the teleworking program, 39.41% were negative and only 13.67% were positive. The word "problem" was featured in 32.97% of the tweets that identified a problem with the website and described it as a failed system. The words "fake" and "lie" were present in 16.21% of the tweets, where people accused the program of being fake or offering fake job opportunities. Notably, this was the most common theme in tweets mentioning the name of the program. The following are some of the instances of this theme:

"Are you sure that the website is working? I applied for tons of jobs and I think it is all fake because the organizations ignored us and didn't even send an apology."

"This website is a lie – it's offering fake job opportunities."

"I applied for jobs aligned with my CV and nobody contacted me – I'm starting to think that it's all fake."

"The website is very slow and has many problems."

V. DISCUSSION AND RECOMMENDATIONS

From the results discussed previously, the first important topic we investigated was the overall experience of teleworking. The public orientation toward neutrality and positivity may be due to the national lockdown, which helped employees to focus more on job tasks and be less stressed about balancing work and social life. This led to many not viewing the situation as a negative experience.

Since the pandemic, the use of teleworking has increased and, as a result, work flexibility has become more common. This has elevated the importance for organizations to build a positive teleworking experience to achieve high productivity levels. Offering flexible hours for teleworkers can improve their productivity. In a study conducted in Japan, the

researchers found that suitable telework hours increased employee productivity, whereas long working hours decreased productivity [29]. For the teleworking program, the results showed that it is not a feasible program and it has not been well received by the public. We recommend a more transparent recruitment process and a user-friendly website to avoid problems with registering and applying for jobs [30].

VI. CONCLUSION AND FUTURE WORK

This paper performed sentiment analysis and thematic analysis focusing on the teleworking experience and teleworking program in Saudi Arabia. The purpose of this study was to gain insight into the experience of teleworking among the public in Saudi Arabia during the work suspension period, as well as to determine the public sentiment of the experience. Furthermore, this study sought to analyze public sentiment on the teleworking program. A dataset extracted from Twitter, consisting of tweets posted between March 2020 and July 2021, was used to analyze the public sentiment toward teleworking. Mazajak, an online Arabic sentiment analyzer, was used for data analysis. The results revealed that neutrality was the most prevalent sentiment in the tweets, followed by positive sentiment. Furthermore, the results detected themes of flexibility, teamwork, teleworking preference, and learning in association with the positive view of the practice. By contrast, the themes related to negative sentiment were the private sector, companies, and fake.

Future work should concentrate on comparing the public view of teleworking before and after the pandemic. In addition, it would be beneficial to study the emerged factors that affect the success of teleworking in Saudi Arabia to improve the experience and leverage its advantages. Finally, this research used data from public users on twitter with different economical and educational backgrounds. However, focusing on the impact of different demographics on the effectiveness and acceptance of teleworking deserve further research.

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