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Sentiment Analysis on Twitter-Based Teleworking in a Post-Pandemic COVID-19 Context

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Abstract: The implementation of the telework model has become popular globally due to the COVID-19 pandemic. However, this new model of work organization generates conflicting opinions regarding the positive and negative effects that its implementation can bring to organizations. In this study, sentiment analysis of Twitter-based teleworking in a post-pandemic COVID-19 context was conducted. A set of Twitter conversations is examined by applying text mining and opinion analysis techniques. The results show the prevalence of positive sentiments regarding telework. In addition, opinions are generally associated with confidence, anticipation, and joy. According to the results, it is recommended to consider telework as an opportunity to improve worker well-being. However, it is important to consider some factors, such as the sector to which the company belongs, the characteristics of the job, and the working conditions.

Keywords: sentiment analysis; Twitter; teleworking; post-pandemic COVID-19; text mining



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1. Introduction

The adoption of telework during the COVID-19 pandemic had social, economic, and even emotional consequences. Telework implies a change from the centralized (Cortés-Pérez et al. 2020), pyramidal, and hierarchical model based on the fulfillment of a schedule towards an open, horizontal, and dynamic model. This has had both positive and negative effects on labor relations, personal life, and productivity. Okubo (2022) pointed out that flexible work schedules are positively associated with teleworking. However, in some cases, teleworking may increase the time the worker has available for the development of their work activities. In this regard, Adamovic (2022) found that while some employees may accept teleworking arrangements, it could be considered a dysfunctional way of working for others.

Globally, some governments and private sector actors have implemented programs to transition to telework, with varying nuances. However, the COVID-19 pandemic has marked a significant milestone in this process in that it spurred the widespread adoption of telework. According to Ivasciuc et al. (2022), in Europe, 56% of employees had already experienced some sporadic teleworking arrangements before the pandemic, but a good portion of them started working from home during the crisis. Meanwhile, Global Workplace Analytics (2021) indicated that, between 2005 and 2019, teleworking grew by 216% and that the pandemic saw a significant increase in teleworkers; during the peak of the crisis, 69% of U.S. workers were working remotely.

Based on the above, the pandemic has provided some important lessons for considering the implementation of telework as an opportunity in many companies. In this regard, Ng et al. (2022) argued that the COVID-19 pandemic accelerated labor trends related to remote work practices and made it evident that 25% of the workforce in advanced economies

can work under this modality. For their part, [Dingel and Neiman \(2020\)](#) pointed out that 37% of jobs in the United States can be done entirely from home and that this represents more than 46% of the wages of all Americans. [Althoff et al. \(2022\)](#) argued that much of the work that can be done remotely comes from the business services sector, where more than 50% of their workforce was observed to have adopted remote work during the early months of the pandemic.

One factor driving the adoption of teleworking arrangements is the accelerated advance of information and communication technologies. However, it was held as potentially inconsequential as most workers did not use it. Consequently, the recent COVID-19 pandemic accelerated the transition to actual telework practices ([Althoff et al. 2022](#)). Once the restrictions were lifted, a significant volume of people returned to their usual workplaces. However, the new practices were maintained in many cases; as many as 12% of respondents in the European Union reported performing their tasks exclusively from home by the spring of 2022 ([Ivasciuc et al. 2022](#)). Other authors reported that teleworking has become part of the new normal and is seen as a practice that will tend to become commonplace and even a new work paradigm ([Ng et al. 2022](#); [Zhang et al. 2022](#)).

Despite the opportunities and advantages offered by teleworking arrangements such as work flexibility ([Ng et al. 2022](#)), the possibility of avoiding commuting, fewer interruptions, lower noise levels, personalized work environments ([Ivasciuc et al. 2022](#)), or increased productivity ([Dingel and Neiman 2020](#)); there are still significant challenges to achieve effective implementation. [Ng et al. \(2022\)](#) suggested that to achieve maximum productivity in remote work environments, high-quality technology and a comfortable work environment is required. Therefore, success depends on employees having the resources, knowledge, and ability to achieve work objectives. For their part, [Ivasciuc et al. \(2022\)](#) argued that it is essential for employers to ensure that the culture of their staff adapts to the new way of working. Moreover, the sector to which the company belongs and the level of education of workers can also favor or limit the benefits of telework ([Althoff et al. 2022](#)).

For the above, the perceptions that workers have about teleworking arrangements can vary significantly. While there is a clear preference for teleworking, as shown by [Ivasciuc et al. \(2022\)](#), who reported that more than 60% of women and men express a predilection for this modality, there are also some mixed opinions. For example, [Zhang et al. \(2022\)](#) reported that many small companies do not have adequate infrastructure for teleworking deployment. They also pointed out that, when implementing home-based work, many employees may feel the need to reciprocate for the privilege, which may be reflected in longer working hours and difficulty in achieving disconnection from work ([Zhang et al. 2022](#)).

Meanwhile, [Althoff et al. \(2022\)](#) posited that remote work arrangements may disadvantage workers in consumer services and who are less educated. For their part, [Ng et al. \(2022\)](#) referred to the importance of workers' perception of controlling their behavior to complete their tasks effectively, as well as their attitude, as this can influence their concentration, performance, and emotional exhaustion.

Therefore, this document analyzes the perceptions about teleworking arrangements from the experiences derived from the pandemic. For such a reason, this research aims to conduct a Sentiment Analysis on Twitter-based teleworking in a post-pandemic COVID-19 context. According to [Liu \(2012\)](#), unlike factual information, opinions and sentiments are subjective; therefore, it is important to examine a collection of opinions from many people. This contributes favorably to the representativeness of the sample, reduces bias, and, in general, increases the statistical reliability of the research. Thus, by performing a careful analysis of such a rich dataset of Big Data, it can be used for predictions that improve the field of decision-making. In this study, a set of tweets written in English from different geographical settings but related to telework is made. A classification approach based on sentiment polarity is adopted to systematize these opinions in quantitative terms. In this way, we seek to establish the positive or negative connotation of Twitter opinions to subsequently perform a descriptive analysis.

The opinions shared in social networks are a significant source of information for understanding complex phenomena such as telework. The large volumes of data circulating in networks reproduce what is known as the wisdom of crowds, which can be understood, according to James Surowiecki, as the fact that “large groups of individuals are better at making forecasts under conditions of uncertainty than experts on a specific topic” (Schumaker et al. 2016, p. 76). Thus, the analysis of social network sentiments is expected to shed light on the possible positive and negative effects that the implementation of the telework model may have. The results can be considered to address problems related to labor productivity, technostress, fair remuneration, organization of work schedules, generation of virtual workspaces, and development of control mechanisms.

2. Literature Review

2.1. Teleworking

The term teleworking is presented with different nuances. A term frequently used in North American media is telecommuting. Work Remote is the possibility of performing work beyond the boundaries of the traditional office (Nicklin et al. 2016) or the usual place of work, with the consequent transfer of work activities to the home. Another recurrent term is teleworking, which is frequently used in European publications (Lamond et al. 1997). It is a broader term and encompasses the different modalities related to work performed outside the office.

