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Sociocultural factors during COVID-19 pandemic: Information consumption on Twitter

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ABSTRACT

The purpose of the research is to describe the sociocultural factors that emerged during the COVID-19 pandemic. Twitter is used as an instrument for data collection. The study is qualitative and uses the netnographic method. To analyze the flow of messages posted on Twitter, the model proposed by Perez-Cepeda and Arias-Bolzmann (2020), which describes sociocultural factors, is taken as a basis. The semantics that people use are a type of functional knowledge that reveals sociocultural factors. Sentiments were analyzed through lexicon-based methods, which are the most suitable. The categorization and classification of the data are performed based on the information that users post on Twitter. The tweets related to COVID-19 describe the sociocultural issues and the level of sentiment around the pandemic. The discussion centers on the COVID-19 pandemic, information consumption, lexicon, sociocultural factors and sentiment analysis. The study was limited to the social media Twitter; another limitation was not to consider the social group of the users who interact with @pandemic_Covid-19, official account of the World Health Organization (WHO). This research contributes to the social sciences, focusing on sociocultural interaction through the use of the social network Twitter. It describes the link between sociocultural factors and the level of sentiment on issues related to the COVID-19 pandemic.

1. Introduction

The global crisis generated by the COVID-19 pandemic tested the existing culture of human beings (Tran, Hardie, & Cunningham, 2020). This pandemic has led individuals to change the way they communicate and behave socially in physical and virtual environments. On the other hand, the COVID-19 lockdown imposed rules of social distancing, which require people to stay away from each other, and thus people around the world responded to this forced isolation by adopting forms of sociability that do not require physical interaction. This contradicts the fact that the human being, as an actor in society, maintains the momentum and desire to socialize with others (Morrow, 2020). Social isolation does not isolate human beings from their environment; rather, the human being seeks to integrate into society through different means of communication and learn from that relationship. In this way, it is up to society to learn from the crisis triggered by the COVID-19 pandemic (Besand, 2020). According to Siripongdee et al. (2020), the COVID-19 pandemic has a strong impact on society. For Torales et al. (2020), it is a matter of debate whether COVID-19 will modify the sociocultural and individual

environment where human beings interact. On the other hand, Khaleghi et al. (2020) stated that the COVID-19 crisis puts human health, life, economy, international relations, and social interactions at serious risk. Based on these criteria, it is important to investigate the sociocultural factors that emerge from the interaction between individuals and society during this pandemic.

It is true that the COVID-19 pandemic requires lockdown restrictions and social distancing, but this does not mean that the exchange of information between people ceases to exist. In this way, digital channels play an important role in establishing communication links between individuals. Regarding digital channels, Khaleghi et al. (2020) stated that the COVID-19 pandemic appeared in a world equipped with much more advanced digital technologies, including the internet and social media. Siripongdee et al. (2020) said that the internet has become a necessity in almost every aspect of daily life, especially when physical contact between people is restricted to prevent the spread of COVID-19.

On the other hand, Amara et al. (2021) determined that most of the research works on the COVID-19 pandemic use data collected from Twitter. They support this fact by stating that compared to other social

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networks, Twitter Inc. has open policies to collect data, and because of that, Twitter data have been exploited by most research works, although Facebook is ranked as the social network with the most active users. In addition, [Hua Tan et al. \(2020\)](#) mentioned that Twitter has become particularly relevant in the context of COVID-19 because multiple users use this social network to express their opinions on issues related to the pandemic. This makes sense and aligns with the research of [Missier et al. \(2017\)](#). They investigated how the Zika virus affected society and determined that it was possible to identify the social content of the messages posted on Twitter.

There are important international organizations focused on people's health, such as the United Nations Children's Fund (UNICEF), the Pan American Health Organization (PAHO) and the World Health Organization (WHO). However, a review of the WHO's Constitution shows that "The objective of the World Health Organization shall be the attainment by all people of the highest possible level of health". Furthermore, Article 54 of the WHO Constitution states that "The Pan American Sanitary Organization represented by the Pan American Sanitary Bureau and the Pan American Sanitary Conferences, and all other intergovernmental regional health organizations in existence prior to the date of signature of this Constitution, shall in due course be integrated with the Organization". Based on this information, it can be inferred that the WHO is the organization that leads the health of people worldwide. For this reason, this research takes the WHO as a source of information.

During the COVID-19 pandemic, the WHO became one of the actors that posts and consumes information on a social network such as Twitter. WHO on its website states that "On this website you can find WHO information and guidance on the current coronavirus disease outbreak (COVID-19) that was first reported in Wuhan, China, on December 31, 2019." With this description, we can infer that the WHO provides relevant information regarding the COVID-19 pandemic. For this reason, the purpose of this research is to describe the sociocultural factors related to the group of people interacting with Twitter users @pandemic_Covid-19, official WHO account.

On the other hand, the narratives made by groups of people from different environments and social classes should be analyzed to investigate consumption behavior. The findings that emerge from the analysis of conversations contribute to the academic community with relevant data on social sciences, such as perceptions or assumptions of norms, values, beliefs, and ideologies ([Coskuner-Balli, 2013](#)), which are inherent to sociocultural factors. Thus, it can be determined that interactions between individuals leave a trail of information that can be analyzed by researchers focused on the social sciences ([Pérez, 2019](#)). It is expected that the results of this research will be an instrument for (a) social media administrators, so they can learn about the lexicon used by users when posting messages, especially during the pandemic; (b) researchers, so they can analyze the body of the message and determine sociocultural factors that underlie the writing, interpretation, and exchanges of tweets between users; and (c) academics, so they can use Twitter as a tool to collect data to determine the perception of users exchanging information in times of crisis. The relevance of this research lies in describing the link between sociocultural factors that emerge in times of global crisis, such as the COVID-19 pandemic, and the model describing sociocultural factors proposed by [Perez-Cepeda and Arias-Bolzmann \(2020\)](#) and [Perez-Cepeda and Arias-Bolzmann \(2021\)](#).

