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Social and Institutional Presence of the Presidents of the Americas on social media: An analysis of the Communication on Twitter about COVID-19

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Abstract— *This article examined, through Social Network Analysis (SNA) techniques, the personal profiles of theHeads of Government of countries in South and North America and how they communicated withtheir audiences on institutional measures to contain COVID-19. Analyses were carried out on data collected from Twitter from November 2019 to November 2020. This study includes: i) quantitative analysis, measuring categories and emphases in the communication of tweets, retweets, likes, and comments on matters relevant to the pandemic; ii) qualitative analysis that allowed evaluating speeches to identify political interference and the effectiveness of communication at critical moments of the pandemic. It was possible to infer that each president has his singularities and understanding about Social Media's use as a more direct communication tool with his audience. It was also found that successful communication is not directly proportional to the volume of messages on Twitter, but to socio-political aspects and institutional leadership that can make a difference in Social Media in combating COVID-19.*

I. INTRODUCTION

The world is experiencing a challenge of grand proportions, the discovery and a worldwide spread of the Covid-19 virus at the end of 2019 and throughout 2020. This occurrence showed the global fragility of the Health Systems and a communicational difficulty in the face of Disinformation. Social Media has become an open pathway for a flood of fake news propagated mainly on social media. In addition to competing with misinformation on social media, governments deal with an internal difficulty to create disclosure processes consistent with the line of action in fighting the Pandemic. SARS-CoV-2 and COVID-19 disease provide an opportunity to investigate the consequences of functional fragmentation in government communication when the issues concern public health and pandemic response (ZEEMERING, 2020).

According to United Nations Educational, Scientific and Cultural Organization (UNESCO, 2019), finding ways through contemporary information challenges is of utmost importance for society, including governments, Internet companies, educators and NGOs.

We are faced in 2020 with Covid-19 and an invisible virus, but one that materializes in social media and as lethal as the physical virus, we speak of Disinformation. Unesco (2019) also characterizes the false information in three ways:

- Disinformation: refers to false information that was intentionally created to harm a person, social group, organization, country or institution.
- Misinformation: is information that, even if false, is not intended to cause harm to anyone or any institution.
- Mal-information: is information that, even if based in reality, aims to cause harm to someone or some organization.

In this context, according to Gruzd& Mai (2020, p. 04), social media has emerged as an indispensable lifeline for people to connect with friends, family, classmates, and co-workers. This growing reliance on social media has its problems; social media is well established as a vector in spreading false narratives. Twitter is in the second most accessed group of Social Media as a source of information on COVID-19, with 67% of information-consuming respondents stating that they sometimes or more often find out on Twitter (Gruzd& Mai, 2020, p. 08).

We noted in our study that one of the key issues in fighting Pandemic is the ways in which governments have organized themselves to combat Disinformation and disseminate science-based data. While some governments are trying to address the problems through regulation, it is unlikely that this can solve the problem at scale (UNESCO, 2020). Ines Mergel (2013) presents a study identifying U.S. government strategies in the use of social media, thus notes that social media applications offer the opportunity to integrate citizen information and opinions into the policymaking process in innovative ways, to increase transparency, sharing information on social media channels and collaborate with the public to prepare decisions or create solutions to government problems.

Thus, this paper aims to analyze communicational contrasts and similarities in combating COVID-19 from South and North American leaders. We observe in the period 2020, the protagonism of rulers on Twitter to communicate and mobilize the population about the measures to combat COVID-19. To identify the actions of each leader, we use Social Network Analysis Techniques to map this protagonism and, as a result, we present a quantitative analysis of the communication actions on Twitter.

In addition, we investigated the type of discourse of each ruler and, for this discussion, we analyzed the semantic networks published in the comments. Thus, it was possible to assess types and emphases in the speeches of each ruler through the relationships of the most recurrent terms. Currently, social media is fed by many types of content, from personal to political. In this semantic analysis, the priority was to understand the direction of each governor on the actions to fight the Pandemic.

Our key research question is to identify how governors have communicated with their publics through the Social Media Platform - Twitter, checking how this communication can enhance the guidance of fighting a pandemic and strengthen the public's bonds of trust with the government.

Research contributions

Our contributions can be summarized as follows: i) quantitative analysis, measuring categories and emphases in the communication of tweets, retweets, likes and comments on issues pertinent to the pandemic; ii) qualitative analysis that allowed us to evaluate discourses to identify political interference and the effectiveness of communication in critical moments of the pandemic.

Brief background on the Heads of Government of the Americas

Given this scenario and the changing paradigms of communication with social media, our research examines how was the social presence on Twitter, in times of the COVID-19 pandemic, of the Presidents of the USA, Brazil, Argentina, Mexico, Venezuela, Colombia, Bolivia, Ecuador, Uruguay, Chile, Paraguay and Peru and the Prime Minister of Canada. Adopting distinctive postures, the Heads of Government of the USA, Brazil, Argentina, and Canada stand out.

Donald John Trump, former president of the United States for the Republican party, held political positions described as populist, protectionist, isolationist, and nationalist. According to McCormick (2016), Donald Trump claims that Facebook and Twitter helped him win the 2016 presidential election.

Jair Messias Bolsonaro is a retired military man, politician and current president of Brazil. He was elected to the presidency by the Social Liberal Party (PSL) with promises of liberal reforms in the economy and with a conservative speech. He uses Twitter as a communication channel for his government and has more than six and a half million followers. Since the beginning of the pandemic, he has minimized the severity of COVID-19, describing it as a ‘little flu’, Guardian (2020).

