


# Environmental Disclosure as a Tool for Public Sector Legitimacy: A Twitter Intelligence Approach

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## ABSTRACT

The purpose of this study is to measure the extent of Twitter environmental reporting by Andalusian municipalities (Spain) and identify the determinant factors of such a disclosure. Thus, factors such as population, geolocation, political signs, and sustainable commitments were analyzed under the legitimacy theory approach. The sample consisted of the official Twitter accounts of the 153 biggest local governments in Andalusia. The classification of the environmental tweets was based on a dictionary based on the GRI reporting standards for environmental disclosure, and a Twitter environmental disclosure index (TEDI) was developed. The results show that most of the local governments in Andalusia (77.78%) have an official Twitter account with different levels of audience, penetration, and activity. On the other hand, it was found that environmental disclosure is very low. However, municipalities with more surplus budget and municipalities with a greater number of sustainable commitments networks tend to report more on environmental issues through Twitter.

## KEYWORDS

Environmental Disclosure, GRI Reporting, Legitimacy Theory, Local Government, Twitter

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## INTRODUCTION

Air and water pollution, waste disposal, deforestation and CO<sub>2</sub> emissions are just a few of the environmental concern's society is facing today. Despite the global efforts being made toward different environmental policies, environmental crimes have gradually increased (Ramírez & Palos-Sánchez, 2018). Internationally, there is an increased concern about the negative environmental impact of organisational activities (Bakan, 2004; Osborne & Ball, 2011). Nevertheless, research has focused mostly on trends in environmental disclosure by big corporations (Deegan et al., 2002), and attention to environmental transparency in the public sector has been rather low (Lodhia et al., 2012).

In terms of environmental disclosure in the public sector, a number of studies have used as a basis for content analysis (Dumay et al., 2010; Farneti & Guthrie, 2009; Lodhia et al., 2012) the Sustainability Reporting Guidelines by the Global Reporting Initiative (GRI). The GRI guidelines, developed in 1997, are the most developed sustainability reporting standards based on the triple bottom line approach (economic, environmental and social indicators), and for more than a decade, they have been the leading reporting framework for sustainability disclosure worldwide (Alazzani & Wan-Hussin, 2013; Alonso-Almeida et al., 2014; Ballou & Heitger, 2005; KPMG International, 2017; Roca & Searcy, 2012).

The organizations interested in GRI are not only companies, but governments, since widespread sustainability reporting can help drive progress toward sustainable development goals (GRI, 2019) and can be the basis of environmental information disclosure that is regarded as a prerequisite for local socioeconomic development and is a basic requirement of a transparent government (Kosajan et al., 2018). The environmental disclosure reported by the governments studied is not limited exclusively to the impact of their institution on the environment, but also takes into account any environmental information or action interesting to citizens based on the 300 series of GRI Standards issued in 2016, that is composed by the thematic standards that report the material impacts of an organization regarding environmental issues.

However, despite the existence of standardized environmental framework, public awareness is key to making a success in fighting environmental problems (Easman et al., 2018; Knee Tan et al., 2008). For this, there must be a well-informed public. Since disclosing environmental information to the public offers an opportunity for them to understand and develop stewardship about their environmental entities (Spash, 2002; Zheng et al., 2014) and they can increase their support to environment actions (Easman et al., 2018).

Environmental information disclosure is a significant subfield of government information disclosure (Kosajan et al., 2018) and having it from the government is an essential requirement for the exercise of citizenship (Quiroga, 2019). Governments worldwide have embraced environmental information disclosure as an indispensable key of their strategies to improve environmental conditions (Chen & Ting Cho, 2019). This means that the responsibility for disclosure of this information must be borne by

all and sundry at all levels- national, regional and local (Oyero et al., 2018). Specially, the local government is at a relevant level to undertake the strategies of environmental governance (Wu et al., 2020), since they are the institutions more close to citizens to create them environmental public awareness. Although environmental information disclosure by local governments has been shown as a useful tool, for example for pollution control (Tian et al., 2016), their evidence has been understudied (Switzer, 2019).

Notwithstanding, many efforts to disclose citizens about environmental issues are not translated into a large degree of public awareness if there are ineffective communication strategies (Mooney et al., 2009). Unlike traditional communication media, social media (SM) allow for immediacy in information sharing and offer stakeholders more possibilities for interaction (Suárez-Rico et al., 2018). Criado and Villodre (2018) point out the rapid adoption of SM by public administrations. Taking into account that, 49 percent of the world's total population are SM users (We are social & Hootsuite, 2020), SM can be utilized as a tool for reaching all of them and both greenwash or raise awareness against environmental issues (Macotela & Burman, 2016). Thus, there is a need for more in-depth analysis of the extent and drivers of voluntary environmental disclosure in the public sector using these platforms.