Based on the above, the following research question (RQ) arises: How do sociocultural factors and the level of sentiment related to the group of people interacting with the Twitter user @pandemic_Covid-19 influence tweets referring to the COVID-19 pandemic? Furthermore, we posed additional questions that relate to the analysis of conversations on Twitter among users who consume information related to the COVID-19 pandemic. RQ1: What is the structure of tweets posted by users interacting with @pandemic_Covid-19? RQ2: What are the topics addressed by users interacting with @pandemic_Covid-19? RQ3: What level of sentiment characterizes social factors emerging from topics addressed by users interacting with @pandemic_Covid-19? RQ4: How are topics

addressed by users interacting with @pandemic_Covid-19 conceptualized? RQ5: What are the sociocultural ideologies related to topics addressed by users interacting with @pandemic_Covid-19?

Studying what people say about the COVID-19 pandemic is important for two reasons. First, according to consumer culture theory, the frequent use of data consisting of images, texts and objects allows us to describe how people consume in multiple social spaces, such as the internet ([Arnould & Thompson, 2007](#)). Based on the content of messages (tweets) built through images, texts, and objects (videos) on the COVID-19 pandemic, you can determine how users give meaning to messages they consume on Twitter. [Lawrence and Dover \(2015\)](#) indicated that people need to build or choose places to interact with other individuals to make sense of things. [Küçükömrürler and Özkan \(2018\)](#) added that the attribution of meaning underlies the cognitive process from language, allowing people to interact among them.

Second, the implementation of digital communication channels promotes the production and consumption of information, which makes it possible to know the sociocultural factors of the people who interact in them ([Perez-Cepeda & Arias-Bolzmann, 2020](#)). In this way, this research provides relevant information on sociocultural factors during the pandemic and generates new knowledge that serves as a livelihood for studies aimed at identifying behaviors in virtual environments. In addition, it promotes the use of netnography as a research method to understand social interaction in digital environments. It also allows us to identify areas of theoretical interest that have not been addressed in other research through social media theory, sentiment analysis, and netnography.

The contents of this document are organized as follows. First, we address the background and situations generated by the COVID-19 pandemic. Later, we review the literature on the COVID-19 pandemic, sociocultural factors, social media, lexicon-based approaches, nongovernmental organizations (NGOs), and the literature gap. Then, we describe the approach and research methods. After that, we present the results from the categorization and classification of the tweets collected for research. Finally, we list the conclusions based on the findings. This document ends with implications and recommendations for future studies.

2. Literature review

2.1. COVID-19 pandemic and social factors

Regarding the COVID-19 pandemic, [Adams \(2020\)](#) stated that today's concerns are not only biological but also psychological, sociocultural, economic, and spiritual. [Frith \(2020\)](#) indicated that the coronavirus pandemic has created conditions for rapid knowledge generation about the virus itself and its behavior in humans and individual societies. On the other hand, [Suyanto et al. \(2020\)](#) stated that the COVID-19 pandemic has forced people to develop new social constructs to face the so-called new normality, and added that social change can occur in many ways, such as in economic activities, lifestyle, behaviors, structure of society, ideology, beliefs, values and even in things that were previously thought indispensable. According to [Litam \(2020\)](#), social inequalities and COVID-19-related policies can disproportionately affect minority groups and people from lower socioeconomic groups. From the same perspective, [An and Tang \(2020\)](#) said that the evolution of emergencies generated by COVID-19 may be visible in society at large but mask the problems that lie ahead among minority groups. In terms of cultural factors, we can say that the role of culture has been widely studied for decades by researchers, discussing how cultural factors can act as a buffer against environmental stressors or, conversely, exacerbate stress levels ([Dar, 2017](#)). [Farsi \(2021\)](#) believes that cultural factors should not be ignored in digital capability because they belong to the continuous improvement of the process toward digital transformation. [Magis-Weinberg et al. \(2021\)](#) found that cultural factors influence the access, use, and appropriation of digital technology. [Kowal et al. \(2020\)](#),

on the other hand, stated that cultural factors related to daily life have become relevant in predicting the well-being of the population during isolation. However, the reasons for the difference between men and women in their responses to COVID-19 cannot be clarified. This occurs despite an agreement in the scientific community on the convergence of cultural factors (Montesi, 2021) and because among the various cultural factors, those related to information behavior, which can be fundamental in adaptation processes, including the response to crises such as the current pandemic, are generally not addressed. In addition, Mirba-baie et al. (2020) stated that messages must be culturally appropriate to be properly interpreted by the consuming society. It is worth mentioning that cultural factors always play an important role in the nonobservance of norms and, especially, in health. Without knowing them, it is not possible to give a complete explanation of the reasons for not following the established norms (SoleimanvandiAzar et al., 2021). Therefore, surviving during the COVID-19 pandemic requires creating support communities, sharing tools, knowledge, and listening to different voices (Bozkurt et al., 2020). To listen to the voices of global society, minimize misinformation and learn about social concerns related to the COVID-19 pandemic, the WHO created a communication team for the management of social networks and thus kept global society informed about the behavior and evolution of the COVID-19 (Schillinger et al., 2020). Moreover, Casero-Ripollés (2020) stated that information was a fundamental resource for society at large, and it was a valuable mechanism to guide people, especially in extremely complex situations such as those generated by the COVID-19 pandemic. It can therefore be inferred that information flowing through different channels of virtual communication, such as social networks, leads to awareness of sociocultural factors emerging from the COVID-19 pandemic.