Elected by the Frente de Todos party, he is a representative of Kirchnerism. Considered a center rather than progressive politician, he has a dialogic rather than polarizing profile (BBC News Mundo, 2019).

Justin Trudeau – Prime Minister of Canada –is a teacher, leader, and defender of youth. He belongs to the Liberal Party, emphasizes fair economic opportunities for all, respect and promotion of freedom and diversity of more democratic government (Canada, 2019).

II. CORRELATED WORKS

This section presents works that structure this research. Literatures that have concepts relevant to the writing of this article is addressed. Additionally, the differential of this proposal in relation to the state of the art is highlighted.

Governments and Social Media

It is still unclear how politicians use different social media platforms in political communication (Stier et al, 2018). However,for governments, social media applications offer the opportunity to integrate information and opinions from citizens to assist innovatively in the policy-making process; to increase transparency, sharing information on social media channels; to collaborate with the public and prepare decisions or create solutions to government problems Mergel (2013).

Several authors have studied the topic and developed different approaches and methods to evaluate the role and use of social media and its relationship with government. Castells (2017) gives examples of the Arab Spring demonstrations in 2010 and the Occupy Wall Street movement in 2011. Mathur et al. (2020) used Twitter data to analyze across the world the mental health of people during the COVID-19 pandemic situation through emotion analysis and classified it into basic emotions. The idea is via their analysis, authorities can better understand the mental health of the people and update the content accordingly.

Waisbord and Amado (2017) analyzed the use of Twitter by populist presidents in Latin America. They identified that the platform was not used to promote a dialogue between presidents and the public or to change conventional presidential communication practices. Instead, it was identified that populists used Twitter to counter criticism from journalists, to put their points of view, but not to promote direct communication with citizens or to listen to their ideas.

The research conducted by Mergel (2013) indicates that the American government, at this point, still has little experience in extracting knowledge from the exchange of messages on social media sites. In contrast to the doubts of Mergel (2013), more recent studies also show that the political space found in social media a favorable environment to legitimize ideological discourses with the increasing purpose of leveraging more followers.

In another line of investigation, there is evidence that social media were determinant as a communication channel during election campaigns, especially for heads of government. The authors Groshek and Koc-Michalska (2017) credited Barack Obama's campaign successes, in part due to his experience in social media, in 2008 and 2012. In his study, Kreis (2017) showed how USA President, Donald Trump, employed Twitter as a strategic power politics tool to spread his right-wing populist discourse. Nai (2020) deepened his studies in discourse analysis and investigated how messages are interpreted when the public is for or against a government head. The study of Nai (2020) used change and Donald J. Trump posts on this subject.

Populism in the Twitter Age: How does the government communicate?

According to some authors (Falk et al., 2012; Müller, 2016, Diluar, 2020), the term populism has been used as a synonym for anti-establishment narrative. Thus, populism can be understood as a set of generally demagogic ideas and as a political communication strategy. Populism can be said to constitute a set of political practices adopted by a given government that usually justifies them as a necessary measure to "give a voice to the people" or the "masses", configured by that part of the population that has different goals from the ruling elite, politically or economically.

Political populism thrives headed by a charismatic leader, praising the role of "the people" and aiming to dichotomize the political arena and society. In general, this term has a negative connotation by political opponents or the media (Wettstein et al., 2018). With ideological links to the right or left, populism is related to party or candidate radicalism (Rooduijn and Akkerman, 2017).

Throughout history, populism can be identified in various forms, including: national-populism, left-wing and right-wing populisms, media or digital populism – especially those emerging at the present time –, neoliberal populism, among others (Diluar, 2020).

Thus, social media is seen to offer "low-cost" communication opportunities and potential for wide and rapid dissemination of messages (Ratkiewicz et al., 2011), often classified as "viral" (Ernst et al., 2017). Some political leaders also indirectly achieve their goals by fostering discussion of their original messages. Previous research has also identified that, for a message to go viral,

it must incorporate certain elements, such as emotional attachment, new and surprising information, fuel passive broadcasting, and seek personalization of the message (Aral and Walker, 2011; Hong et al., 2011), leaving informative public affairs facts and the pursuit of a common societal goal in the background.

In a negative way, the space in which Populism found echo represents an even more significant challenge: disinformation. Social media has become an open way to spread a flood of fake news. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2019), "Finding ways through contemporary information challenges is of utmost importance to society, including governments, Internet companies, educators, and NGOs".

According to the report of Gruzd and Mai (2020), Twitter in Canada is in the second most accessed social media group as a source of information about COVID-19. Sixty-seven percent of respondents who consume information stated that they 'sometimes' or 'more often' get information from Twitter.

The key issue of this research is to identify initially if occurred, through Twitter, communication of the heads of government of the American continent's countries with their audience during the pandemic with messages, verifying whether the most liked messages dealt with COVID-19. Then, to examine the communication that occurred at the peak of the disease, check whether there was direct interaction with the public, and whether this interaction generated a passive communication of sharing, strengthening the ties between governments and their citizens.

When it comes to speeches on social media, we must not forget that the Populism practiced by heads of government in the American continent countries was a strong legacy of the 20th century and that it has also been present in the political sphere of the contemporary world. This article aims to verify whether there is a relationship between more populist attitudes of these heads of government with more active communication on Twitter and how this practice impacts and strengthens the discourse on COVID-19.