According to Allen et al. (2015), although the term telecommuting has been used for decades, researchers have used various terminologies and conceptualizations when reporting their research findings. Thus, the lack of a generally accepted definition has been inherent to understanding this phenomenon (Nicklin et al. 2016). One of the first accepted definitions of teleworking is the one proposed by Nilles (1988), who points out that teleworking puts the main emphasis on the use of technologies to assist the tasks that can be developed without having to attend the office. In his conceptualization, information and communication technologies have played a determining role. For its part, Allen et al. (2015) identify other terms related to teleworking, such as:

- Virtual Work: Describes individuals or organizations that do not interact face-to-face but do so using some form of technology.
- Flexible Work Arrangements: In addition to telework, flexible work arrangements include a broader range of flexible work programs such as flextime or compressed workweeks.
- Remote/Distributed Work: This is considered broader than telework, where forms of work that are not performed in a central office can be included. Therefore, functions may be performed in branch offices or different business units.

Simenenko and Lentjushenkova (2021) proposed Distance Working as an analogous term. According to the authors, this type of worker may work in the office or never do it. The worker may work outside the office while traveling or may not have to commute to the office at all. A term used interchangeably is Work from Home. Ellison (1999) proposed a specific definition for this modality, which can be understood as work performed at home with or without information technology. Andriessen (2003) pointed out that, under this modality, the worker performs his or her work at home most of the time, although they may occasionally visit the employer’s or their clients’ homes. Another variant is mobile workers, defined as “those who work at least 10 h a week away from home and their main place of work” (Richter et al. 2006, p. 232).

While there is a wide range of definitions related to telework, the common denominator is that “all these terms exchange a common idea, and that is that work does not have to be done in the office but can be done anywhere in the world” (Sroka 2018, p. 147). In some contexts, it is common for definitions to be punctuated from a normative perspective. For example, in the United States, Public Law 111-292-Telework Enhancement Act 111-292 (2010) defines teleworking as:

“a flexible work arrangement under which an employee performs the duties and responsibilities of such employee’s position, and other authorized activities, from an approved work location other than the location from which the employee would otherwise work”. (Chap. 65, Sect. 6501)

Latin America, or more specifically, Mexico, has regulated the modality of the Home Office, as it is contemplated in Article 311 of the [Federal Labor Law \(2018\)](#), where it is stated that “homework is the one that is usually executed for an employer, in the worker’s home or in a place freely chosen by him, without immediate supervision or direction of who provides the work”. For its part, in Brazil, it has been regulated by what is established in Title II of Chapter II-A of [Law 13,467 \(2017\)](#), where telework is defined “as the predominant provision of services outside the employer’s premises, with the use of information and communication technologies”. In Argentina, [Decree 27 \(2021\)](#) regulated [Law 27.555 \(2020\)](#). In this law, the concept of telework is proposed as the performance of acts, execution of works, or provision of services that are carried out totally or partially at the domicile of the person working or in places other than the employer’s establishment or establishments, using information technologies. For its part, in Colombia, the legislation has imposed a clear distinction between telework, work at home, and remote work. According to [Law 1221 \(2008\)](#), telework can be defined as:

“A form of labor organization, which consists of the performance of remunerated activities or the provision of services to third parties using information and communication technologies (ICT) as a support for the contact between the worker and the company, without requiring the physical presence of the worker at a specific work site”. (p. 1)

Likewise, in Colombia, [Law 2088 \(2021\)](#) regulates homework, which is transitory and applies to occasional, special, or exceptional situations that prevent the worker from performing his/her duties at the workplace, favoring the use of information and communication technologies. Additionally, [Law 2121 \(2021\)](#) regulates teleworking in Colombia, which is characterized by flexibility in all pre-contractual and contractual stages, which may be performed remotely. This modality also implies the non-existence of exclusivity. Additionally, [Decree 1227 \(2022\)](#) eliminates some provisions necessary to adopt teleworking to facilitate the implementation in Colombian companies.

Regardless of the conceptual and legal framework with which the telework phenomenon is approached; it is a fact that technologies have become a relevant catalyst for its implementation in organizations ([Nicklin et al. 2016](#)). Flexibilization in the organization of work has been driven by a higher level of technological adoption in companies, such that “the evolution and growth of telework is also linked to technological advances and changes in the economy” ([Allen et al. 2015](#), p. 41). However, an institutional framework is required to strengthen the capacity to develop the infrastructure that facilitates the implementation of telework ([Kord et al. 2019](#)).

The above also raises some issues related to the use of technology that should be considered when regulating the model and implementing it in organizations. In this regard, [Mohalik et al. \(2019\)](#) pointed out that connectivity through technological tools such as email, telephone, and social networking platforms allows employees to remain connected to work for longer, which blurs the temporal boundary between work and home. Therefore, it is appropriate to discuss the positive and negative effects associated with telework technologies on the health and well-being of employees.

In academia, interest in teleworking has grown and has become a relevant object of discussion following the COVID-19 pandemic ([Okubo 2022](#)). Studies find both positive and negative repercussions for workers. For example, [Tahlyan et al. \(2022\)](#) found that the benefits are greater for people without vehicles and living in the suburbs, while there are barriers for workers performing essential activities.

A very important issue is work well-being because if the dynamics of teleworking are not properly managed, it can generate stress, sentiments of isolation, or loneliness, with its corresponding effect on productivity and coordination of activities. For example, [Adamovic](#)

(2022) cited the conclusions of some studies stating that teleworking generates benefits such as stress reduction because it favors autonomy and flexibility and helps to reduce travel times. However, teleworking can also generate isolation, fatigue, and difficulty in maintaining a balance with one's personal life (Ivasciuc et al. 2022). New technologies have psychosocial effects on the worker. In this regard, Brillhart (2004) distinguished four conditions associated with the phenomenon of technostress:

- Data Smog or Computer Fatigue Syndrome: This is the excess of information received by workers through telematic tools.
- Multitasking Madness: Occurs when workers are unable to adapt to the pace of work required using technology.
- Computer Hassles: Occurs when the use of technology generates desperate situations for workers.
- Burnout or Burnout Syndrome: Consists of "a syndrome of emotional exhaustion, depersonalization, and reduced personal fulfillment" (Maslach et al. 1996, p. 192).

Other studies find some effects of teleworking implementation, which should be considered. Tahlyan et al. (2022) identified the negative consequences of teleworking in young people, such as the loss of opportunities to establish relationships with people that allow them to advance in their careers. For their part, older people face problems such as "difficulty in managing their work teams in a more senior position and possible technological limitations in performing regular work activities" (Tahlyan et al. 2022, p. 399).

Delanoeije et al. (2019) noted that on teleworking days, workers may be occupied for periods that exceed the usual working day, which can cause conflicts to the extent that the boundary between work and home becomes permeable. Mendonça et al. (2022) found that teleworking is related to high imaginary vigilance and high communication overload, which can generate effects such as depression or entrapment. Meanwhile, Adamovic (2022) analyzed how employee beliefs about the effectiveness of telework and the isolation of telework depend on their cultural background. Thus, positive beliefs may be prevalent in environments with low power distance and employees with an individualistic attitude.

2.2. Social Networks and Teleworking

The study of social networks contributes to the understanding of different phenomena present in human relationships. The methodology applied is called social network analysis (SNA) and is considered the study of social structure (Hawe et al. 2004). According to Scott (2011), social network analysis consists of a research approach within the social sciences that focuses on the forms of interaction and interconnection between individuals and social groups to explain the social patterns of sentiments, thoughts, and behaviors. In this sense, social network analysis (SNA) allows the understanding of the behavior of members of social groups. The formation of these networks can be enabled by computer technologies. Thus, the so-called social networks appear; they are a family of interactive technologies through which people can exchange content, ideas, and interests (Tenzer 2022).