Etter (2014) and Dutot, Lacalle Galvez, and Versailles (2016) indicated that Twitter is currently being widely used as a tool for environmental disclosure. To their knowledge, there is no previous study examining environmental disclosure by local governments via Twitter. In the present study, the authors aim to analyse the extent of Twitter environmental reporting by Andalusian municipalities (Spanish region) and to identify related determinant factors of such a disclosure. Factors such as population, geolocation, political signs and sustainable commitments were analysed following the premise of the legitimacy theory. For the purposes of this study, a Twitter Environmental Disclosure Index (TEDI) was developed based on the GRI 300 standards to conduct an automated content analysis. Thus, through this study, the authors seek to shed more light on the drivers of environmental transparency in local government via Twitter.

According to recent international statistics, Spain has the second highest usage of Twitter in Europe (Statistic, 2018). The Andalusian municipalities have been chosen for further analysis because it is the region with the highest population in Spain (INE, 2017) and a leading region in the use of SM (Fundación Orange, 2014; Fundación Telefónica, 2016). SM are a major channel for online communications, and local governments are seizing this opportunity (Haro-de-Rosario, Sáez-Martín, & Caba-Pérez, 2018). A novel aspect of the present study is the focus on environmental disclosure via Twitter by local governments and the robustness of the study, as the analysis has considered nearly every tweet by each municipality since they started their account.

This paper addresses two research questions: RQ1: How do local governments use Twitter to divulge environmental issues? and RQ2: What are the factors that influence the environmental disclosure of local governments on Twitter? Their findings provide a contribution to the understanding of how and why local governments disclose

environmental information. The administrators of SM in local governments can take advantage of the findings drawn in this study to better understand the general trend of environmental disclosure in public sector and plan the future communication strategies.

After offering a brief introduction in this section, the rest of the article is organised as follows: the authors present a review of previous studies in the following section, related to environmental reporting. The next section explains the data used in the research and the methods followed in this analysis. Later, the findings on the environmental disclosure on Twitter of the Andalusian municipalities are presented and discussed. The conclusions and contributions of the study are presented. Finally, the main limitations and avenues for future investigations are discussed.

## **LITERATURE REVIEW**

### **Environmental Reporting**

Over the last two decades, environmental disclosure by corporations has dramatically increased as a response to environmental concerns and social pressure. As a result, the number of companies paying attention to environmental concerns and providing information about their environmental impact, in addition to their financial performance, has significantly increased (Serafeim, 2013). KPMG International's Corporate Social Responsibility (CSR) reporting survey (2017), analysing the 100 largest companies in 49 countries, reveals that 72% of these companies provide a sustainability report which includes information on the economic, environmental and social performance of the company.

Although there are many standards offering guidance on how to report on environmental issues, there is no one internationally recognised and generally accepted standard for environmental disclosure, as there is for financial reporting (Marimon, Alonso-Almeida, Rodríguez, & Cortez, 2012). However, international institutions such as GRI represent a significant step towards unification in this matter.

The majority of research analysing environmental disclosure by companies shows that it is a tool to achieve a certain degree of legitimacy with stakeholders (Deegan et al., 2002; Lodhia, 2004). On the other hand, public sector environmental disclosure has not increased as dramatically as it has in the private sector (Lodhia et al., 2012), and there is relatively little research or theoretical framework on why public sector entities engage in environmental reporting (Burritt & Welch, 1997; Guthrie et al., 2010). Dumay et al. (2010) provided a review of GRI sustainability reports issued within the public sector, indicating that only a few entities have issued a sustainability report in compliance with these guidelines. Some authors claim that public sector entities should act as a role model to guide the private sector into appropriate practices in sustainability accounting (Guthrie et al., 2010; Osborne & Ball, 2011).

### **Legitimacy Theory**

One of the most widely used approaches to justify the disclosure of sustainability information focused on the legitimacy theory (Deegan et al., 2002; García-Sánchez et

al., 2013). In short, the theory of legitimacy is about meeting expectations of society as implied in the social contract (Richardson, 1987). Dowling and Pfeffer (1975) see legitimacy as a harmonisation of organisational practices and social values.

Prior use of this theory has mostly focused on the environmental reporting of companies (Deegan & Rankin, 1996; Gray et al., 1995; Patten, 1991). Numerous studies show that companies exposed to public pressure, usually from those operating in the critical sector, tend to disclose more environmental information to gain legitimacy. Some companies with poor environmental performance even use environmental disclosure as a tool for greenwashing (Cho & Patten, 2007; Deegan et al., 2002; Lodhia, 2004).