In recent studies, Groshek and Koc-Michalska (2017), De Vreese, Esser, Aalberg, Reinemann, and Stanyer (2018) and Fernández García and Salgado (2020) addressed concepts or the relationship Populism vs. Electoral Process. These authors discussed theories and argued about populist impacts and actions, widely followed by traditional and social media. Fernández García and Salgado (2020) considers a gap in Populism research that tends to focus only on politicians and not on people. Our research also examines whether the heads of government considered populist were successful[1] in communicating via Twitter about COVID-19 measures with their audience.

Fake News, Misinformation and Information

When evidence and facts become irrelevant and adjustable to a political cause, the principle of truth loses its relevance. On the other hand, debate, with the presentation of fact-based policy alternatives, independent of ideological differences, is at the heart of democracy. When citizens and politicians no longer engage in fact-based discourse, democracy is in danger (Zúñiga et al., 2020).

We agree with Ryabchenko and Malysheva (2017) when these authors warn of possible inappropriate use of Social Media in the political-social sphere, and we wish to identify patterns that may point to the dissemination of false content or that may suggest an action of negative use of the networks. In this case, we investigate whether Populism (from the analysis of the number of tweets) and disinformation (from the study of works in the literature) have a direct impact on COVID-19 deaths in the analyzed countries.

It is worth mentioning yet another result from Ryabchenko and Malysheva (2017). These authors consider that the recent political and social events characteristic in each country, as well as the different political regimes, made evident the need for a new look at the influence of information and communication technologies in the public sphere.

To reinforce interest in the topic, the search for works related to Social Media, Presidents and Politics allows locating 220 documents in a query in the Scopus scientific database to reinforce the interest in the subject. Among these documents, there is an annual increase in publications from 2017 onwards, with 17, 20, 30, and 1 (until January 15, 2021) documents recovered, respectively. Figure 1 shows the networks of occurrence of words extracted from the abstracts of these 220 documents, including the search string 'tweet' and 'twitter', the most used social media platform in this case. By restricting the search, replacing social media with Twitter, 32 documents are located, indicating an annual increase in the number of publications with this platform, from 2016 to 2021, with 2, 7, 10, and 1 (until January 15, 2021) studies published, respectively.

[1] A president who uses twitter as an information tool is considered successful.

In the lexical similarity analysis graph Thijs and Glänzel (2018) of Figure 1(a) – built with VOSviewer (2020) – the nodes represent the words and the size of these nodes represents the number of co-occurrences. The distance between two nodes establishes the identified proximity between them: a shorter distance usually indicates a stronger relationship. By default, network nodes are organized into clusters displayed in different colors that allow you to identify the cluster to which a node has been assigned. Thus, a cluster is a set of closely related nodes. It appears that the nodes 'twitter' and 'tweet', highlighted in Figure 1(b), are part of the same red cluster and are connected to 'fake news', 'election' and 'trump'. In the green cluster, the 'brazil' node appears associated with 'world', 'process', 'population', 'work', 'human right', 'woman'. Finally, it is worth highlighting the network of two other countries analyzed in this article, Mexico and the United States, both belonging to the blue cluster. The 'mexico' node connects more closely with 'nation' and 'culture'. In contrast 'united states' connects with 'war', 'percent', 'child', 'education' and 'value'.

The next section presents the methodology adopted in this article.

III. METHODOLOGY

A sequence of steps was established to analyze the Twitter profile of each head of government. The process of collecting, extracting, and analyzing relevant data is based on steps that involve obtaining publications and treating attributes present in the profiles of the social media users, producing qualitative or quantitative information analysis, as well as data visualization through graphs and tables.

Previous works use similar methodologies, such as the one proposed by Khan et al. (2015), which presents a Framework capable of performing the extraction of tweets from any location and classify the texts between political and non-political classes, besides analyzing the sentiment of the publications, in order to provide an adequate vision about political adversities in any specific analyzed location. Similarly, Chatziadam et al. (2020) proposed the TwiFly Framework, with the intention of providing Twitter data analysis. This model is capable of monitoring profiles and ensuring real-time visualization of useful information extracted from the social network.

Based on works of a similar nature, Figure 2 presents a schematic diagram of the methodology developed and employed, in which three macro steps are highlighted, indicated by different colors: data collection, quantitative analysis, and qualitative analysis.

The general purpose of this work is to analyze metrics related to the behavior and activities of heads of government on Twitter social media, showing characteristics of interaction with their audiences, as well as the type of content most popularly disseminated by these heads of government in their profiles. Thus, it is essential to use tools that enable the analysis of the use of social media, starting from the data collection process to the graphic visualization phase, so that the results can be discussed.

In the Analysis Criteria stage, Twitter profiles of heads of government of countries in South and North America that had posting activities from November 2019 to November 2020 were chosen. To establish a comparative of social and institutional presence were used SNA, Lutu (2019); Recuero et al (2020) and webometric techniques. The latter allows qualitative data analysis and include quantitative research methods to analyze the content collected from Twitter, Khan, Yoon, and Park (2014).

In the Data Collect step, the Twint tool, Twint Project (2017), was used. Twint is an advanced tool written in Python that allows for scraping Tweets from Twitter profiles without using Twitter's Application Programming Interface (API). This tool has been used in other similar researches, such as in Narayanrao and Kumari (2020), in which data extraction is performed to predict tweets that have depressive content, in addition to Chamby-Diaz and Bazzan (2019), where the detection of transport traffic events is performed using machine learning models.