Electronic platforms allow their users to share opinions, communicate, interact, and establish entities with related objectives; they arise from the need for individuals to interact with others to generate agreements, arrangements, and consensus that lead to the solution of specific problems. In the context of management, Jue et al. (2009) proposed that organizational leaders can rely on networks to help improve business performance and build long-term capabilities. Social networks facilitate content sharing and expand the communication channels of work teams. In addition, social networks "allow employees to experience connecting with co-workers and non-work colleagues remotely, satisfying the need to feel connected" (Nicklin et al. 2016, p. 54).

The analysis of these communications helps to understand user perspectives on topics of interest and contains information capable of explaining and predicting business and social phenomena. According to Blount and Gloet (2017), the ongoing development of social networks, smartphones, and the way humans leverage technology for work has evolved over the past decade. Workspaces are an enabling context for the construction of

networks, which can transcend the professional plane and transit into the personal realm. In this way, virtual interactions become permissible in addition to traditional workplace exchanges. In addition, there are two reasons why labor markets deserve attention in terms of the construction of social networks (Jackson 2008). First, the diffusion of information, and second, because the network structure influences the transmission of information, behavior, and job performance.

Teleworking has energized new forms of social interaction that promote exchange through networks. According to Sohail et al. (2020), social networks allow for establishing direct connections with end customers and facilitating several areas' activities. These networked interactions are important to the extent that access to valuable information can influence the performance of collaborators. Mapping and measuring formal and informal relationships manifested in social networks allows understanding and facilitating knowledge flows that link interacting units (Serrat 2017). For their part, Gaál et al. (2015) argued that social networks provide the possibility of obtaining knowledge from people, which is susceptible to be recorded and stored and could also be beneficial for organizations and their members. Meanwhile, Lal et al. (2021) discussed how workers engage with their colleagues in technology-supported social interactions for working from home.

One way to systematize social network comments is through sentiment analysis. López-Chau et al. (2020) state that sentiment analysis in social networks is an active area of research that allows for improving the understanding of opinions expressed in text, as evidenced in Twitter. The telework phenomenon is an issue with which voices for and against are associated, whose comments circulate in social networks, so it is possible to take advantage of sentiment analysis techniques and tools to study their strength and polarity. The results of this analysis can be of importance to identify patterns and perceptions about teleworking around the world.

Sentiment analysis in social networks has become a frequently used methodology for the study of phenomena that have a widespread impact on society. COVID-19 is no exception. Thus, we find work such as that of Thakur (2023), where more than 600,000 tweets were collected during the outbreak of monkeypox and COVID-19 in 2022. The results showed that 46.88% of the tweets featured negative sentiment. Meanwhile, Albahli (2022) performs a sentiment analysis in which he observes that half of the population shows a negative opinion about the COVID-19 phenomenon during the beginning of the pandemic. This opinion begins to regulate over time so that towards the end of the crisis, there is a positive feeling when the virus is more under control.

Other studies apply a social network analysis approach to study opinions directly related to telework and its variants in a pandemic context. The research article by Xiong et al. (2021) aims to analyze the opinions of North American workers during the COVID-19 pandemic. Tweets were collected using the Twitter API. The results show that gender and age are the characteristics that most influence opinions about working at home. The research by Zhang et al. (2021) aims to understand attitudes toward remote work by analyzing Twitter data. An analysis of individual words and word pairs was performed, grouping them into linguistically meaningful variables. The findings highlight several common benefits and challenges associated with remote work, especially when the work team is virtual or when relocation is impossible.

Dubey and Tripathi (2020) set out to examine sentiments about working at home by analyzing Twitter data. They collected 100,000 tweets around the world for one month. Use is made of the Syuzhet application, which classifies tweets according to positive and negative sentiments and classifies them into eight emotions. The results evidenced that 73% of the tweets had positive sentiments, while 26.2% had negative sentiments. In addition, eight emotions were evaluated, from which it is concluded that in most tweets, a connotation of confidence, anticipation, and joy prevails.

Vohra and Garg (2023) argued that there is evidence of a growing preference for working from home, according to the data obtained from Twitter; to the extent that 54.41% of the tweets show a positive and satisfactory opinion, compared to 24.50% where dissatisfac-

tion is observed. These results contrast with [Gutierrez-Lythgoe \(2023\)](#), who performed a sentiment analysis using a deep learning model for natural language processing where he shows that 43.5% of the tweets analyzed present a negative connotation, concerning 35.5% where neutrality is observed and 21.1% with a positive connotation.

[Alotaibi and Alharbi \(2022\)](#) conducted a sentiment analysis and thematic analysis of telework programs in Saudi Arabia. Overall, the study shows that the most prevalent sentiment is neutrality. Furthermore, in order of prevalence, positive sentiment was the second most important sentiment, to which aspects such as flexibility, teamwork, and learning opportunities are associated ([Alotaibi and Alharbi 2022](#)). Other works show similar results, as is the case of [Zhang et al. \(2021\)](#), where sentiment analysis was performed where they found that slightly positive attitudes related to teleworking, and some benefits are observed in terms of productivity, learning, work flexibility, and availability of co-collaboration and communication tools.

Furthermore, some studies identified negative aspects related to teleworking. For example, [Loia and Adinolfi \(2021\)](#) analyzed the perceptions about telework during the pandemic. The authors performed a sentiment analysis; specifically, they studied the benefits and disadvantages of teleworking. The results showed that the most frequent words are markedly negative, such as emergency, disaster, panic, threat, and crisis. This suggests that telework, in the context of the COVID-19 crisis, was conceived as an extraordinary event and was necessary to implement. However, some positive perceptions associated with telework are identified as the connotation of protected, successful, safe, flexible, beneficial, trust, love, or happiness. On the other hand, the results of the sentiment analysis of [Saura et al. \(2022\)](#) showed concerns related to privacy control, stress, and, in general, the negative effect that the use of some technologies can have on the mental health of workers. [Mattes et al. \(2022\)](#) distinguished between voluntary and mandatory telework. The latter can have a negative impact on the work–life balance of employees because of an increased workload.

Some studies analyzed the influence of telework on health, considering consequences such as stress. For example, [Oksanen et al. \(2021\)](#) proposed a model covering different risk factors for technostress and job burnout during the COVID-19 crisis. It could be shown that technostress increased during the crisis and that excessive use of social networks at work strains people. However, this effect was not seen in those people already accustomed to using social networks at work.

On the other hand, [Daneshfar et al. \(2022\)](#) conducted a sentiment analysis to process the polarity, subjectivity, and emotions of tweets about working at home during the pandemic. According to [Daneshfar et al. \(2022\)](#), telecommuters went through different emotional states during the pandemic; while some people suffered from stress, others found the opportunity to develop their competencies and strengths in remote work.