It is that in some investigations (Burritt & Welch, 1997; Farneti & Guthrie, 2009; G. R. Frost & Seamer, 2002; Lodhia et al., 2012) the legitimacy theory has been applied to public sector disclosure, despite the reasons behind the interest of public agencies in revealing how they address sustainability issues do not differ from those of private companies (Lamprinidi & Kubo, 2008).

Burritt and Welch (1997) found that public sector entities with greater visibility tend to report more environmental information. Broadbent, Laughlin and Alwani-Starr (2010), on the other hand, stated that increased environmental reporting is actually a result of a regulatory push and claimed that normative forces are powerful drivers for sustainability practices in the public sector.

In short, despite the fact that sustainability disclosure practices in the public sector are in their infancy compared to the private sector (Dumay et al., 2010; Leeson et al., 2005), governments have as part of their original functions providing better information on sustainability activities (Ball & Bebbington, 2008).

In this way, they face public pressure, which requires them to legitimize that their activities are socially responsible, as well as responsible in terms of sustainability (García-Sánchez et al., 2013), given the fact that the public sector operates with funds from citizens, they demand more and more information and transparency about their public actions (Guillamón, Rios, et al., 2011). However, legitimacy is threatened when it is only about symbolic actions and not facts actions (Berrone et al., 2009). In addition, Ferejohn (1999) argues that politicians who want to improve the size of the public sector must increase the dissemination of information to receive more resources and obtain the trust of voters.

## **Social Media in the Public Sector**

The rapid adoption of SM by public administrations deserves attention (Criado & Villodre, 2018). Incorporating SM into the local administration communication strategy provides transparency to local governments and improves policy-making and the provision of public services (Bonsón et al., 2012). SM platforms may become the new local discussion forums, where local governments send local service-related messages to their citizens and may serve as information exchange channels to obtain feedback from citizens (Haro-De-Rosario et al., 2018).

Thus, SM is an effective means for local government to improve citizens' trust in government (Song & Lee, 2016), allowing citizens and government to get closer and they can co-created information, citizens demand services, policy is negotiable, and governance is shared (Reddick & Norris, 2013). Thereby SM decreases information asymmetry between government functionaries and citizens, and it is empowered citizens to expand their role in dealing with public problems (Eom et al., 2018). Highlighting the SM's role as a tool for generating beneficial effects in the public sector.

Despite its beneficial effects, the decision of local governments to adopt SM practices is driven, according Mergel (2013), by in some cases they actively search for information and existing best practices and in other cases they passively observe and copy other institutions' behaviour.

### **Twitter as a Tool for Environmental Disclosure in the Public Sector**

SM are powerful communication tools, allowing for the scale-free dissemination of information (Wukich & Steinberg, 2013). Millham and Atkin (2018) point out that the dynamics of sharing information via SM responds to their innate need for communication. Among the different existing SM platforms, the most used by governments were Facebook, Twitter, YouTube and Instagram (Contreras-Orozco, 2017). However, Twitter is the most popular SM in world politics (BWC, 2019).

Twitter is an example of less-constrained communication representing a millennial style, which is short, quick, and interactive. It is an innovative media platform with open and horizontal networks (Honeycutt & Herring, 2009; Lerman & Ghosh, 2010), which grants users access to a large amount of content and it provides a more interactive and open communication than other SM in where users are allowed to follow others without their approval as well as trending topics without having to login (Kim, 2015). For these reasons, Twitter is the SM's platform preferred among public administrations, since it allows to communicate with others who have similar interests, regardless of whether users know each other, and disseminate information to a broad range of communities (Gao & Lee, 2017).

That is why it has gained so much popularity and currently counts more than 330 million monthly users exchanging more than 500 million messages every day (Suárez-Rico et al., 2018). Although the growth of active users has moderated, Twitter has created a great community that, for now, shows a strong loyalty (Sánchez, 2018).

Twitter's functionalities can assist in communicating information about environmental issues (Mooney et al., 2009). Busch and Shepherd (2014) claim that one of the main factors that has made Twitter an attractive tool for sustainability disclosure is the perception of democratic participation, related to more opportunities for social activism, digital citizenship and free speech—something that is only possible in a two-way media format. In addition, Akerlof and Maibach (2008) indicated that higher public awareness achieves when the environmental campaigns have higher rates of message frequency and for that, Twitter is the ideal platform where you can post short messages frequently.

Although there are some studies on Twitter in the public sector, the literature on Twitter in local governments is rather scarce (Anderson et al., 2015; Criado & Villodre, 2018; Sobaci & Karkin, 2013) and almost non-existent in the use of Twitter on environmental issues (Hodges & Stocking, 2016; Shan et al., 2020). A study by Wukich and Steinberg (2013) analysed how the use of hashtags facilitates the dissemination of information during extreme events. Haro-de-Rosario et al. (2018) analysed the usage of Facebook and Twitter as tools for citizens' commitment with Spanish local governments. Bonsón, Perea and Bednárová (2019) studied Twitter usage and citizens' engagement in Andalusian local government.