Data Collect processing resulted in a large database in CSV (Comma-separated values) format. Then, Data Extractions were carried out, with the purpose of organizing the data, discriminating the following metrics: id; conversation_id; created_at; date; time; timezone; user_id; username; name; place; tweets; language; mentions; urls; photos; replies count; retweets count; likes count; hashtags; cashtags; link; retweet; quote url; video; thumbnail; near; geo; source; user_rt_id; user_rt; retweet_id; reply_to; retweet date; translate; trans_src; trans_dest.

Data Extractions originated the Profile Metrics and these were used in the initial analysis, the quantitative. The most important quantitative analysis metrics were: created_at, username, tweets, language, mentions, retweets_count, likes_count, and hashtags. The metrics of followers and followings directly from the social network were also analyzed, respectively, indicating the total number of profiles followed by a head of government and the total number of profiles followed by the head of

government. The results of this stage are shown in Table 1. This stage sought to answer questions such as: how close is the head of government to his audience? What is the degree of networking or passive communication between the head of government and the public? Which heads of government publish the most? Which heads of government have the most followers?

After extracting the data in Profile Metrics, a complementary quantitative analysis based on Relative Metrics was performed. The purpose of these calculations is to verify whether the values obtained in Table 1 are significant when compared with other demographic metrics of the country and of each head of government analyzed, such as the size of the country's population that governs, the number of followers, total tweets, etc. Thus, it is possible to make a more consistent analysis, given that certain heads of government use Twitter profiles to propagate government and/or personal information, as well as some profiles, even if they belong to the head of government, are administered by advisors. In this way, a more detailed analysis can qualify this social presence. Table 2 presents the results generated by the equations proposed in this article.

From the quantitative analysis, additional processing was carried out so that the results could be better understood and discussed qualitatively. Thus, the construction of curves that relate the Top10+ – Tweets x COVID-19 Deaths – to each of the countries analyzed was made. The purpose was to identify the 10 most liked tweets from each of the heads of government's profiles. Then, two questions could be answered: (i) which of these most-tweeted tweets are related to COVID-19? (ii) at what point in the curve of disease deaths in the country were these tweets posted? This last question was answered for Brazil and Canada in Figure 3. The processing of this step allowed the generation of tables of the Top 10 - Tweets x COVID-19 (Tables 4, 5 and 6). Figure 4 illustrates the consolidation of this data.

With the complete database, containing all the tweets published in the heads of government profiles, it was possible the Vocabulary Analysis – Graph stage. The objective of this step is to verify the subjectivity of the word cloud generated in the profiles. Besides, answering questions such as: Did the head of government use the profile to help effectively fight the pandemic? What were the main words mentioned in the collected vocabulary?

In this step, was used VOSviewer version 1.6.15, VOSviewer (2020), a tool capable of forming and visualizing maps from different sources of textual data based on co-authorship relations, co-citation, bibliographic coupling, citation and co-occurrence, making use of network layout and network clustering, allowing layout adjustments and clustering with different metrics, including natural language processing techniques, indicating that relevant and non-relevant terms can be distinguished algorithmically. VOSviewer was chosen due to its ability to visualize the relationship between keywords in the analyzed tweets, as also used in Purnomoet al. (2019). Figures 5 and 6 illustrate the word clouds generated in this graphical analysis.

IV. RESULTS AND DISCUSSION

In order to answer the questions raised in this article, we sought to identify the metrics, webometrics related to the Degree of Centrality (OutDegree) and Ego Analysis, which are addressed in other themes, such as Xiong et al (2018) that from semantic network analysis and thematic analysis methods, findings of the study enhance literature of social movement organizations and activism as well as provide practical implications for effective social movement campaigns. We propose to analyze the type of communication adopted by each of the heads of government through tweets, retweets, likes, and mentions.

The results of the present investigation are divided into three parts: (i) general analysis of the profile data (Table 1), (ii) relativized results (Table 2) of the metrics observed in (i), making a relationship with the number of COVID-19 cases in the countries; (iii) analysis of the published tweets and map of terms about COVID-19 related to disease progression.

General Profiles Analysis

In this respect, Chatziadam (2020) presents a similar analysis with regard to the analysis of Twitter profiles, considering, among other factors: Accounts and Users; User and account management; Tweets and Responses; Access to tweets and public responses; ability to post and search for tweets; Direct messages; Calculate the number of tweets based on various filters and criteria; Calculate the number of retweets based on various filters and criteria; Calculate the number of followers of a specific politician; Calculate the growth rate of followers of politicians in a specific period; etc.

The Table 1 presents, in columns 1 and 2, the country's name and the official profile of the President or Prime Minister. The choice of these parameters (columns) was based on the literature cited in this article and according to the expertise of the research group. The 'Total Tweets' column indicates the number of tweets sent in the analysis period (from November 2019 to November 2020), while 'Followers' and 'Followings' represent the numbers of followers and followed by the head of

government. The 'retweets' column indicates the number of times that a message published by the profile owner was resent by another user. 'Total Likes' and 'Top10+' are the total likes that the Presidents and the Prime Minister received in the period's posts and the ten most liked posts, respectively.