2.3. Perceptions about Teleworking

Some studies addressed the perceptions about telework by adopting a qualitative approach. Among these, we can mention [Fana et al. \(2020\)](#), who conducted a series of in-depth interviews from April to May 2020 in France, Italy, and Spain. The results reveal that middle and lower-level workers, and those working in close contact with customers, were often more satisfied working from home than in the office. On the other hand, [Maillot et al. \(2022\)](#) adopted a qualitative approach with a longitudinal design to conduct a set of interviews in France, from which a lexical and morphosyntactic analysis was performed to understand the impacts of the reconfiguration of work activity and employees' experience during the crisis. The results show how videoconferencing technologies became essential during the pandemic, but the excessive number of meetings and dependence on these applications generated worker fatigue. There was also an overlap between the family and work spheres, as many employees had to adapt their work schedules to attend to other family responsibilities.

[Varshney \(2021\)](#) conducted a set of telephone interviews with medio-level employees in India, ranging in age from 30 to 50 years. The interviewees were employees of different

private organizations working in junior and mid-level positions. These interviews revealed expressions of distress and vulnerability on the part of the workers. Most described feelings of desolation and disconnection, as well as impacts on their mental health (Varshney 2021). Another important finding relates to the experience of female employees, who expressed pressure and increased work responsibilities that were affecting their psychosocial well-being. In general, a lack of stability and balance between professional and personal activities was shown to be a persistent concern among the participants; they also complained about a lack of focus and difficulty in managing their schedule and time (Varshney 2021).

Daneshfar et al. (2022) adopted a qualitative approach based on the net-ethnographic method, analyzing data extracted from the social network Twitter. According to the authors, what is special about their study is that it emphasizes subjectivity as opposed to the objectivity of the tweets in the context of work at home. Thus, further study of the tweets revealed a range of concerns, such as cybersecurity and problems with technology use, such as technostress. Other areas of concern are social distancing norms, lack of social support, limited peer interactions, poor health habits, ambiguous task performance, lack of parenting agreements, and increased domestic violence.

As evidenced in previous lines, the analysis of workers' perceptions of teleworking arrangements generates a significant contribution to identifying the factors that affect their job satisfaction and have an impact on their performance. The development of research based on social network analysis has been extended as a methodology applicable to the study of opinions on phenomena affecting society. As far as the adoption of teleworking in crises is concerned, a generalized positive sentiment is evident. This favorable opinion is based on advantages such as flexibility, learning opportunities, or increased productivity. However, in some studies, there are concerns about aspects related to the effect of the use of technologies on mental health, the blurring of the boundaries between the family and work spheres, limited social interactions, and difficulties in establishing household agreements related to the allocation of domestic tasks such as childcare.

Since the studies do not reach conclusive results about perceptions of telework, further research is needed to obtain a more solid understanding of this topic. Therefore, this study generates some contributions to the approach to telework arrangements in periods of crisis. First, the findings of previous works are considered to contrast the prevalence of feelings and emotions related to telework. Additionally, some relevant categories identified in the previous studies are considered to be the basis of a thematic analysis around issues such as work-life balance, productivity, use of technologies, mental health, family relationships and home management, leadership, administration, and business. In addition, some emerging themes are identified based on an analysis of semantic networks that make it possible to identify clusters of topics.

3. Methodology

The scope of this research is descriptive. It proposes an analysis of patterns of textual information and sentiments about telework from the systematization of conversations on Twitter. According to data from Shewale (2023), there are currently 1.3 billion Twitter accounts and 450 million active users. Martínez-Rojas et al. (2018) stated that Twitter allows users to share information quickly and interact with others through topics and tags. In addition, the authors state it is a social network characterized by an increase in audience, instant communication, real-time information, and support for response efforts.

For relevant purposes, a textual and opinion analysis of a set of tweets extracted between 13 March 2022 and 28 March 2022 is proposed. March was the second anniversary of the declaration of COVID-19 as a global pandemic. A survey by the American Psychological Association (2022) revealed that 63% of adults stated that their lives had changed since COVID-19, revealing widespread grief and loss and accentuated difficulties in the most vulnerable population. However, restrictions began to be relaxed largely in different parts of the world, and many workers were returning to their usual workplaces.

In March 2022, Decree Law No. 24/2022 will come into force in Italy, updating some anti-COVID-19 measures considering the end of the emergency period ([Moresco et al. 2022](#)). Tourist entry restrictions were lifted in Israel. During March 2022, almost all measures restricting social contact were also lifted in Vienna (Austria), as well as in Germany, where most of the restrictions imposed would come to an end during the month ([Heinrich 2022](#)). As of February 2022, several of the measures taken in the United Kingdom began to be relaxed to the point of restricting, by 1 April 2022, the application of free testing to only the most vulnerable population ([O'Connor 2022](#)). In February 2022, workers were asked about plans after England and Scotland lifted government guidance on working from home. Eighty percent of workers indicated that after the coronavirus pandemic, they planned to work hybrids ([Office for National Statistics 2022](#)). In Mexico, hybrid work is proposed as an alternative to control the undesired effects of full-time teleworking, such as the isolation of work teams, which can represent a risk to the innovation of companies ([Hernández 2022](#)).

According to the above, the period of analysis allows us to reflect a unique perspective regarding the perceptions of individuals on telework arrangements. This, to the extent that many had to submit to this new form of work organization on a voluntary or forced basis for a period that extended for more than two years and that was beginning to show signs of normalization during March 2022. Workers were able to experience first-hand, and for an extended period, the benefits and challenges posed by teleworking. As a result, they became more aware of the implications, advantages, and disadvantages of telework, and their perceptions of telework were shaped by this direct and prolonged experience. In addition, many workers were returning to on-site workspaces, so they were able to contrast working at home with the experience of working in the office.

Considering the above, a database of 335,009 tweets was formed during this period, which are analyzed, considering the frequency and prevalence, as well as the polarity and strength of these. For the extraction of information, use was made of the Twitter API, applying search terms in English related to the concept of teleworking. For the consultation of the tweets, terms such as Telecommuting, Teleworking, Work-From-Home, Remote Work, Homework, Distance Working, and Mobile Work were considered.

The data collection was carried out with the Mozdeh tool. This is software that allows for the extraction of information from different social networks through an application programming interface (API). As [Thelwall \(2018\)](#) pointed out, this API is an information exchange technology that Mozdeh interacts with to download posts. The extracted information is public data; therefore, it can be leveraged in the research process. The software facilitates the management of the extracted information since it allows data debugging, classification, and graphic visualization. Additionally, the Syuzhe library was used, which implements the NRC Saif Mohammad sentiment classification lexicon ([Jockers 2023](#)). It consists of a list of words and their associations with eight emotions: anger, fear, anticipation, confidence, surprise, sadness, joy, and disgust, and two sentiment valences: positive and negative. According to [Mohammad and Turney \(2013\)](#), although different theorists posit different ways of categorizing emotions, they have selected Plutchik's approach, which is well grounded in psychological, physiological, and empirical research. Furthermore, the authors suggest that it is a balanced set of positive and negative functions and brings together the contributions of other classifications.

A cleaning process of the corpus of information was carried out to eliminate empty words, links to websites, and spam present in the conversations. Mozdeh has filtering options, allowing for the elimination of identical publications that have the same author, which allows for the control of spam campaigns that have practically the same text, but only the URLs change ([Thelwall 2018](#)). Once the database was cleaned, sentiment analysis was applied using a lexical dictionary; to assign a positive and negative polarity to the tweets and measure the strength of the sentiment. Finally, the extracted information was represented in bar charts, networks, and frequency distributions. In this way, a characterization of the corpus of information extracted from the social network Twitter is made to identify the prevalent sentiments on the issue of telework, the strength of such

sentiments, and the words that best characterize the conversations. In addition, some of the messages are presented to illustrate the type of comments on telework circulating on Twitter.