## **Factors Behind Environmental Disclosure**

For the second research question (RQ2: What are the factors that influence the environmental disclosure of local governments on Twitter?) the previous literature has presented that there are factors that may either increase or slow environmental disclosure by governments. They include economic factors, municipal features and political factors.

### *Economic Factors*

To carry out any environmental action the municipalities need to have an economic sustenance, which they obtain from their public budgets. This indicator is representative of good management of local government (Andrews, 2010). The balance of the positive budget (surplus) allows municipalities to improve their information systems (Alt et al., 2006) and thus increase environmental disclosure. In contrast, with a negative budget balance (deficit), municipalities usually are more transparent (Guillamón, Rios, et al., 2011), although other authors (García-Sánchez et al., 2013; Navarro et al., 2010) find no evidence that environmental disclosure is favored by the budget balance.

The unemployment rate, which is strongly related to the economic level of the municipality (Alonso-Villar et al., 2009), has been analyzed in various investigations showing that it affects the environmental disclosure of municipalities in different scenarios. (Guillamón, Rios, et al., 2011; Navarro et al., 2011). However, other authors (García-Sánchez et al., 2013; Prado-Lorenzo et al., 2012) have not found a significant relationship.

### *Municipal Features*

Among between, there are differences regarding of population size, so that their behavior will be different in some respects between a large municipality and a small municipality (McElroy et al., 2005). Several authors (G. R. Frost & Seamer, 2002; García-Sánchez et al., 2013; Joseph & Taplin, 2011) obtain evidence in favor of the fact that large municipalities disclose more environmental information, since they should be more transparent to legitimize their functions because they have a higher degree of visibility, for which attracts the attention of politicians, environmental groups and the general public. In contrast, neither Prado-Lorenzo et al. (2012) nor Sánchez de Miguel (2019) found a significant relationship of population size in environmental disclosure.

The location of the municipality (coast or inland) is usually an indicator of the municipality's development (Ribeiro & Guzman, 2011), which is linked in Spain with its main productive sector, tourism (WTTC, 2020). Despite the fact that tourism activity generates positive impacts in the municipality's environmental sphere, the negative impacts have been greater and more visible as they are direct impacts on the physical environment (Gómez Bruna & Martín Duque, 2019). Some authors have concluded that the harmful impacts of tourism on the environment they are perceived more negatively in coastal municipalities than in inland municipalities (Gómez Bruna & Martín Duque, 2019; Zahedi, 2008), which implies that coastal municipalities should disclose more about the environment to legitimize the actions of the negative impact of tourism on its citizens. However, this does not only occur in the public sector since keeping in mind that the reasons behind legitimizing the disclosure of how they address sustainability problems in the public sector do not differ from the private sector (Lamprinidi & Kubo, 2008; Liu & Anbumozhi, 2009) Chinese companies operating in coastal regions are more likely to disclose sustainability-related data. However, other authors (Ribeiro, 2007; Ribeiro & Guzman, 2011) have pointed out that the geolocation of the municipalities has no association with their environmental disclosure.

### *Political Factors*

The ideology of the ruling party in each Spanish municipality is framed in left-wing blocks (progressive) and in right-wing blocks (conservatives) (CIS, 2015), which are not characterized by the agreement culture of the pacts between the different ideological blocks compared to Europe (Aunión et al., 2020). Although the legislature lasts four years, in Spain there is no maximum limit of legislatures to national or municipality level, so the president or mayor can be re-elected in several consecutive elections (Rodríguez-Pina & Mateo, 2017). As Andreu-Abela and Romero-Reche (2019) present, that at national level the party chosen to govern changes more while at the municipal level there is greater continuity of the ruling party. They explain that this is because in the behavior of the Andalusian voter, the contextual factors are basic, both the roots of the formation and the habitat seem effective predictors of the vote in this community. For this reason, at the municipal level, a party with roots has a much greater chance of being voted for than another, without headquarters, infrastructure and regular activity in the territory.

This means that the political sign of the municipal government can influence sustainable dissemination practices, given that different ideologies often propose different styles of city (Prado-Lorenzo et al., 2012). However, in the literature there are disparities in conclusions about how municipalities report on environmental matters according to their political sign. On the one hand, some authors have found a negative relationship between right-wing ideology and the implementation of sustainable practices, while other authors have presented that it is left-wing governments that negatively influence sustainable practices, since right-wing parties dedicate additional efforts regarding the environment to attract voters with a left-wing ideology (Prado-Lorenzo et al., 2012). On the other hand, Guillamón et al. (2011) and García-Sánchez



et al. (2013) show that municipalities governed by left-wing majorities are more transparent than those governed by conservatives. However, Navarro et al. (2010) find that the political tendency of a government party does not explain the environmental disclosure of the public sector.