The 'Total of Mentions' (TM) is the total number of mentions that the head of government (OutDegree) made in all his publications during the analyzed period, and the same profile can be mentioned by them several times. The 'Total of Mentioned Profiles' (TMP) corresponds to the number of different profiles that the President or the Prime Minister mentioned in the period. The 'Total of Hashtags' (TH) is the total amount of hashtags that the head of government used in the period, and the same hashtag can be present in several publications of the same profile.

Individual profiles of a network are important structures that reveal individual and group identity characteristics. In this research, we adopted the metrics of Degree of Centrality OutDegree to verify the activity of the main actors in each analyzed network. To measure the degree of OutDegree are adopted the metrics highlighted by Recuero and Gruzd (2019), Lutu (2019) and KušenaEma, Strembeck Mark (2018). In short, when a user mentions or retweets someone, there is a connection produced through that tweet.

It can be seen from the Table 1 that former President Donald Trump (USA) presents much higher values for almost all metrics. This is due, mainly, to the expressive amount of followers (greater volume of followers) that he had[2] compared to the other profiles.However, the former USA President had the second lowest value of Followings (51), although the former President aimed to get closer to the public, indicated by the highest values of TM (1,769) and TMP (651), among those presented in Table 1, by mentioning several times other profiles, many times of supporters. In addition to Donald Trump (USA), Jair Bolsonaro (Brazil), Ivan Duque (Colombia), and Justin Trudeau (Canada) also present this characteristic, highlighting the profile of the President of Brazil, who has one of the smallest TMP.

In contrast, the profile of President Andrés Manuel López Obrador (Mexico)does not mention other profiles, nor does it mention other publications, leading to the belief that the profile is not used for the personal opinions of the president. This suggests that there is no interest in more direct interaction with the public. Mention-based studies can provide more information about influencers than SNA based on 'followers', Lutu (2019).

Another highlight pointed out in Table 1 is the president Jair Messias Bolsonaro (Brazil), which presented a TH of 4. This value represents a small use of hashtags, having as reference the President Ivan Duque Márquez (Colombia) which presents the largest number of hashtags (2,104) in his tweets in the period under analysis. Another profile that draws attention is that of president Miguel Juan Sebastián PiñeraEchenique (Chile)with the highest number of "Followings" (19,900), contrasting with that of the President of Lenín Moreno GarcésBoltaire (Ecuador), which has the lowest value of 'Followings' (41).

One cannot fail to consider, among the metrics in Table 1, that Donald Trump has the highest retweets value, indicating active participation of followers, accompanied by Jair Bolsonaro, with a value 13 times lower in this metric when compared to the US Former President. Also, Trump has approximately 10.5 times more likes than the president of Brazil, second in the number of likes.

Relativized Results

Once the questions made in the first part of the methodology were answered, with the quantitative analysis of Table 1, additional metrics were defined. This is because the values indicated in Table 1 can be related to several factors, such as the time the account is active, the engagement of followers, and even exogenous factors, such as the size of these countries' population.Thus, a complementary quantitative analysis requires the evaluation of other metrics in addition to those presented in Table 1. Table 2 presents relativized results of the metrics noted in Table 1.

Studies such as the one proposed by Yin et al. (2018), developed relativized metrics aimed at comparing values collected from heads of government more appropriately, for example, USA is 55.79 times larger in territory and 95.29 times larger in population than Uruguay. Thus, the data collected from Tweet was normalized aiming for a fairer comparison between the data. Yin et. al (2018), Lacatus, C. (2019) and de França (2018) present studies in which the data covered are relativized with various factors, such as population size, relative frequency of most prevalent themes or from political parties. To compose the metrics in this article, based on the literature, the following relationships were proposed and analyzed:

FP (Follower per Population) indicates the proportion of the number of Followers by the size of the country's population of each head of government, using the Followers metrics in Table 1 and the population size

[2]The data used in the present analysis was collected before former President Trump's Twitter account was permanently deleted.

indicated in the second column of Table 2, according to Equation 1.

$$FP = Followers \div Population\ Size \quad (1)$$

RF (Retweets per Follower) calculates the ratio of retweets divided by profile follower, using the Retweets and Followers metrics of Table 1, according to Equation 2.

$$RF = Retweets \div Followers (2)$$

LT (Likes per Tweet) is the number of likes per tweet posted by each President and Prime Minister, obtained from the Total Likes metric in Table 1, and the total number of posts made by the profile, according to Equation 3:

$$LT = Total\ Likes \div Total\ Tweets \quad (3)$$

LF (Likes per Follower) corresponds to the number of likes per follower for each President and Prime Minister, obtained from the Total Likes and Followers metric in Table 1, following Equation 4:

$$LF = Total\ Likes \div Followers (4)$$

TMT (Total of Mentions per Tweet) is the Total number of Mentions by the total number of Tweets posted by each President and Prime Minister, noted in Table 1, calculated by Equation 5.

$$TMT = Total\ Mentions \div Total\ Tweets \quad (5)$$

TMPT (Total of Mentioned Profiles per Tweet) is the Total number of Profiles Mentioned by the total Tweets posted by each President and Prime Minister, as shown in Table 1, according to Equation 6:

$$TMPT = Total\ Mentions\ Profiles \div Total\ Tweets \quad (6)$$

The results of Table 2 suggest that, even considering the number of Followers weighted by population size shown in Table 2, the profile of the former USA President stands out with 0.2677 FP, followed by the profiles of the Prime Minister of Canada (0.1429), of the President of Venezuela (0.1356) and of the President of Chile (0.1308), which present similar relative values, but of the order of 46% lower.