4. Results

The results of the opinion analysis of the set of tweets obtained with the Mozdeh software are presented below. Although 353,472 tweets are obtained in the data collection process, an information filter is performed to eliminate blank, duplicate, or spam tweets, from which a database with 101,150 tweets is obtained. First, an exploratory analysis of the information is performed, considering the prevalence of query terms, the tweets that have been most frequently classified in the “Likes” category, the users with the highest number of followers, and those who report the highest number of tweets. Subsequently, a text mining analysis is carried out in the statistical software R, for which an additional cleaning is made to the corpus with the tm library. In this way, we proceed to standardize uppercase and lowercase letters and eliminate punctuation marks, numbers, empty words, and blank spaces. Finally, sentiment analysis is performed.

Figure 1 shows the query terms used and presented in the methodology. Mozdeh identifies each of the tweets with the query terms used. As seen in Figure 1, the three most frequent query terms are Work-From-Home, Home Working, and Remote Work. This finding contrasts with the academic literature, where the terms Telecommuting or Teleworking are frequently used to refer to this modality of work organization (Allen et al. 2015). The results show that the latter are the least frequent labels within the database obtained.

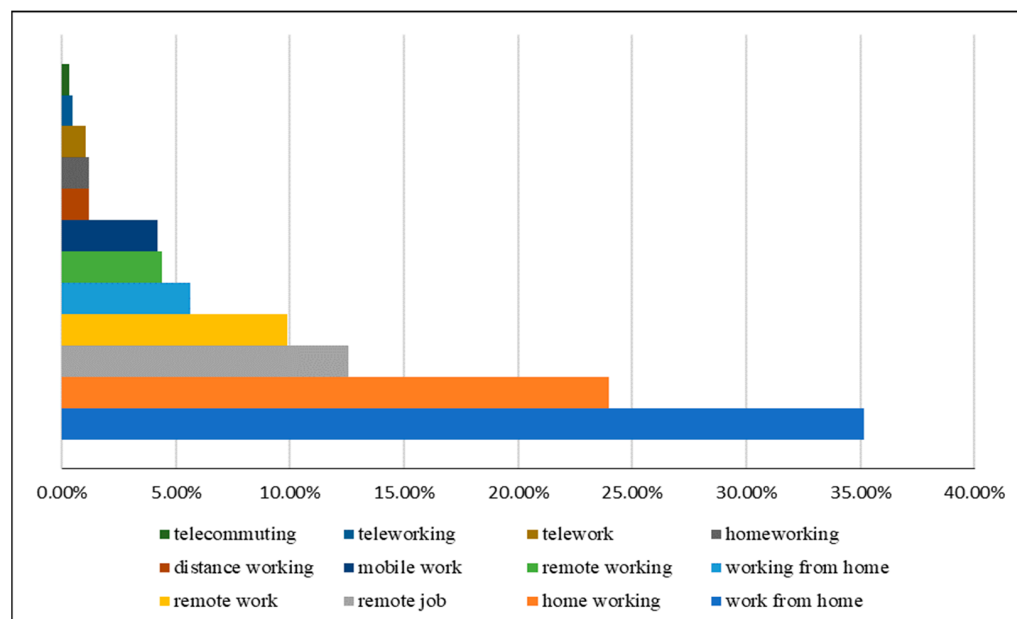


Figure 1. Data obtained with Mozdeh v. 5.12.0.0. Source: Own elaboration.

Table 1 shows an excerpt of those tweets that have received a higher number of likes or are tagged as favorites. Based on these five tweets, a positive opinion about telework is observed. In general, the conversations show the practicality of teleworking in terms of convenience and comfort and even the possibility of attending to some household obligations, such as caring for pets. In some tweets, links to images are presented where the possibility of carrying out work activities in the comfort of the home is observed, with some adaptations of spaces. This supports the idea that those who work with flexible work arrangements tend to rearrange their home, workspaces, and the relationships within them (Richardson and McKenna 2014).

Table 1. Top Five Tweets by Number of Likes.

Tweets	Number of Likes
"Me when I come home from work lol https://t.co/No3DJ7LsEw (accessed on 22 July 2022)"	1,055,998
"So my dog has been so happy that everyone is home for quarantine, that his tail has stopped working, so we went to the vet and the vet said 'he had sprained his tail from excessively wagging it'" 🐶🐶🐶🐶💔💔	995,304
"Oop, I need to update my work-from-home setup https://t.co/ZrS0z2Mr3q (accessed on 22 July 2022)"	601,634
"This should be the blueprint in working from home https://t.co/VrZxdihDIY (accessed on 22 July 2022)"	598,349
"you don't have the space to put a GIGANTIC beanbag in your one-room apartment to work from home...."	597,450

Note. Data obtained with Mozdeh v. 5.12.0.0. Source: Own elaboration.

Figure 2 shows the level of influence and activity of social network users according to the number of followers and the number of tweets. In terms of level of influence, *The Wall Street Journal*, *TIME* magazine, and the *Associated Press* stand out. The publications refer to the comfort of the clothing for those who work from home and challenges for those who return to the office, such as the increase in the cost of restaurants. There is also a reflection on remote work for Ukrainian citizens due to the conflict with Russia. In addition, one of the users refers to changes in population distribution between large and small cities because of the pandemic. Meanwhile, the users with the highest number of tweets are, in their order, the user care account, AmazonHelp, user soldier_777, and PulpNews. These users' posts are related to news of personalities who contracted the virus, concerns about cybercrime during the pandemic period, and a reference to pets.

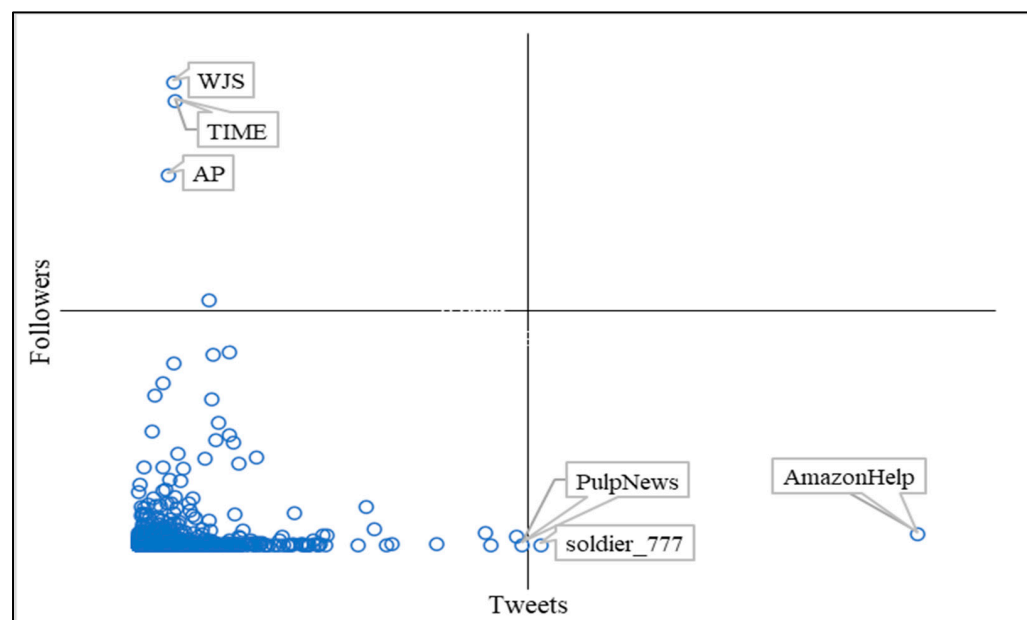


Figure 2. Twitter Followers and Activity. Note: Users with the highest number of tweets and followers standardized based on the highest number. Prepared based on data from Mozdeh. Source: Own elaboration.