It has been observed elsewhere that local governments seeking to address environmental issues frequently join urban sustainability commitment networks (Anguelovski & Carmin, 2011; Bulkeley, 2010; Cashmore & Wejs, 2014). It is one of the indicators of transparency and cooperation that determine the sustainability of cities according to the 2030<sup>th</sup> Agenda for Sustainable Development (Gobierno de España, 2018). Sustainable cities are those that have established action plans and policies that aim to guarantee the availability and reuse of the environment resources for future generations (Regional Environmental Center for Central and Eastern Europe, 2010). The association with city networks for sustainability generates good results (Observatorio de la Sostenibilidad, 2018). The highlighted networks are Aalborg Charter, Covenant of Mayors for Climate and Energy (CoM), among others. Their mission is to mobilize and sensitize society, public institutions and the private sector on sustainable matters (REDS, 2015), so if they are associated with more networks, the more they must disclose about the sustainability to legitimize their agreements, which makes it a considerable factor for the analysis.

## **METHODOLOGY**

### **Sample Selection**

Andalusia is the leading Spanish region in the use of social media (Fundación Orange, 2014; Fundación Telefónica, 2016). Three of its cities, Seville, Granada and Malaga, are among the five Spanish cities with the highest number of SM profiles related to their population (The Social Media Family, 2018). Hence, Andalusia seems to be an interesting sample for social media research. In this study, all 153 Andalusian municipalities with more than 10,000 inhabitants are analysed. Nearly 80% of the Andalusian population resides in these municipalities.

To identify the Twitter accounts of the selected municipalities, a multi-track search strategy was carried out as follows: (1) Search for logos or Twitter links on the homepage of the municipality website. If the Twitter/link logo was not available on the home page, the site map was checked for a link to a Twitter account or any other relevant link that could redirect to Twitter, e.g. a link to 'social media', 'contact us' or 'connect with us'. (2) If the site map search did not lead to a link to a Twitter account, then an Internet search engine was used to search for the words 'Twitter' next to the name of the municipality. Therefore, when searching with the keywords, the search results return accounts that contain those words and allow the official municipality account identification. (3) If neither the municipality's website nor the Internet search engine showed any sign of a Twitter account, then Twitter itself was used to search for the name of the municipality. If a Twitter account was found for a particular municipality, it was then verified by searching the bibliography provided

by the Twitter account, or by checking whether the Twitter account had a link that redirected to the municipality’s website. This verification step was important to make sure that the accounts that were found are authentic. If a municipality had several Twitter accounts, the main Twitter account, which generally only carries the name of the municipality without further specifications, was the one to be included in the sample. Following these steps, 119 verified Twitter accounts were found from the sample of 153 municipalities.

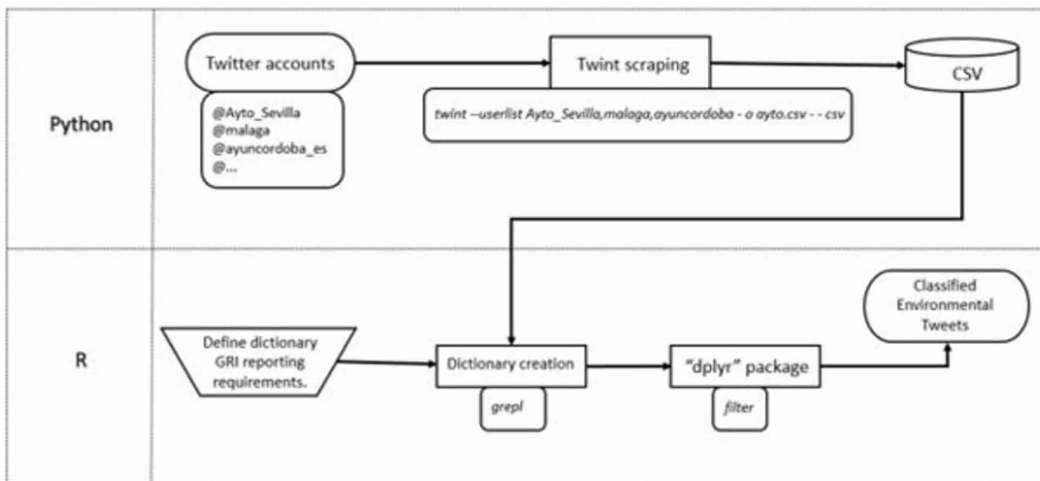
## Tweet Extraction

The process of tweet extraction and environmental content analysis conducted in this study is depicted in Figure 1.