When looking at the number of retweets per followers (RF), Uruguay stands out, indicating that the small amount of followers retweet a lot of posts made by President LacallePou (Uruguay), who took office on March 1, 2020, that is, thirteen days before the first cases of COVID-19 were reported in the country.

For the number of Likes por Tweets (LT), the USA stands out again, followed by Brazil, Argentina, and Mexico. It should be noted that the difference between the USA and Brazil (first and second in the ranking of this item) is of the order of 4.35 times, that is, even considering the total of tweets, Donald Trump's profile was the one with the highest number of likes. Uruguay stands out, being approximately 3.49 times bigger than the second place (Brazil) in Likes per Followers (LF).

Regarding the Total of Mentions per Tweet (TMT), the highlights are Brazil's President with the highest value (0.6858), and the profile of the President of Mexico, with a value equal to zero. While for the TMPT, the Presidents of Peru with the highest value and again Mexico with the value of zero are highlighted.

The Total Tweets (Table 1)and the number of followers per population(FP)(Table 2) can be used to identify populist heads of government. Considering only these metrics, the USA is again ahead of other countries, followed by Canada by far, both in number of tweets and in FP. Mexico has the second-largest number of followers, but has a low number of tweets and makes no mention (TM). Thus, it could not be considered by these metrics as populist.

Relativized Results considering COVID-19

Pascual-Ferrá et al (2020) demonstrate the use of social network analysis to understand public discourse on Twitter around the novel coronavirus pandemic. The results show that looking at basic metrics might create a misleading picture of the effectiveness of risk communication efforts on social media if not analyzed within the context of the larger network.

Thus, the values obtained in Tables 1 and 2 were compared with Table 3. Statistical data on the impact of COVID-19 on the population of each country are shown, with the following information: PS (Population Size) pointing out the population size; TD (Total Deaths) referring to the total deaths due to COVID-19; TI (Total Infected) showing the total of infected by COVID-19; PDI (Percentage of Deaths by Infected) specifying the percentage of deaths of infected by COVID-19; PIP (Percentage of Infected Population) indicating the percentage of the population infected by COVID-19; and PDP (Percentage of Deaths in the Population) informing the percentage of deaths in the population due to COVID-19.

In this sense, Uruguay was one of the least affected countries with COVID- 19 in terms of deaths, percentage of contaminated people in the population, and percentage of deaths by infected people.

Mexico, which had one of the highest percentages of deaths by infected people (Table 3), was one of the countries with the lowest LF index (Table 2). The TMT indicator also indicates that this country made no mention

during the pandemic period. Andres Manuel Lopez Obrador, Mexico's President, considered a left-wing populist, has not been successful in fighting the Pandemic in his country Agren (2021) and, until the moment of this survey, has not used the resources of Twitter to establish more active communication with its public. It is also worth noting that the number of tweets (677) is very unrepresentative compared to other countries and, consequently, suggests that Twitter is not the main platform for institutional communication/representation.

On the other hand, the TMT metric positions the President of Brazil as the one who made the most mentions to users, but is one of the least diversified of the mentioned profiles, indicating that it restricts his comments to a specific set of users. This passive communication of quotations and sharing reinforces the formation of bubbles of ideological filters. In the case of President Jair Bolsonaro, the TMT indicator indicates a heavy use of Twitter to strengthen his populist discourse among his followers.

A similar situation was identified in the 2016 United States elections. The Groshek and Koc-Michalska (2017) survey found that social media acted as informational portals, often with false information shared by users. According to this study, this shared action helped Trump win the election by cultivating ideological filters bubbles.

Ecuador and Bolivia were two other countries with the second and third highest mortality rates due to COVID-19, considering the countries evaluated in this work. The TMPT metric indicates the diversity of profiles mentioned, with Peru, Ecuador, and Argentina standing out as the countries that most cite different profiles in messages. It is worth noting that Argentina has a strong tradition of using Social Media in political contexts. Slimovich (2016) identified in the presidential elections in Argentina, in 2011, the use of Twitter as a strategy to promote an interrelation with the mass media and the world of politics.

Qualitative Analysis

The relationship between the posts and elements of COVID-19 was identified from the data survey carried out, such as: combat speeches and the number of deaths in each country. Thus, trying to identify which profiles of government head use Twitter as an element that can help inform the population about the disease, for example.

Narrative Analysis

Narrative analyses reflect in the identification of aspects concerning the way the head of government communicates with the public. In this sense, it was verified that in Pain and Masullo Chen (2019) an interpretive qualitative analysis is made about the Twitter social network publications made by then-President Donald Trump, observing the most relevant themes in his speeches with his target audience and indicating that the themes of populist speeches are predominant in his profile, while lacking themes related to deliberative speeches.

The approach presented by Grimaldi (2019), on the other hand, bypasses the development of strategies that favor the analysis of political discourses through the observation of the volume of tweets and retweets, number of profiles that mention each candidate, in addition to the amount of likes in tweets, allowing evidencing how the extraction and investigation of these publications can assist in predicting the scaled position of different candidates in an election. With the same perspective, considering the relevance of highlighting the type of discourse disseminated by each president of the Americas, analysis of the content developed in their social network profiles was performed.