2.2. Social media and Twitter

Litam (2020) stated that social media and the internet are essential as information, communication and entertainment resources. On the other hand, Akbulut et al. (2020) indicated that the COVID-19 pandemic has made social media play an important role in increasing citizen participation in virtual communication channels. In turn, Chesser et al. (2020) stated that a low level of knowledge about COVID-19 promotes the need to share disease-specific information through online sites and social networks, where people are already accustomed to the operation and know how to search for information. Woo et al. (2020) said that despite the spread of multiple digital platforms, Twitter remains at the heart of the social networking landscape. Twitter has been found to be especially effective in communicating with audiences actively participating in a social crisis (Jin et al., 2014). Tan et al. (2020) mentioned that Twitter has become particularly relevant in the COVID-19 context, and an increasing number of people are using social media to express their views on pandemic-related issues. For Call-Cummings et al. (2019), people outside their home country, without friends or family, consume news from the COVID-19 pandemic via Twitter. Based on these criteria, it can be said that during this crisis, the information consumed through the social network Twitter has relevance to society at large because it allows us to stay informed about the global crisis that humanity is going through.

2.3. Nongovernmental organizations (NGOs) and digital media

The use of digital media in NGOs promotes the construction of a vibrant civil society within countries (Armstrong & Butcher, 2018). Digital media, such as the internet and social media, play an important role in organizations such as NGOs (Lo & Waters, 2012). Liu (2011) stated that the use of digital media in NGOs aimed at identifying countless patterns of use, such as the adoption of dialogical principles and the formation of digital communities. Furthermore, Yazdavar et al. (2020) said that ideas that are extracted from messages posted on digital media such as Twitter are a complement to the results obtained by other

research methods such as surveys. This is because this information contributes to the development of the policies of governmental and nongovernmental organizations. On the other hand, Saffer et al. (2019) stated that the number of times users mention or forward messages where the NGO is implied denotes the degree of interaction with and interest in the organization. For, Gálvez-Rodríguez et al. (2019), there is little research to address how governments and NGOs use messages posted on social media to foster civic engagement and address humanitarian crisis situations. Based on the arguments expressed, it can be deduced that the consumption of information from users involved in social networks belonging to NGOs, such as the WHO, will be significant according to the topic and social factors to be investigated.

2.4. Literature gap

We must recognize linguistics as the fundamental basis of natural languages, namely, linguistics is the ability of human beings to express thoughts and sentiments through words. In turn, the use of language aims to build and maintain identities and social relationships and even define the boundaries of communities (Nguyen et al., 2016). On the one hand, the semantics that people use when structuring a message are a type of functional knowledge that reveals sociocultural factors (Liang et al., 2016). Social factors such as attitudes, motivations, and the social and political context are just as important as linguistic factors in multilingual environments (Bhatt & Bolonyai, 2011). Casero-Ripollés (2020) believed that COVID-19 is a phenomenon of enormous magnitude and relevance that has affected several social domains. The COVID-19 pandemic has unintentionally taught us that interacting with other people and meeting social or business needs can be done virtually with the help of applications available on the internet (Suyanto et al., 2020).

Regarding sentiment analysis, Adwan et al. (2020) indicated that for future research on sentiment analysis approaches on Twitter, the use of theories and technologies to establish the sentiment of linguistic expressions published on the Web is recommended. On the other hand, Mostafa and Nebot (2017) suggested that future research uses topic recognition techniques to determine the most representative topics behind each sentiment, allowing comprehensive knowledge of the underlying causes of positive or negative sentiments to be obtained. In addition, Perez-Cepeda and Arias-Bolzmann (2020) recommend that future studies look at how people make sense of the information they consume in digital media and how information influences sociocultural factors. In addition, they propose to use as a starting point the model that describes the cultural factors of the homosexual subculture to compare sociocultural contexts that arise from studies on social domains with the social network Twitter.

Based on the above, the following hypotheses are formulated. H1: The content and semantics used by people when structuring a message on Twitter is a type of functional knowledge that reveals sociocultural factors. H2: The use of theories and technologies focused on sentiment analysis determines the sentiment level of sociocultural factors and linguistic expressions posted on Twitter.

To summarize, in times of global crises, such as those generated by the COVID-19 pandemic, virtual communication channels play a predominant role in human connections. Through them, messages are posted and consumed, and their contents have perceptions or assumptions of norms, values, beliefs, and ideologies that lead to determining the sociocultural factors that influence the construction of messages. Social networks such as Twitter make this connection feasible worldwide. Accessibility to publications and instant communication makes people publish and consume information in real time. For this reason, Twitter is used by a great deal of people to do research and share news about relevant events such as what is happening with the COVID-19 pandemic. It is important to point out that technological media such as the internet and social networks such as Twitter have become an ally for organizations, allowing them to know and respond to the concerns of users who interact through them. During the world crisis generated by

the COVID-19 pandemic, the WHO became the focus of global attention, which led to the publication, reception, and response of messages about the COVID-19 pandemic through various virtual communication channels, including Twitter messages with structures and wording that reveal different sentiments.

3. Method

This research is descriptive and uses a qualitative approach. Qualitative research is used in the social sciences to understand the patterns of behavior and consumption of individuals in different environments (Arnould & Thompson, 2005). The netnographic method is focused on qualitative research because it leads to the study of cultures and communities over the internet and therefore allows us to acquire significant knowledge of consumers interacting in digital environments (Kozinets, 2002b). With this background, the netnographic method is used for this research. According to (Kozinets, 2002a), there are two crucial stages in netnography. First, researchers must prepare in advance the questions to identify the communities and forums that will be studied. Second, they should be familiar with the online forums where community members interact. Based on these criteria, it is clear that user @pandemic_Covid-19, which belongs to the WHO, is aligned as recommended by Kozinets (2002b). In addition, there is great user interaction and message traffic related to the research question (RQ). Likewise, Yum (2020) stated that people rely on the WHO to share information about COVID-19.

Social networks have become a predominant communication method in social settings (Sanderson et al., 2014). Twitter is a platform on which there are significant discussions on cultural issues in general (Schmittel & Sanderson, 2014). Segerberg and Bennett (2011) affirmed that the virtual environment is an adequate place to exchange different criteria, such as social protests. With this background, Twitter is adopted as a data collection tool.