After the Twitter accounts were identified, the tweets were scraped and extracted via Twint (Figure 1), a Python library that automates the Twitter gathering process (Zacharias & Poldi, 2018). It is an advanced Twitter scraping and open source intelligence tool that is designed to massively extract the history of the tweets that were tweeted by each municipality’s account. However, Twint is not able to scrape retweets as it does original tweets. Therefore, this study only analyses the original tweets from each account. Nevertheless, these are of greater importance, as only these tweets can reflect the intention of the municipality to communicate certain information via social media.

The tweets were extracted at the end of March 2019, producing 817,903 tweets ranging from the period each municipality joined Twitter (average year 2013) to 15 March 2019, representing about 80% of the total number of tweets published by the municipalities studied. The remaining 20% are retweets, which cannot be collected automatically.

Figure 1. Flowchart of scraping and environmental analysis



## Creation of Dictionaries

The identification of the environmental tweets was based on a Spanish keyword list (dictionary) based on the Global Reporting Initiative (GRI) information requirements for environmental disclosure (300 series) (Figure 1).

The dictionary is based on GRI keywords because GRI standards represent global best practices for publicly reporting a variety of environmental, economic and social impacts (GRI Standards, 2018). As previous research has shown, the GRI framework has already been used as the basis for the analysis of environmental disclosure content (Dumay et al., 2010; Guthrie & Farneti, 2008; Lodhia et al., 2012). Sustainability reports based on the standards provide information about an organisation's positive or negative contributions to sustainable development (GRI Standards, 2018). The 300 series of the GRI Standards includes the standards for specific environmental issues: Materials (301), Energy (302), Water and Effluents (303), Biodiversity (304), Emissions (305), Effluents and Waste (306), Environmental Compliance (307) and Supplier Environmental Assessment (308). Thus, the dictionary is composed of 92 keywords from these eight specific topics plus a generic topic. The reason for the elaboration of a dictionary of environmental key words was due to the lack of Spanish-language dictionaries in this field. The GRI 300 was chosen as a reference due to its robustness in terms of environmental indicators. They were obtained from GRI Standards download center, where the Environmental Standards Spanish translations are available. Once completed, the elaborated dictionary was applied to identify the municipalities' tweets with environmental content.

The coding of the dictionary (Figure 1) was performed using the function of the R base package, `grepl` (R Core Team, 2018), where tweets containing at least one of the key words from the dictionary have been identified. Once the tweets had been analysed and the environmental disclosure tweets had been identified, they were automatically classified (Figure 1) using the R 'dplyr' library (Wickham et al., 2017). The `dplyr` library is a powerful R package for transforming and summarising tabular data with rows and columns. It is very useful when performing analysis and manipulation of exploratory data. The package contains a set of functions that perform common data manipulation operations, such as filtering rows, selecting specific columns, rearranging rows, adding new columns, and summarising data (Irizarry & Love, 2017). The `filter` function was used to sort tweets by category. This way, a new database was obtained, containing 18,675 tweets which correspond exclusively to environmental disclosure tweets. Those were used for further statistical analysis.

## Twitter Environmental Disclosure Index (TEDI)

Once the database of environmental information tweets was obtained, the tweets were paired with their corresponding municipalities. This resulted in the possibility of creating an index that measures the environmental dissemination of Twitter by, in this case, the Andalusian municipalities. Thus, the Twitter Environmental Disclosure Index (TEDI) is calculated for each municipality considering its number of environmental

tweets and its total number of tweets (TEDI = number of environmental tweets/total number of tweets).

## Measurement of Variables

Table 1 summarizes the variables used in this study and their measurements.

**Dependent variable.** The presence of environmental disclosure tweets is measured by the Twitter Environmental Disclosure Index (TEDI) as the percentage of environmental tweets tweeted by each municipality since they joined Twitter with respect to their total number of tweets. It lets you know how the environmental commitment of the municipalities in Twitter.

**Independent variables.** The variables used in this study are the result of balance (surplus or deficit) of current budget by inhabitant of each municipality (Government Budget Balance by Inhabitant), the proportion of unemployed (Unemployment Rates), whether it is a coastal or inland municipality (Geolocation), the left-wing or right-wing political ideology governing the municipality (Political Sign), the number of inhabitants of each municipality (Population) and the number of institutional urban environmental commitments to which the municipality is attached (Sustainability Commitment Networks). For each of these variables, there is a justification following legitimacy theory, which seeks to explain which of these variables lead to greater environmental disclosure on Twitter. These variables refer to the year 2018. Both 2018 unemployment rate and budget are used as a proxy for the evolution of both indicators over the years analyzed in a period of recovery of the Spanish economy (Hernández de Cos, 2018).