It can be seen in Figure 3b that the most liked tweet in the period of this study – by Brazilian President Jair Bolsonaro – was close to the peak of deaths of COVID-19 in Brazil.Inparticular,70%ofthemostlikedpostsoccurredin May–November,2020,whentherewasanintensificationofBrazil'sdeaths.Similarly, in the profile of Prime Minister Justin Trudeau, 60% of Top10+ are concentrated between March –July, the period in which the highest number of deaths occurred inCanada.The authors make the graphs that relate these metrics for all the countries analyzed in this article available on GitHub[3].

The qualitative analysis of these graphs allows us to infer that the content of what was posted by the President of Brazil, for the most part, is not related to the fight against COVID-19. More specifically, only two tweets from the Top10+ are related to COVID-19. Considering also the most liked post in the analyzed period, as indicated in Table 4, the President tweets the slogan of his 2018 election campaign, in June 2020, close to the peak of the number of deaths by COVID-19. Besides, the 7th most liked tweet occurred in the month of the peak of deaths from COVID-19, but it deals with a video about the inauguration of building work.

This shows that the President of Brazil does not use the social network to disseminate information that can help fight the disease. On the contrary, when using Twitter it is

[3]https://github.com/Adrianomadureira1/America-Presidents-Research/blob/annexs/ANNEX%20A%20-%20GRAPHICS%20OF%20RANKING%20LIKES%20IN%20PUBLICATIONS%20x%20COVID-19.pdf

usually to misinform about the disease. In the research of Recuero et al. (2020 [n.d]) '[...] the president defended that COVID-19 was a "little flu", that things "should return to normal"', directly contradicting the Minister of Health, in addition to claim that chloroquine would be the '"cure" for COVID-19'.

On the other hand, the Prime Minister of Canada uses Twitter to disseminate news and mechanisms to combat COVID-19. Table 5 shows the positive posts to fight the disease, among the Top10+. As previously mentioned, the posts were made when Canada had the highest mortality due to COVID-19.

It should also be noted that the narrative used by the Prime Minister of Canada is more detailed than that of the President of Brazil. Jair Bolsonaro, on several occasions, made posts from third parties, with shallow texts, as analyzed qualitatively.

In this regard, the behavior of the President of Argentina is also highlighted, who, despite having fewer posts than the President of Brazil (see Table 1), directs a large part of his posts to address issues related to COVID-19: 50% of the 10 most liked tweets specifically address COVID-19, sometimes disclosing the recommendations of the World Health Organization (WHO), as seen in Table 6. The first records of Argentine presidential candidates on Twitter emerged in the 2011 elections. According to Slimovich (2016), most political figures in Argentina opened an account on Facebook or Twitter between 2009 and 2010. This reveals that, in Argentina, Twitter is a social media of common use in politics for communication with its public.

Similarly, the qualitative analysis, with the generation of Tables similar to Table 3, was performed for all the profiles in this article and can be accessed on GitHub[4].

In order to summarize the Top10+ of the heads of government analyzed in this article, relating to the tweets that deal with COVID-19, Figure 4 is presented, containing absolute values and percentages.

Analyzing Figure 4, it is noted that the Prime Minister of Canada is the one who uses Twitter the most to send messages about COVID-19, unlike the profiles of presidents of Bolivia, Chile, and Mexico, who do not make any posts about it.Justin Trudeau and Alberto Fernández are prominent in traditional media for their effective Twitter use in institutional communication. Dhillon (2016) notes that since Justin Trudeau was sworn in as Prime Minister of Canada, he has embraced social media, maintaining a robust online presence, especially on Twitter.

Vocabulary Analysis

The relationships between the words or sentences present in texts disseminated on social media allow interpreting the discourses through the most frequent elements in the publications developed by the presidents. The application of textual analysis techniques to publications, evaluating the contents disseminated on social media is verified in Noor et al. (2020) that, through the collection of Twitter publications, provided analysis about the reaction of the general public in relation to the pandemic. In our work, these publications were examined through the VOSviewer tool, and Sequential Pattern Mining (SPM) techniques were used to find frequent words or patterns in the texts, including relationships between tweets.

Our research conducted trend monitoring on how information related to COVID-19 was disseminated, as well as the public's assessment of the pandemic, through a data collection based on hashtags about the disease. This highlights that vocabulary analysis provides techniques to assist in the interpretation of content disseminated on social media.

From the Tables of the presidents' profiles and their posts, containing the subjective elements of this study, a lexical analysis was carried out, aiming to identify narratives constructed from the most evident terms. This visualization was made with the VOS viewer software, as mentioned in Methodology Section.

It is noteworthy that these graphics were generated from all tweets of the heads of government profiles during the period of one year of research. Some profiles, such as the President Argentina profile, have few words in history, thus generating a low-density graph.

Figure 5 presents the word cloud of the profile of the former President of the United States and the President of Brazil. In these clouds, it is possible to verify that there is no significant highlight for the pandemic's words. In the President of Brazil's profile, it is still possible to verify the word 'covid' and in smaller scale, 'pandemic'. However, these have less relevance than 'youtube' and 'work', for example.

On the other hand, the clouds shown in Figure 6, consisting of the profiles of the presidents of Canada and Colombia, contains several highlights for words focused on the fight against COVID-19, such as: 'vaccine', 'covid alert' and 'covid19'. In addition, an important word that can be highlighted in this cloud is 'prevencionyaccion',

[4]https://github.com/Adrianomadureira1/America-Presidents-Research/blob/annexs/ANNEX%20C%20-%20TABLES%20OF%20RANKING%20LIKES%20IN%20PRESIDENT%E2%80%99S%20TWEETS.pdf

which was a hashtag used in social networks in Colombia to alert and motivate the population about the need for prevention and action against the new Coronavirus pandemic. Figures 5 and 6 show, therefore, the difference in vocabulary between the heads of government profiles.