To collect tweets with their respective polarity scores according to the lexicon and record them in an Excel file, we used R Studio software including the library (Sentiment Analysis). At the end of the data extraction, 909 tweets were obtained. Later, the data were migrated to ATLAS ti software to analyze the tweet contents. This software is a useful tool for academic research, especially for social science disciplines, and helps to quickly identify specific topics related to the proposed research (Gualda & Díaz, 2020; Hwang, 2008).

3.1. Sampling

Giesler and Thompson (2016) recommended that researchers on consumer culture apply an analytical logic to the data they take as input in different social environments, which can be found in institutional, political, social, and economic trends that would explain market behavior. In this way, it can be inferred that social environments are spaces where people get together and interact, similar to social media. On the other hand, Twitter Inc. provides users with instant connection and communication with people around the world, and thus Twitter can be considered a social environment and in turn a source (input) of information. Moreover, Twitter has the following features: (a) any user can post one or more tweets; (b) each tweet can contain 280 or fewer characters; (c) default messages are public; (d) tweets may include content such as photos, videos, links to other websites; and (e) tweets may be published at the time the user deems it appropriate based on the relevance of the event. It should be noted that each event could even trigger a series of events related to sociocultural aspects. All this is triggered by a simple question that Twitter asks: What are you thinking? With regard to the events, Giesler and Thompson (2016) stated that the temporary nature of events may be determined in hours, days, months or even years. Based on these criteria, this research was carried out from January to June 2020 because during those months, the COVID-19 pandemic spread across the world. As a result, in this period of time, 909 tweets were obtained from users who interacted with

@pandemic_Covid-19.

3.2. Data analysis

The nonexclusive class was used to assign categories to tweets, and the exclusive class was used to classify them. According to Zimmer and Proferes (2014), the nonexclusive class means that the content of the message can belong to multiple categories or classifications; in contrast, the exclusive class corresponds to a single category or classification.

First, the contents of the messages were categorized. To do this, tweets were analyzed under the six categories of Luo et al. (2015): URL-Link: a link in the tweet that leads to other websites that contain texts, images or videos; COM-Comment: judgments, opinions or comments posted on the tweet to express any judgment or feeling; TAG-Hashtag: combinations of words preceded by the hash sign (#) to quickly search for a particular topic; RWT-Retweet: tweets received and forwarded without modification; MSG-Message: the message *per se*; and MET-Mention: the recipient of the tweet (see Table 1).

Then, based on the content of the message, the tweets were classified. To do this, we considered the criteria of several researchers who addressed social and cultural topics, as well as those related to the COVID-19 pandemic. Olimat (2020) stated that TV, newspapers, and social media are still the dominant resources through which last-minute news about COVID-19 was broadcast. According to Ghounane (2020), social media are platforms that people use to share information for commercial, economic, and political purposes. On the other hand, Olimat (2020) said that language is an influential way of expressing the objectives of politicians, as well as a way to understand the sociocultural behavior of people. In the view of Schillinger et al. (2020), when health threats are evident, sociocultural and political contexts demonstrate different forms of susceptibility or resistance to social media messages, generating a critical assessment or receptivity to the information they consume. After all, we live in an interresponsible world, and it worries that social distancing creates a different kind of pandemic, such as isolation, loneliness, anxiety, depression, and less care for others. This is why it is now more important to be actively connected by exchanging psychological, sociocultural, and religious issues (Adams 2020). Meanwhile, Scherer and Pennycook (2020) stated that people's tendency to engage in greater thoughtful thinking is associated with their ability to identify incorrect information about COVID-19. In fact, the type of information, whether wrong or accurate, creates an impact on people's emotions (Chou et al., 2020). On the other hand, humor has a variety of social functions, including the creation of meaning, relieving stress and building cohesion for communities (Wills & Fecteau, 2016). Based on the criteria of different researchers, it can be determined that according to their content, tweets can be classified into sociocultural topics, information, reflections, news, politics, humor, rudeness, economy, and religion. Table 1 shows the nine classifications, and Table 2 refers to some tweets concerning the classifications.

Wang et al. (2019) stated that lexicon-based methods are conducive and have received much acceptance when analyzing the ideas, judgments or concepts expressed by people in different social spaces. Jamadi et al. (2020) affirmed that a lexicon-based approach is quick and independent to analyze the different topics that are in the conversations. Adwan et al. (2020) expressed that lexical-based approaches leverage a list of words and, based on the set of words, a polarity score is assigned to determine their influence on the sentence. These approaches make use of a dictionary containing a list of words, which, according to their connotation in the sentence, are classified as positive, negative and neutral. Taboada et al. (2009) concluded that for sentiment analysis, lexicon-based methods are solid, result in good performance among topics, and can be easily improved with multiple sources of knowledge. On the other hand, Miao et al. (2010) argued that the lexicon-based approach is widely used for sentiment analysis (opinions) and added that the sentiment score is determined by a comparison between the sentence presented and an expert-defined entry in the dictionary that is

Table 1
 Categorization, Classification, and Level of Sentiment - prepared by the authors.

Total Tweets	Non-exclusive Categorization	Number	Exclusive Classification	Number	Percentage		
					Positive-Sentiment	Negative-Sentiment	Neutral-Sentiment
909	COM-Comment	688	Sociocultural	210	31.43%	28.10%	40.48%
	MET-Mention	432	Information	209	22.01%	31.10%	46.89%
	MSG-Emoji	363	Reflection	189	19.58%	47.62%	32.80%
	MSG-Message	221	News	136	24.26%	33.09%	42.65%
	RWT-Retweet	688	Politics	78	23.08%	41.03%	35.90%
	TAG-Hashtag	354	Humor	31	19.35%	32.26%	48.39%
	URL-Image-Link	179	Rudeness	24	8.33%	41.67%	50.00%
	URL-Object-Link	142	Economy	22	22.73%	36.36%	40.91%
			Religion	10	20.00%	20.00%	60.00%

Table 2
 Description of Tweets, Polarity, Conceptualization, Ideology - prepared by the authors.