After selecting the sample (119 municipalities) with all its scraped data (817,903 tweets), the identification of environmental tweets (18,774 tweets), the creation of TEDI (dependent variable) and the definition of variables (six independent variables), the following linear regression and ordinary least squares (OLS) was presented:

$$\left( TEDI = \alpha + \beta_1 GovBudgBalH + \beta_2 UnempRat + \beta_3 Popul + \beta_4 Geol + \beta_5 PolSing + \beta_6 SustCommitNet + \epsilon \right)$$

## FINDINGS

### RQ1: How do Local Governments use Twitter to Divulge Environmental Issues?

The results show that 119 (77.78%) of the 153 largest municipalities in Andalusia are present on Twitter and use it as a channel for communication with their citizens and other stakeholders.

Regarding the scraped tweets, about 80% of the original tweets were obtained, for a total of 817,903. Following the elaborated environmental dictionary that was created based on the GRI keywords (300 series), only 18,675 (2.30%) of the total tweets were considered environmental.

Table 1. Variables' Definition and measurement

Variable	Full Name	Shortened Name	Description	Source
Dependent	Twitter Environmental Disclosure Index	TEDI	Proportion of environmental tweets tweeted by each municipality	Calculated and assigned based on environmental topic of tweets extracted via Twint
Independent	Government Budget Balance by inhabitants	GovBudgBalH	Result of balance (surplus or deficit) of current budget by inhabitants of each municipality.	Ministerio de Economía y Hacienda of Spain Government
	Unemployment Rates	UnempRat	Proportion of people who can work and actively seek employment but do not get it in each municipality,	Instituto de Estadística y Cartografía de Andalucía (IECA)
	Population	Popul	Number of inhabitants of each municipality.	
	Geolocation	Geol	Dummy Variable (If it is a coastal municipality = 1; If it is an inland municipality = 0)	Website of municipalities themselves
	Political Sign	PolSign	Dummy Variable (If a left-wing political party governs = 1; If a right-wing political party governs = 0)	
Sustainability Commitment Networks	SustCommitNet	Number of institutional urban environmental commitments to which the municipality is attached (0-10)	Consejería de Agricultura, Ganadería, Pesca y Desarrollo Sostenible de la Junta de Andalucía	

As for the total number of followers (audience), the number of followers with respect to the population (penetration), the total number of tweets (activity total), the number of tweets per business day (daily activity) and the environmental disclosure index (TEDI), there were evident substantial differences between the municipalities analyzed (Table 2). The account with the largest audience had 156,702 followers, while the account with the smallest audience had only 179 followers (average = 5,608, std. = 19,066). Similarly, the largest penetration was 29.78%, while the lowest was as scant as 0.81% (average = 9.90%, std. = 6.24%). In addition, it has been found that there is a negative relationship between population and penetration ( $r_s = -0.234$ ). The differences were also present in the level of Twitter activity, where the most active Twitter account had made 121,217 tweets and the least active only 284 tweets (average = 8,484, std. = 12,783). Regarding frequency of posting, the most active account per business day published 65 daily tweets, while the least active tweeted only 0.32 messages per day (average = 5, std. = 6.86). The Twitter Environmental Disclosure Index (TEDI) ranged from 0.47% to 16.67% (average = 2.24%, std. = 1.96%).

**Table 2. Audience, Penetration Activity, Daily activity and TEDI**

	Maximum	Average	Minimum	St. D.
Audience	156,702	5,608	179	19,066
Penetration	29.78%	9.90%	0.81%	6.24%
Activity total	121,217	8,484	284	12,783
Daily activity	65	5	0.32	6.86
TEDI	16.67%	2.23%	0.47%	1.96%

## **RQ2: What are the Factors that Influence the Environmental Disclosure of Local Governments on Twitter?**

To identify the factors explaining municipality environmental disclosure via Twitter, Ordinary Least Squares analysis was applied (Table 1). Table 3 presents the results. As can be seen, both the government budget balance (Sig. 0.0165\*) and sustainable commitments (Sig. 0.0025\*\*) seem to be positively correlated with TEDI. Nevertheless, other variables tested did not show any significant relation with TEDI.

The results show that municipalities with budget surplus tend to post more environmental tweets than municipalities with budget deficit and that mainly municipalities attached to a greater number of sustainability commitments networks also to post more environmental tweets than those less attached. Even though the estimate coefficients of both are very low, being adhered to more sustainability commitment networks implies more environmental disclosure on Twitter than the increase in the surplus.