Similarly, the qualitative analysis with the generation of the lexity graphs was performed for all the government head profiles in this article and are available on GitHub[5].

V. CONCLUSION

The crisis caused by the new Coronavirus pandemic has demonstrated the value of reliable news and the challenges against disinformation. Research reveals the growing use of social media for the specific consumption of news about the pandemic. The potential of social media in engaging with the public caught the attention of former President Barack Obama's government in 2009, which signaled the use of new technologies at that time – social media – to put information about its operations and decisions online and readily available for the public, Mergel (2013). Added to the use of social media in politics, a discussion about the populist posture of each government official and his social presence on Twitter. We did not identify in this research a direct relationship between the volume of communication on Twitter and the effectiveness in combating the pandemic, but the individual populist or non-populist positions of the government officials who realized the severity of the disease and had their communication to combat COVID-19 amplified on Twitter.

This scenario of rising use of social media in the public, political, and governmental spheres motivated us to identify how heads of government in countries in South and North America communicated via Twitter during the COVID-19 pandemic. We follow methodological steps that are summarized in the planning and collection of data and analysis of quantitative data that measure categories and emphases in communication via tweets, retweets, likes and comments on matters relevant to the pandemic. We use SNA concepts and techniques related to OutDegree Centrality and Ego Networks to base our analysis on the behavior and activities on Twitter of the analyzed profiles. Besides, an analysis of qualitative data was carried out that sought to identify narratives about COVID-19, political interference, communication effectiveness in certain more severe times of the pandemic. Finally, graphs of the analyzed tweets' vocabularies were developed, from November 2019 to November 2020.

[5]https://github.com/Adrianomadureira1/America-Presidents-Research/blob/annexs/ANNEX%20B%20-%20WORD%20CLOUDS.pdf

For general quantitative data, Donald Trump (USA) stands out with the highest rate in almost all quantitative criteria concerning the other heads of government, emphasizing retweets, likes, and followers. For number of Mentions (TM), a measure that may suggest a degree of proximity to its audience, a characteristic identified in the physical world in populist rulers. The TM (1,769) and the TMP (651) indicate that the former President of the United States mentioned several times other profiles and often his own supporters. This action strengthened the relationship he had with his audience. Behavior was also identified in the profiles of the Presidents of Brazil, Colombia, and the Prime Minister of Canada, who also present a high level of mentions, highlighting Jair Bolsonaro (Brazil), which has less diversity among the mentioned profiles, a situation that strengthens the ideals of an ideological bias, having its communication more directed to followers, having a low level of mentions of hashtags which demonstrates a strong Outdegree characteristic. Unlike the President Ivan Márquez (Colombia), who presents the highest number of hashtags (2,104).

For the quantitative data that make a systemic relationship, we highlight the President of Uruguay's profile, when observing the number of retweets per followers (RF), indicating that the small number of followers are engaged, retweeting the posts a lot. This behavior shows a strong relationship with his followers and confidence in the information posted. For TMT (Total Mentions for total Tweets posted), Jair Bolsonaro stands out in the opposite direction of the president of Mexico, the latter, who in this criterion received a value equal to zero. When this systemic relationship takes the pandemic into account, we have the profile of Mexico's President, who used Twitter very little to communicate COVID-19 issues despite the fact that the country has one of the highest percentages of deaths by infected people. His government made use of only 677 tweets during the analysis period.

A paradox was found when we performed qualitative analysis on the profile of Donald Trump. He had an excessive number of published Tweets, and Jair Bolsonaro with a large percentage in the total number of mentions by the total of posted tweets. We found that the two rulers used their popularity and efficiency in communicating with their audiences to deny the disease and disseminate false content on social media. We were remembering that the United States and Brazil configure as the countries with the highest number of deaths by COVID-19. In contrast, we have Canada with the third highest number of published tweets and tweets' highest recurrence on combating COVID-19. The latter country has one of the lowest death rates of the disease in relation

to the population. Another highlight is the President of Argentina's profile, who even having fewer posts than others analyzed, directed much to deal with COVID- 19 pandemic.

To finalize the research findings, we found in the vocabulary analysis that there are tweets related to COVID-19 in Justin Trudeau's profile, which is directly associated with his government's success in combating COVID-19. We have identified that a populist quality can help disseminate social media content and strengthen dialogue with the public. Thus, the problem is associated with each ruler's ideological bias, which in the case of the pandemic, was not always aligned with the precepts of science.

Due to the volume of data with the number of countries analyzed, we limit our analyzes only to an approach of the degree of centrality Outdegree, considered sufficient to verify the role of each profile. For a more in-depth study, we intend to examine the degree of centrality InDegree to identify the impact that a profile has in promoting a more direct communication with its audience, being retweeted or mentioned in the tweets of other networks. Our research identified yet another passive communication between the government when there are retweets, likes, or a mention, but not precisely bilateral and direct communication.

For future work, we intend to add to this research data from Central American countries for a more global view of the Americas' countries. Additionally, apply technologies that can speed up a large-scale discourse or narrative analysis to identify clusters of ideologies, polarizations, and feelings.

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