Topics	Sample Tweets	Polarity	Conceptualization	Ideology
Sociocultural	Tweet 809 @TelGlobalHealth: Decisions about where you go, what you do and who you meet during the Covid-19 pandemic are \life and death\, the @who has warned\n\n@jriggers \nhttps://t.co/ozs675jBjk	-1.0	Show society's behavior during global crisis, as the COVID-19 pandemic	They are based on lifestyles, customs and social interactions, which are affected by the lockdown restrictions
Information	Tweet 388 @BillGates: There are over 100 different coronavirus vaccine candidates in the works. These candidates take a variety of approaches to protecting the body against COVID-19: https://t.co/sFTGWFLglq https://t.co/9iPgelzG1E	1.0	Narrate events, incidents and information about the evolution of the COVID-19 pandemic	They are characterized by the need to spread relevant information on the pandemic to be consumed by different users on multiple social communication platforms
Reflection	Tweet 35 @BarackObama: Protect yourself and your community from coronavirus with common sense precautions: wash your hands, stay home when sick and listen to the @CDCgov and local health authorities. Save the masks for health care workers. Lets stay calm, listen to the experts, and follow the science.	0.0	Promote awareness of the impact of the COVID-19 pandemic on society	Their goal is to raise awareness among society about the seriousness of the pandemic and the importance of complying with biosecurity standards
News	Tweet 47 @WHO: NEW: WHO interim guidance on critical preparedness, readiness and response actions for #COVID19 https://t.co/4QQ7VcQPe4 \n\n#coronavirus https://t.co/4hpP6i0oik	0.0	Communicate recent and relevant facts of public and global interest on the COVID-19 pandemic. Frequent use of links within the message underpins the news	Their objective is to provide rapid and meaningful news about the pandemic. It is clear that this type of news is given by individuals or organizations that enjoy a good reputation
Politics	Tweet 327 @CNN: President Trump's decision to withhold funding to the World Health Organization pending a review of its handling of the coronavirus pandemic is \as dangerous as it sounds,\ Bill Gates has said https://t.co/LDzRNOOP5J	-1.0	Show the points of view, criteria and positions that political actors have regarding events arising from the COVID-19 pandemic	They are based on how political actors deal with the pandemic according to the sociopolitical currents and social factors that shelter them
Humor	Tweet 218 @McCreamy: maybe if i call coronavirus dad i'll leave	0.0	Express in a funny way the events related to the COVID-19 pandemic	They are based on the mockery, irony, witticism, and sarcasm of the events related to the pandemic
Rudeness	Twwet 204 @MonicaLewinsky: one positive thing thats come out of coronavirus... those damn telemarketers w/ the 917 numbers (so i think its someone i know) have stopped calling me.	0.0	Write with vulgar language or insult people or events related to the COVID-19 pandemic	They are eager to insult, denigrate, offend, and criticize people or institutions that play a particular role in the pandemic
Economy	Tweet 400 @realDonaldTrump: Well run States should not be bailing out poorly run States, using CoronaVirus as the excuse! The elimination of Sanctuary Cities, Payroll Taxes, and perhaps Capital Gains Taxes, must be put on the table. Also lawsuit indemnification & business deductions for restaurants & ent.	-1.0	Show the economic impacts on countries, organizations, and individuals, triggered by the COVID-19 pandemic	They are supported by the economic crisis unleashed by the pandemic globally in government, business, and personal areas, among others
Religion	Twwet 403 @davidhogg111: Sending my deepest thoughts and prayers \n\nhttps://t.co/JerIMzYI97	0.0	Show religious beliefs during the COVID-19 pandemic	They are based on beliefs, traditions, and symbols related to the divinity, which are important to users who consume information and suffer the fury of the pandemic

used to validate whether the context of the sentence is positive, negative or neutral. [Pasat and Vasilescu \(2019\)](#) indicated that sentiment analysis is an area of natural language processing that develops systems that aim to identify and extract beliefs and opinions within the text, as well as select attributes of expressions such as polarity. Likewise, [Oussous et al. \(2020\)](#) noted that sentiment analysis, also known as opinion mining, is an increasingly important area of research and is a valuable tool for exploring large raw data and extracting relevant information. Based on the opinion of [Miller et al. \(2011\)](#), because of the growing popularity of

social media, sentiment analysis is being used, especially in text-rich sources such as blogs and Twitter. [Persada et al. \(2020\)](#) concluded that the sentiment-based approach could explain people's attitudes, opinions, emotions and feelings toward products, people, topics, organizations, and services. Based on the different criteria presented, it can be established that the sentiment analysis focused on the lexicon that people use when posting messages on different social networks leaves a trail of information that helps to infer how social factors influence the moment of the construction of the message through texts, images or

objects (videos).

Later, each classification identified the polarity score, that is, the level of sentiment that results from the analysis of the tweets. The polarity score of tweets was obtained automatically using the R Studio library software (Sentiment Analysis). Table 1 shows the nine classifications and their sentiment analysis. It should be noted that several researchers have used machine learning models and probabilistic models to identify words that convey positive, negative and neutral sentiments (Khoo & Johnkhan, 2018).

Finally, the categorization, classification and level of sentiment found as a result of the tweet analysis are mapped in the model that describes cultural factors, proposed by Perez-Cepeda and Arias-Bolzmann (2020). See Fig. 1.

4. Results

RQ1: The categories resulting from this study are used as references (Table 1). With regard to the structure of the tweets, it is clear that out of the 909 tweets, 75.69% belong to the COM-Comment category and 24.31% to the MSG-Message category. The RWT-Retweet category has a percentage similar to the COM-Comment category. Meanwhile, MET-Mention has 47.52%, MSG-Emoji has 39.93% and TAG-Hashtag has 38.94%. In lower proportion, the URL-Image-Link category represented 19.69%, the URL-Object-Link category represents 15.62%, and the URL-Text-Link category represents 29.81% Based on these results, we can infer that most tweets were posted by different users compared to the generation of new messages posted by users who interact with @pandemic_Covid-19. With the percentage obtained in the RWT-Retweet category, we can infer that the Tweet content is very important for users who consume the information and want that other users consume that information as well (MET-Mention). We can also conclude that emojis and hashtags in the tweets are used to strengthen and give

meaning to the content of the message. In addition, users insert links that lead to other social media in order to support the content of the message with images or videos. For all these reasons, we can determine that the findings are consistent with the study of Arnould and Thompson (2007), who stated that the frequent use of data made up of images, texts, and objects allows us to describe how people consume information in multiple social spaces. Thus, we can confirm that the spaces where people interact and the use of language make sense and give meaning to the information that is consumed (Lawrence & Dover, 2015; Küçükömrülçer & Özkan, 2018).