Figure 3 shows the relative frequencies of the ten words prevalent in the corpus under study. In line with the findings on the frequency of labels, similar results are observed for frequent words. Thus, words such as Home and Remote stand out while teleworking, telecommuting, or distance work is absent. Terms related to employment or recruitment

appear, which reveals that Twitter is also a platform where job offers are frequently shared. For example, tweets such as: “We’re hiring! Read about our latest job opening here”.

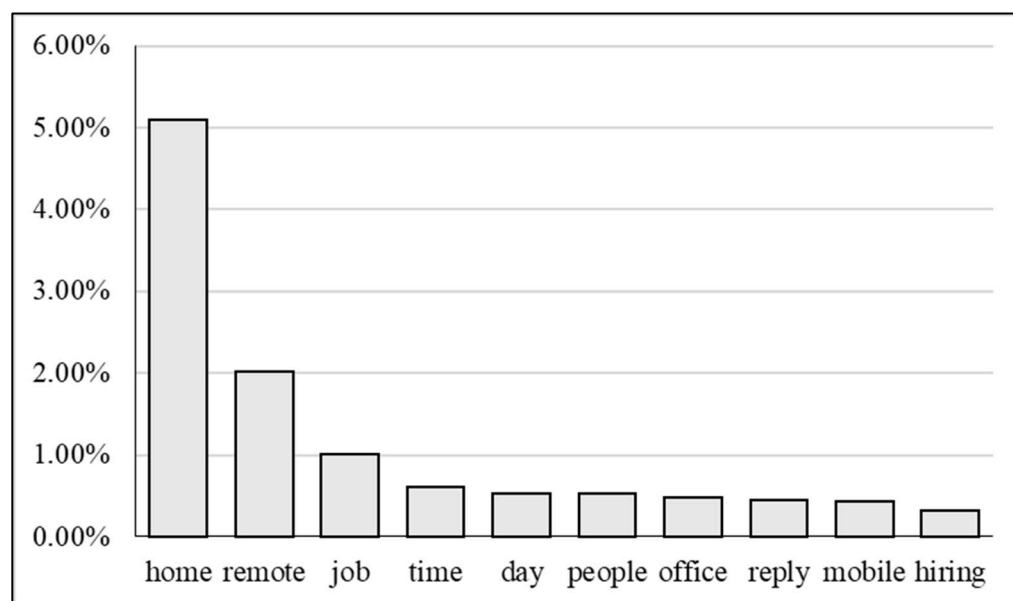


Figure 3. Top 10 Most Frequent Words. Note: Relative frequency of keywords obtained with the ggplot library of the statistical software R. Source: Own elaboration.

Mobile devices also appear as useful artifacts to perform work under this modality, in conditions of isolation; as the following tweet shows: “Portable and mobile, working from homework I prefer to work from home”. In relation to the above, [Adamovic \(2022\)](#) argues that isolation can be avoided by using mobile technology in a more effective way to be socially present. A similar argument is found in [Mendonça et al. \(2022\)](#), who argue that the Internet and social networks help to reduce social distances. Mobile devices can also be important for finding out news or instructions for job functions or new employment opportunities.

Figure 4 shows a cloud graph with the most frequent word pair relations. The application of bigrams is observable in different studies published in the field of management, for example, in [Müller et al. \(2023\)](#), who analyze the challenges faced by remote workers to develop tasks in the field of software development. In the cited study, the results showed that staffing contact is a problem frequently mentioned by experts. On the other hand, in this study, the results confirm the findings presented in previous lines, reaffirming that working at home, homework, or remote work are convenient terms to approach the phenomenon in the practical context.

Table 2 shows the most frequent trigrams. This is the combination of three words most frequently used in the database of tweets. In this case, prevalence is observed in phrases related to achieving work at home or remote work. However, words related to commuting from work to home are also observed, which was an aspect of concern for the public health emergency, as shown in this tweet: “Autumn 2020, on the way home from work, I was told by a woman, on her way home from a club, that I should not be allowed out without a letter from my Doctor, because I cannot wear a mask”.

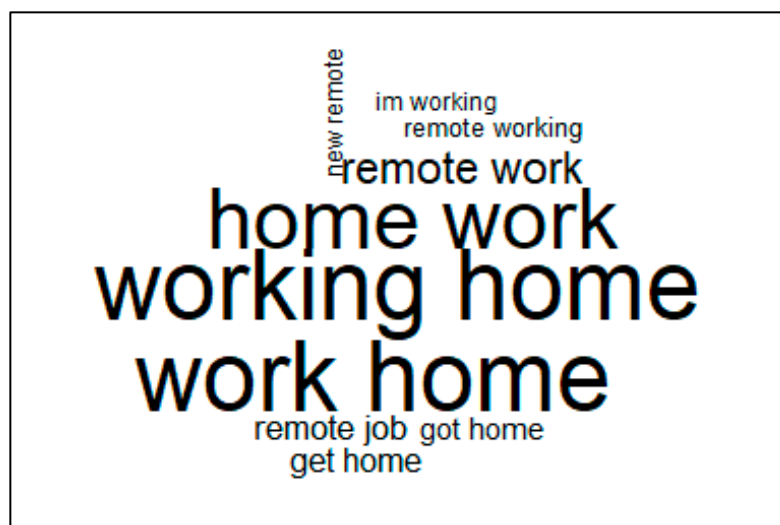


Figure 4. Bigram of words Note: Word cloud constructed with the word cloud library of the statistical software R. Source: Own elaboration.

Table 2. Top Five Trigrams.

Trigram	Absolute Frequency	Relative Frequency
get homework	2.066	0.14%
got homework	1.958	0.13%
new remote job	1.525	0.10%
just got home	1.154	0.08%
way homework	1.106	0.08%

Note: Trigrams were generated with the tidytext library of R. Relative frequencies were calculated based on 1,463,860 trigrams.

Figure 5 shows the most frequently discussed words for a set of topics relevant to the analysis. Issues such as family, business, home management, productivity, technology, health, management, and leadership were considered. In the case of family, the word singular stands out, which can be associated with the benefits of work-life balance related to teleworking. Regarding the business issue, topics such as advertising, e-business, home-based business, and small business stand out. Regarding home management, words such as household, housework, or housewife, related to domestic activities or household chores, are identified. In terms of the above, Çoban (2022) discusses how teleworking can generate an increase in household chores in women. It is also noted that employee productivity and efficiency related to telework are a matter of concern.

Regarding technologies, Figure 5 identifies words related to business, information, and even mortgage credit. Saura et al. (2022) highlighted the importance of technology in making telework more efficient. In addition, reference is made to assistive technologies, which may be important for managing problems of widespread public health concern. Technologies also appear to play a prominent role in health-related issues. However, another issue identified in this thematic axis is mental health. In this regard, Singh et al. (2022) pointed out that some technologies can be intrusive and hurt workers' well-being. Regarding administration, topics such as project management, types of management, and knowledge management are observed, although computer applications for the management of commercial channels and real estate valuation also stand out. Regarding leadership, some styles stand out, such as conscious leadership, non-profit leadership, or sustainable leadership, which can favor the confrontation of situations such as pandemics.

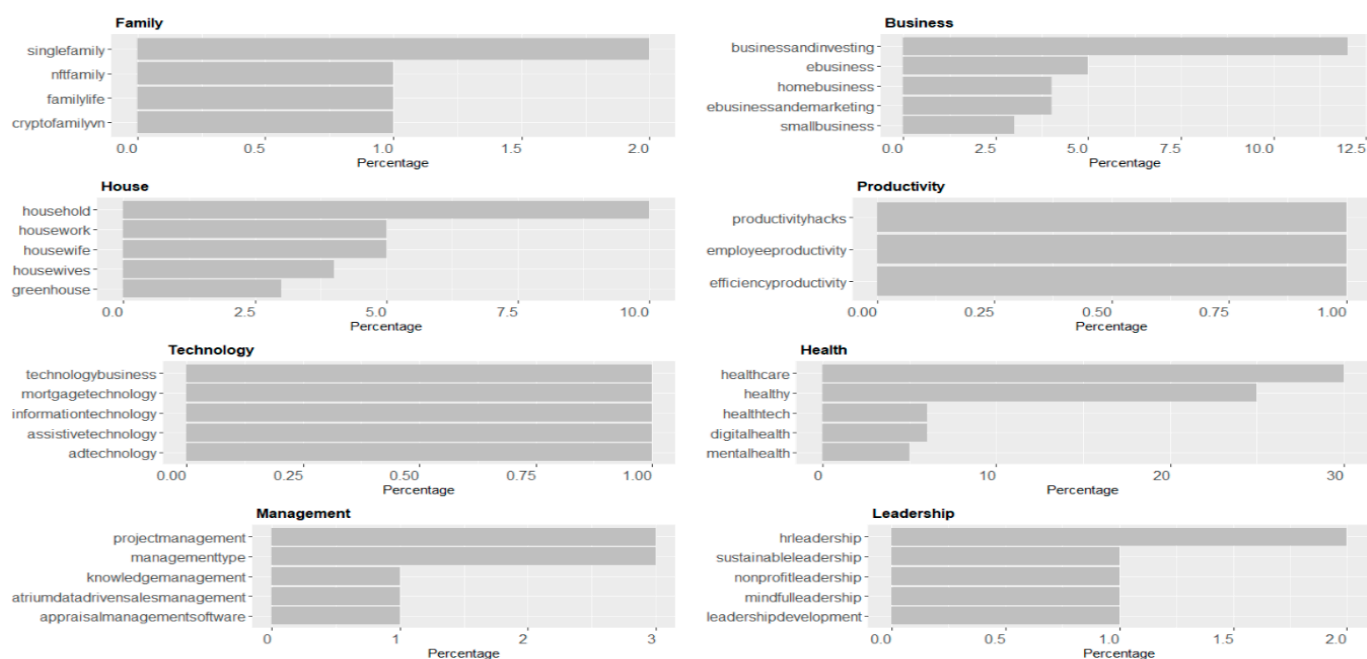


Figure 5. Thematic map. Note: Prepared with the tidytext and ggplot libraries of R. Source: Own elaboration.

Figure 6 shows a network graph, linking those associated with the tweets that make up the corpus based on their co-occurrence relationships. The size of the nodes identifies the centrality or influence of each node within the network, considering the degree metric. The colors of the nodes represent the clustering performed with Louvain's algorithm. In general, at least three clusters are identified in the study corpus. The blue cluster groups the largest number of terms and brings together different issues of concern associated with the pandemic, such as home, school, work, time use, or health. The yellow cluster brings together concepts related to working from home or remote work, where business, support, administration, and specific areas such as engineering, and development stand out. Finally, the red cluster where mobile technologies are related to the word money can be explained by the business opportunities that can be managed through mobile applications.

For this analysis, a random sample of 10,000 tweets is extracted from the 101,150 that make up the database due to the computational requirements to apply the library. Applying the Syuzhet library of the R statistical software, it is observed that 62.73% of the tweets that make up the sample present a positive valence, and the remaining 37.27% present a negative valence. Figure 7 shows the cumulative relative frequency for categories 1 to 9. These categories identify the number of words that can be assigned positive and negative sentiment valence for each tweet. In general, the prevalence in the positive category is confirmed. The above, insofar as cases can be identified in which five or more positive words are found per tweet, cases in which there are more than three words with negative valence in a tweet are less frequent. This result is congruent with studies such as [Arntz et al. \(2022\)](#), who found that workers seem to value working at home according to their level of job satisfaction. Therefore, it can be concluded that the generalized opinion of Twitter users about teleworking is positive.

trust between the employee and the manager generates a greater benefit attributable to flexibility and autonomy. In this regard, the [International Labour Organization \(2020\)](#) proposes that regular electronic communication promotes collaboration, trust, and transparency in teams working remotely. [Dubey and Tripathi \(2020\)](#) conducted a emotion analysis about working from home is carried out where similar results were found to the extent that trust, anticipation, and joy are the emotions that best describe the opinion of Twitter users. Regarding the emotion of anticipation, the authors associated it with people's expectations to experience working from home. Finally, the third emotion in prevalence is joy. [Anderson et al. \(2015\)](#) found that teleworking can reduce the experience of emotions such as stress and anxiety and can increase positive emotions such as happiness, joy, and the like.

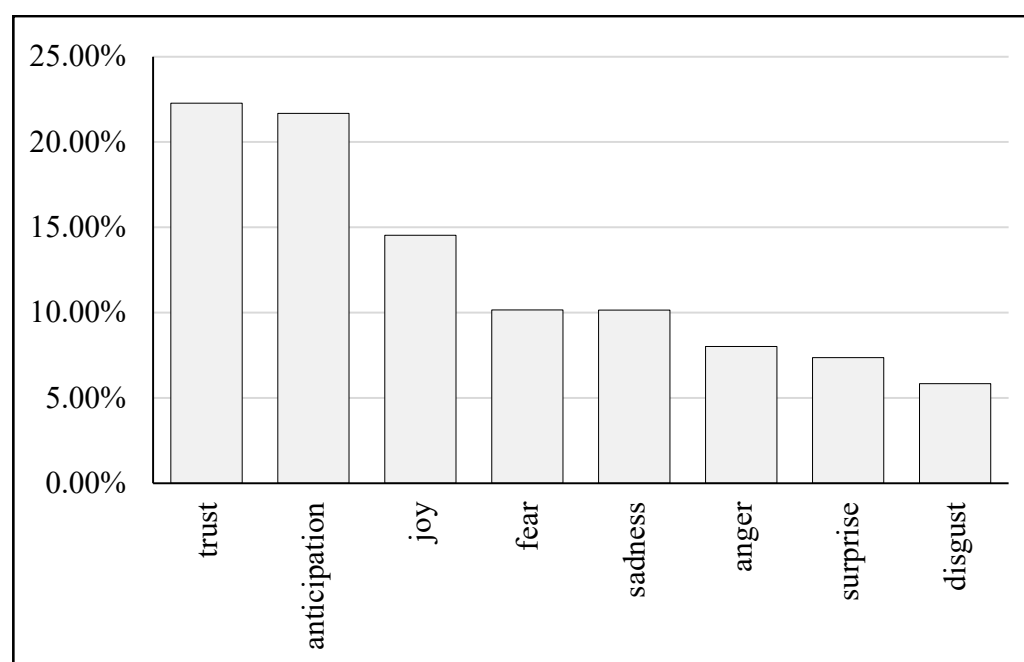


Figure 8. Relative Frequency of Emotions. Note: Relative frequency of emotions, according to the number of associated words, using the NRC Word-Emotion Association Lexicon lexicon by Saif M. Mohammad. The Syuzhet library of R was applied for calculation. Source: Own elaboration.