RQ2: We took as a basis the classifications from this research (Table 1). The topics identified in the study were sociocultural issues (23.10%), information (22.99%), reflection (20.79%), news (14.96%), politics (8.58%), humor (3.41%), rudeness (2.64%), economy (2.42%) and religion (1.10%). Table 2 shows examples of the tweets that make up each classification. We can also confirm that the topics addressed by users interacting with @pandemic_Covid-19 are consistent with those stated by several researchers: sociocultural (Adams, 2020; Olimat, 2020; Schillinger et al., 2020), information (Olimat, 2020; Ghounane, 2020); reflection (Schillinger et al., 2020; Scherer & Pennycook, 2020); news (Olimat, 2020; Ghounane, 2020); politics (Ghounane, 2020; Schillinger et al. 2020); humor (Wills & Fecteau, 2016); rudeness (Olimat, 2020); economy (Ghounane, 2020) and religion (Adams, 2020). It is important to note that in times of humanitarian crises, researchers mentioned the most common topics published in the virtual environment but did not mention which topics are of greater significance to users. This research also shows that in times of humanitarian crisis, such as the COVID-19 pandemic, the most common topics for users according to their relevance have the following priority: sociocultural, information, reflection, news, politics, humor, rudeness, economy, and religion.

RQ3: It is necessary to review the polarity score resulting from the sentiment analysis made for each tweet. The analysis of the positive and

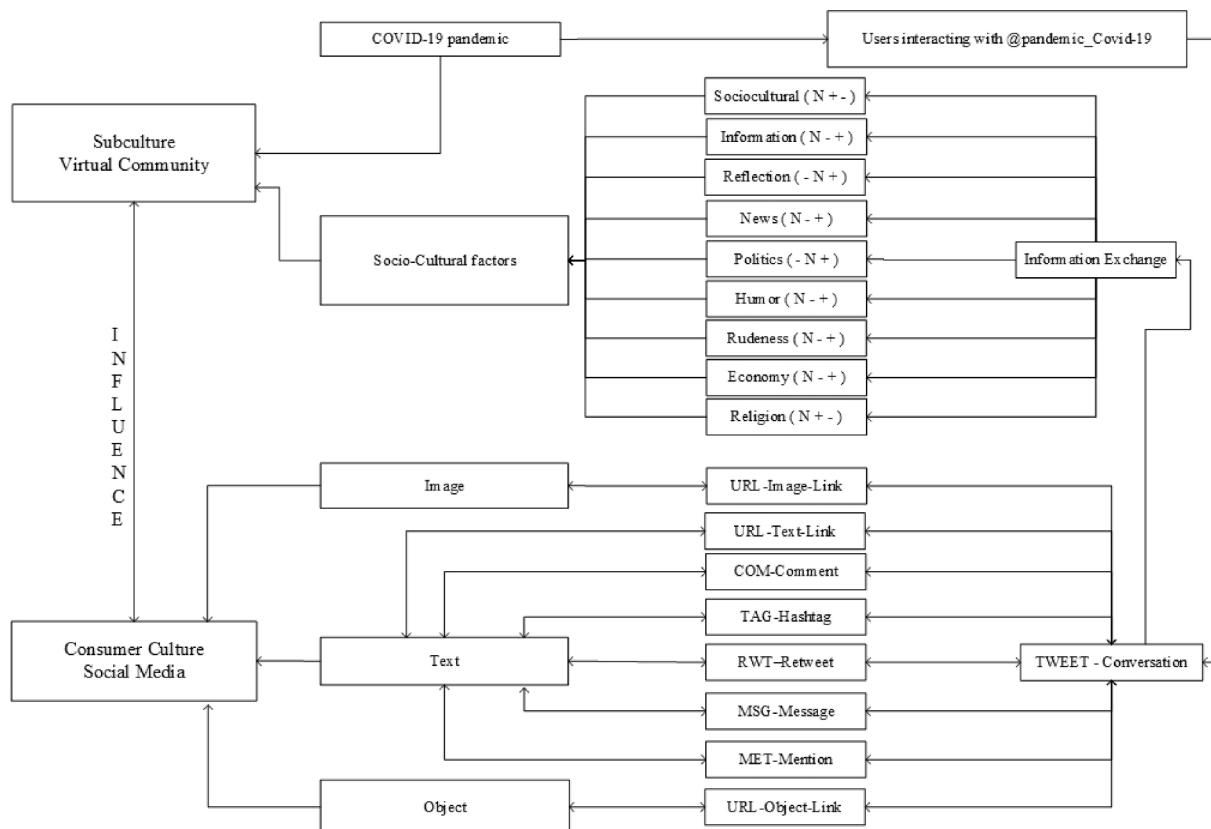


Fig. 1. Model describing sociocultural factors during the COVID-19 pandemic crisis. Sentiment: N: Neutral; +: Positive; -: Negative. Adapted from Perez-Cepeda and Arias-Bolzmann (2020) - prepared by the authors.

negative levels of sentiment of the sociocultural factors shows that the highest score is negative, except for the issues that address sociocultural aspects. Therefore, it can be inferred that during the COVID-19 pandemic, the lexicon used in the tweet is composed of words that express the meaning that the user has given to the information he or she consumes in different environments. Table 2 shows examples of the polarity score. Table 1 presents the percentages of the level of sentiment that were obtained for each sociocultural factor.