5. Discussion

In this study, an analysis of opinions on telework in the context of a pandemic is made. First, an analysis is made of the different conceptual approaches to flexible work modalities. Some nuances are found in terms such as teleworking, telecommuting, remote work, work from home, or distance work. However, the common denominator is that “all these terms exchange a common idea, and that is that work does not have to be done in the office but can be done anywhere in the world” ([Sroka 2018](#), p. 147). Even so, there are some relevant considerations from the regulatory point of view, such as in the Colombian case, where telework, work at home, and remote work have each been regulated with different legal provisions. These normative definitions have an impact on how telework is implemented in the country; therefore, they must be considered when considering its adoption in the organizational context. In any case, for this study, the terms telecommuting, teleworking, work-from-home, remote work, homework, distance working, and mobile work have been addressed as elements associated with the same conceptual category.

A textual and opinion analysis of a set of conversations on Twitter, which were collected during the month of March 2022, at which time the pandemic was still a public health emergency worldwide, is proposed. Mozdeh software was used to collect the information, which in turn has integrated access to the Twitter API and allows for the cleaning of elements such as spam. Based on the above, a general exploration of the

information in the database is made, with which it is possible to identify some patterns. For example, most of the tweets are related to tags such as work-from-home, home working, and remote work, while the tags teleworking or telecommuting are less frequent. The above contrasts with other studies, such as that of [Loia and Adinolfi \(2021\)](#), where it is stated that Teleworking and Telecommuting are used in a large part of academic publications. The above allows affirming that the terms Work-From-Home, Home, and Remote Work are preferred in the practical context. In addition, the tweets that have received a higher number of Likes are analyzed, with which a first impression about the opinion about teleworking is obtained, which is shown to be positive. In the tweets of users with a greater number of followers, the comfort of the home is highlighted as one of the positive aspects related to teleworking.

The textual analysis has allowed us to identify some terms frequently related to flexible work modalities. In general, the results reaffirm that Work-From-Home, Remote Work, or Homework are the terms most frequently used by Twitter users. A term that also stands out for its frequency is Mobile.

[Belzunegui-Eraso and Erro-Garcés \(2020\)](#) point out that despite the idea of linking telework to the possibility of performing work from home, what is important in its definition is the possibility of working outside the employer's premises, with the assistance of technologies such as mobile telework. However, these technologies also pose a challenge insofar as the unnecessary use of mobile devices can generate stress in people during working hours ([Reizer et al. 2022](#)). Some relevant words related to different dimensions of telework were identified. The adoption of telework can contribute to issues such as e-business, project management, or the use of technologies for management. However, some studies denote concerns about the distribution of household chores, work productivity, or mental health implications. Finally, sentiment analysis is conducted to address the opinions of Twitter users about the teleworking model.

According to [Liu \(2012\)](#), since the concept of opinion is very broad, sentiment analysis deals with the evaluation of opinions involving positive or negative sentiments. The findings show a higher proportion of positive sentiments in the body of tweets under analysis. These results are consistent with studies such as [Dubey and Tripathi \(2020\)](#), who find a positive perspective of people towards the concept of working at home. [Saura et al. \(2022\)](#) identify aspects of teleworking that are positively evaluated, such as work-life balance, stress management, and even the issue of sustainability, considering that the lower level of travel by public transport reduces pollution in cities.

[Zhang et al. \(2021\)](#) conducted a sentiment analysis on remote work and found a slight predominance of positive tweets. The authors point out some benefits of remote work, such as collaboration and communication tools to conduct virtual transactions with people. They also refer to positive effects on productivity, flexibility, and social connections.

The analysis of opinions regarding teleworking allows us to analyze the valence of sentiments about teleworking. The results show that positive sentiments are prevalent and related to emotions such as confidence, anticipation, and joy. This can be interpreted in terms that the adoption of telework can generate a sentiment of expectation; however, generalized confidence is perceived in this model of work organization, which may be associated with a connotation of protection against possible contagions related to the pandemic. In addition, the sentiments of happiness stand out, which can be justified based on the positive benefits of teleworking, which have been mentioned in the studies cited in previous lines. In any case, governments and organizations interested in promoting this modality of work in the organizational context should strive to pay attention to negative conditions related to telework that are manifested in the networks, such as the exhausting hours of teleconferencing, inappropriate home configurations or poor internet connections ([Zhang et al. 2021](#)).

6. Conclusions

The objective of this paper was to conduct a Twitter-based sentiment analysis of telework in the post-pandemic context of COVID-19. To this end, a textual and sentiment analysis of a set of publications of users of the social network Twitter during the month of March 2022 was carried out. Firstly, the concept of teleworking was analyzed from a contextual perspective. Although, from a theoretical and conceptual point of view, there is no single definition with well-established delimitations to refer to telecommuting or remote work, the findings reveal that the terms most frequently used in practice are Working-From-Home, Homework, and Remote Work. This result constitutes a first contribution to the body of knowledge on teleworking, in the sense that a greater prevalence of these terms is observed, in contrast to Telecommuting or Teleworking, which are more often observed in the academic literature. Therefore, it is recommended that empirical studies consider those terms of widespread use in the practical context.

The study also generates a contribution regarding the characterization of the different topics of discussion related to telework. In that sense, some relevant issues are identified, which can be considered by academics or professionals in the administration and management of human resources to carry out research in this field. For example, the results reveal the importance of telework in areas such as advertising, e-business, or activities related to information technology. Thus, work developed in specific contexts can contribute to the analysis of the sentiments and the value that people assign to teleworking work situations. In addition, further studies could analyze the benefits of teleworking for people with special conditions, such as those who must travel long distances to attend the office, people with physical or mental disabilities, or single-parent households. It is also important to consider the negative effects that telework can have on mental health, the ability to socialize with others, or the blurred boundaries between work and home, which can produce negative emotions such as sadness, disgust, or anger.

The sentiment analysis developed in this study, in general terms, shows a positive opinion about teleworking, in line with the results of previous studies. This idea is reinforced according to the prevalence of positive emotions such as confidence and joy. This is an important finding in the sense that, by the time the data collection was done, the isolation measures had been implemented for about two years, and in many areas, they were already being relaxed. Therefore, there was an extended window of time for experimentation with teleworking arrangements by many individuals worldwide. In that order of ideas, the results reveal that positive sentiments persist; therefore, it is convenient to consider teleworking, in its different modalities, as an opportunity to boost the welfare of workers. However, it is advisable that decision-makers in organizations find a balance between the benefits and limitations of telework, for which it is advisable to carry out an adequate analysis of the context in which these arrangements are to be implemented.

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