Actually, the study of the level of sentiment carried out in tweets allows us to compare the criteria of different researchers. Thus, it is demonstrated that thanks to the lexicon used in the tweets, we can understand specific ideas, judgments, concepts, and topics regarding the events of the COVID-19 pandemic (Wang et al., 2019; Jamadi et al., 2020; Taboada et al., 2009). In addition, when comparing the words used in the COVID-19 tweets and the list of words in the “Lexicom” dictionary that is embedded in the library (Sentiment Analysis) of the R program, we can confirm that the polarity score makes it possible to determine the positive, negative or neutral influence on the sentence (Adwan et al., 2020; Miao et al., 2010). Therefore, the results confirm that the analysis of the tweets on the COVID-19 pandemic leads to the identification of the level of sentiment of the sociocultural factors resulting from this study (Oussous et al., 2020; Miller et al., 2011; Pereda et al., 2020).

RQ4: We took as a source of information the sociocultural factors that were identified in the tweets addressing the COVID-19 pandemic crisis, whose order of priority was sociocultural, information, reflection, news, politics, humor, rudeness, economics, and religion. According to Hagler (2013), social media influences the behavior of society. They are also useful for understanding how people interact with each other (Mathur, 2019). Such interactions between participating users allow us to relate and compare meanings (Pérez, 2019). Gleason (2018) stated that to explain the conceptualization of topics covered on social networks, it is important to observe and explore interactions between users. Similarly, Kozinets (2001) found that people conceptualize topics according to the way messages are written (text, images, objects). To summarize, it can be inferred that the content of the tweets posted by users who interact with @pandemic_Covid-19 about the events generated by the pandemic is based on sociocultural aspects such as behavior, way of thinking, and beliefs. Thus, it can also be concluded that the incidents, news, information, criteria, and points of view of politicians and health professionals, among others, about the COVID-19 pandemic include messages with a certain style and structure that imply specific opinions about the information they consume in multiple communication channels. It is also noticed that the frequent use of links in other virtual environments is a way of defending the tweets that are published. Furthermore, users who interact with @pandemic_Covid-19 are aware that, by mentioning other Twitter users in their tweets, those messages concerning different sectors of society, such as the political, economic, cultural and other areas, are also consumed by these users. Table 2 shows the conceptualization of each topic.

RQ5: Brock (2018) highlights the utmost importance of carefully separating and examining repetitive discussions on sociocultural aspects to critically analyze the technical and cultural discourse. Thus, we can determine that the identified ideologies are consistent with Hamedani and Markus (2019), who claimed that sociocultural patterns mark or guide people’s actions and that these in turn can strengthen, reflect, challenge or change these sociocultural patterns. Askegaard and Kjeldgaard (2002) indicated that when identifying sociocultural ideologies, it should be noted that people have free will to exchange information using text and images. The identified nine factors (sociocultural, information, reflection, news, politics, humor, rudeness, economy, religion) are made up of a set of emotions, sentiments and collective ideas that have been triggered during the COVID-19 pandemic, which leads us to infer the ideology of the users who interact with @pandemic_Covid-19 about various topics. Mandatory lockdown restrictions have changed social interactions, affecting lifestyles, communication,

and practices in both physical and virtual environments. This means that to satisfy the need to transmit the ideas, emotions, and feelings that people harbor on different topics, such as sociocultural (lifestyle - customs), political (political actors - government regulations), and economic (government regulations, business - personal), they realize that the use of multiple channels and social communication platforms offer them the viability to meet this objective, that is, to disseminate relevant information about the COVID-19 pandemic so that it is consumed by different actors who have influence on the media and politicians. Likewise, they discern that when writing messages, the combination of text, image, and video enhances the content of the ideas, emotions and feelings of the topics they want to convey. Table 2 presents the sociocultural ideologies identified in tweets posted by users who interacted with the Twitter account, @pandemic_Covid-19.

Based on the RQs, the results of the hypotheses are as follows.

H1 is accepted. It is confirmed that the topics around the COVID-19 pandemic are of great interest to users who interact with @pandemic_Covid-19. The linguistic expressions used by users demonstrate that they consume and post messages that reveal sociocultural factors such as sociocultural issues, information, reflection, news, politics, humor, rudeness, economy, and religion. Similar findings were shown in the research works about Twitter users who posted messages of topics related to the homosexual subculture (Perez-Cepeda & Arias-Bolzmann, 2020) and refugees (Perez-Cepeda & Arias-Bolzmann, 2021). Through the analysis of linguistic expressions used by users in tweets, it was possible to determine the sociocultural factors associated with each study group. In addition, it is noted that users give importance to comments from other users (COM-Comment) and forward them (RWT-Retweet) so they can be consumed by multiple users (MET-Mention). In addition, emojis and tags are often used to express happiness, surprise, fear, disgust, anger, and sadness (MSG-Emoji) or to indicate a particular topic (TAG-Hashtag).

H2 is accepted. It is clear that the use of lexicon-based methods in the messages posted on Twitter allows us to establish the level of sentiment found in each of them, which is consistent with the studies of several researchers (Wang et al., 2019; Jamadi et al., 2020; Adwan et al., 2020; Taboada et al., 2009). Likewise, as suggested by Mostafa and Nebot (2017), it was found that the use of topic recognition techniques (classification of tweets by sociocultural factors) enables us to obtain a comprehensive understanding of the underlying causes of positive or negative sentiments. In addition, the use of technological programs such as R Studio library (Sentiment Analysis), which automatically generates the polarity score, facilitates the analysis of the level of sentiment. This is consistent with Khoo and Johnkhan (2018), who mentioned that machine learning models identify words that convey positive, negative, and neutral sentiments.

5. Conclusions

5.1. Exchange of information

After comparing the research results with the literature review, we came to the following conclusions: We note that the flow of information between users who interact with @pandemic_Covid-19 about the evolution of the COVID-19 pandemic becomes relevant information to be consumed by society. Therefore, information is a fundamental resource for society at large, especially in extremely complex situations such as the one generated by the COVID-19 pandemic (Casero-Ripollés, 2020). On the other hand, it is noted that users link their messages to other social media (URL-Link), so we could not confirm the study of Tan et al. (2020), who stated that Twitter became particularly relevant during the COVID-19 pandemic. However, we can affirm that today, an increasing number of people are using social media to express their opinions on issues related to the pandemic. We also identified that messages are written and structured in different ways. However, this does not imply that we can obtain concepts and ideologies from users who interact with

@pandemic_Covid-19 based on the analysis of the content. In fact, this is consistent with Wang et al. (2019), who stated that lexicon-based methods are suitable to analyze the ideas, judgments, or concepts expressed by people in different social spaces. Moreover, we noted that within the messages written by users who interact with @pandemic_Covid-19, it is common to mention the WHO. Therefore, it can be said that the number of times users mention or forward messages where the NGO is implicit denotes the degree of interaction and interest with the organization (Saffer et al., 2019).

5.2. Language

Language (the ability of human beings to express thoughts and sentiments through words) is essential to build and maintain identities and social relationships and even define the boundaries of communities, which is consistent with the study of Nguyen et al. (2016). It is also confirmed that the use of language, when users interact and exchange messages with @pandemic_Covid-19, aims to communicate, request and propose topics or actions that will mitigate the uncertainty generated by the COVID-19 pandemic. The linguistic expressions used in the messages represent a type of functional knowledge that reveals sociocultural factors (Liang et al., 2016). It is verified that the lexicon used in the messages related to COVID-19 depends on the meaning that users give to the information they consume in different communication channels and, in turn, how the content of the message influences their sociocultural factors. It is verified that there are different types of users who interact with @pandemic_Covid-19, that is, they come from different social and political environments as well as from different countries. Sociocultural factors are evident through the lexicon regardless of this dissimilarity. This lines up with the research of Perez-Cepeda and Arias-Bolzmann (2021), who stated that multiple users from different countries meet and post messages in multiple languages. However, this difference in the characteristics does not necessarily imply that social factors differ between them. This confirms that social and linguistic factors are important in multilingual and virtual environments (Bhatt & Bolonyai, 2011; Casero-Ripollés, 2020; Suyanto et al., 2020). On the other hand, the theory of social media focused on Twitter and the use of technological programs such as the R Studio library (Sentiment Analysis) allow us to know the level of sentiment (positive–negative–neutral) in the tweets posted by users who interact with @pandemic_Covid-19. This supports the studies of several authors, who recommend the use of theories and technologies in future research on sentiment analysis approaches on Twitter to establish the sentiment of linguistic expressions and thus gain a comprehensive understanding of the underlying causes of positive or negative sentiments (Adwan et al., 2020; Mostafa & Nebot, 2017).

5.3. Sociocultural factors

Finally, to answer the RQ, we refer to the study of Perez-Cepeda and Arias-Bolzmann (2020), who recommended using the model that describes cultural factors with the aim of comparing sociocultural contexts arising from studies on social domains that use Twitter. For this purpose, the nine sociocultural factors that were identified from the consumption of information on Twitter by people who interact with the user @pandemic_Covid-19 were considered. It is important to note that, according to the density of each of the sociocultural factors, the order of priority is: sociocultural, information, reflection, news, politics, humor, rudeness, economy, and religion. Fig. 1 shows the sociocultural factors emerging from this research, which are mapped in the model proposed by these authors.

6. Implications and recommendations

Organizational: In this research, there are three classifications with a higher percentage: sociocultural issues, information, and reflection. It can be inferred that during the COVID-19 pandemic, users who

participate in social media, such as Twitter, consume and produce information framed in their culture, customs, society, majority groups or minority groups. Consequently, for-profit and nonprofit organizations need to implement digital communication policies, i.e., processes that include methods and tools to validate information that is posted in digital media and is expected to be consumed by different users. Likewise, it is important that the people in charge of generating the information content contemplate the sociocultural environment to which the information is directed to avoid any crisis of social networks such as online reputation, that is, a negative situation that grows and goes viral on social media. From another point of view, organizations need to standardize the COVID-19 pandemic in the business world, i.e., in times of business crisis, the content of messages (text-image-object) must be interpreted to validate the sociocultural factors presented by this research.

Researchers: It is appropriate that researchers in the social sciences field and in other fields start to analyze how people build, exchange, and consume information on social media during the pandemic. Likewise, they should analyze the body of the text and the content of the message to determine the social, cultural, personal and psychological factors underlying the interpretation and wording of conversations between consumers.

Academics: Promote the use of the netnographic method to study virtual communities. Additionally, other social media, in addition to Twitter, can be used as a tool to gather information and identify the behavior of people during global crises, such as the COVID-19 pandemic.

Practice: The use of the six categories proposed by Luo et al. (2015) to analyze tweets and the nine sociocultural factors that emerge from this research lead us to understand the behavior of society that consumes information through virtual environments during the COVID-19 pandemic. Moreover, it promotes the study of the behavior of society in various crisis scenarios, with the purpose of contrasting information that contributes to both the social sciences and the business environment.

6.1. Limitations and further research

This study has two limitations. The first limitation was to use only Twitter, despite the existence of several platforms, such as Facebook, WhatsApp, Instagram, and Pinterest. The second limitation was not knowing the social group of the users who interact with @pandemic_Covid-19. Therefore, for future research, we recommend using a different social media platform as a tool to collect data. However, we also analyze institutions other than the WHO that are immersed in addressing global crisis issues such as the COVID-19 pandemic. Finally, with the research findings in times of global crisis, we recommend validating the model proposed in this research adapted from Perez-Cepeda and Arias-Bolzmann (2020), which describes cultural factors.

CRediT authorship contribution statement

Maximiliano Perez-Cepeda: Investigation, Formal analysis, Data curation, Conceptualization, Writing – original draft, Methodology.
Leopoldo G. Arias-Bolzmann: .

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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