The adjusted R-squared value is also low (0.06471), so the proportion of variation in the dependent variable that has been explained by this model is low. This does not indicate whether a regression model is adequate, since in this case it is possible to have a low R-squared value for an adequate model (p-value: 0.03566). Any discipline that attempts to predict human behavior typically has low R-squared values, as humans are simply difficult to predict (J. Frost, 2019).

## **DISCUSSION**

Local governments must inform about their sustainability activities (Ball & Bebbington, 2008). On the other hand, citizens must be provided with accurate information about environmental issues and should receive this through the most effective communication channels available (Mooney et al., 2009). This study has been carried out under both premises of public awareness and citizen pressure.

According to the findings, most Andalusian municipalities (77.78%) have an official Twitter account. This presence on Twitter is relevant, although somewhat smaller compared to that reported (96.55%) by Bonsón et al. (2019). However, the sample in that study included bigger municipalities. This is consistent with the assumption that bigger municipalities can afford to maintain more SM channels. The

Table 3. Ordinary least squares (OLS)

Independent variable	Dependent variable			
	TEDI			
	Estimate	Std. Error	t value	Sig.
(Intercept)	-1.797e-03	8.087e-03	-0.222	0.82459
Government budget balance by inhabitant	3.735e-05	1.571e-05	2.378	0.01911
Unemployment rates	1.210e-06	1.817e-06	0.666	0.50693
Population	-1.390e-07	2.022e-07	-0.687	0.49319
Geolocation (coastal vs. inland)	-1.161e-03	3.996e-03	-0.291	0.77188
Political sign (left-wing vs. right-wing)	4.039e-03	4.220e-03	0.957	0.34058
Sustainable commitments networks	4.461e-03	1.455e-05	3.065	0.00273
* Significant at $p < 0.05$ (2-tailed) ** Significant at $p < 0.01$ (2-tailed) Multiple R-squared: 0.1118, Adjusted R-squared: 0.06417 F-statistic: 2.349 on 6 and 112 DF, p-value: 0.03566				

Twitter presence in Andalusian municipalities is also relevant when compared with SM usage in other Western European municipalities as reported by Bonsón, Royo, and Ratkai (2015)—79% for Facebook, and Bonsón and Bednárová (2018)—39% for YouTube. This makes Twitter an important communication channel for public sector issues, where municipalities can leverage on its specific features.

Nevertheless, a simple presence on Twitter does not guarantee an active and fruitful communication between the municipality and its audience (Bonsón et al., 2017). Relevant content is one of the key aspects to gain an audience’s attention. This way, the municipality can leverage Twitter and use it as a dissemination channel for various public issues or initiate a conversation with citizens.

The results show that the audience (number of followers) varies considerably depending on the municipality. When the audience is considered in relative terms—followers with respect to population—an inverse relationship has been obtained between municipality size and penetration. Penetration is lower when the population increases. The findings show that in the larger municipalities the audience feels less connected to the municipality, which is in compliance with previous research (Bonsón et al., 2019). The average penetration rate on Twitter was 9.9%, which reflects relatively small interest on the part of the Andalusian population in following their municipalities on Twitter in general.

To attract more followers, municipalities should use Twitter in an effective way. For instance, activity should be frequent, but not overwhelming (Bonsón et al., 2017).

The total Twitter activity of the municipalities in this study varies. An average daily activity was five tweets per business day, which would follow the recommendations of the UK Government Cabinet Office, which in their guidelines suggests 2 to 10 publications per day to be an adequate frequency for SM publications.

Regarding environmental disclosure, the results show rather little concern on the part of the municipalities for environmental issues on Twitter, as environmental tweets (TEDI) only represent 2.30% of the total number of tweets.

Despite Twitter being an attractive tool for corporate environmental disclosure (Busch & Shepherd, 2014; Dutot et al., 2016; Etter, 2014), municipalities do not seem to leverage the opportunities this platform offers. Nevertheless, a similar phenomenon, a difference between corporate and public administration disclosure practices, has been observed with other SMs (Bonsón et al., 2015, 2017; Bonsón & Bednárová, 2018; Ribeiro et al., 2016). Despite that, citizens seem to be interested in the environmental actions that public entities carry out (Ribeiro et al., 2016). Bonsón et al. (2019) point out that environmental content generates the most comments from citizens. Therefore, a lack of attention to environmental issues from the municipality side might not satisfy the citizens' demand for public entity environmental legitimacy.

Regarding the factors influencing the level of environmental disclosure measured by TEDI, no association was found between population, geolocation, and political sign and TEDI. Later, the factors are mentioned for which there is empirical evidence.

The relationship between the unemployment rate and environmental disclosure on Twitter (TEDI) has not been significant. Therefore, it implies that neither the municipalities with the highest unemployment nor those with the lowest unemployment disclose more about the environment. This coincides with that obtained by García-Sánchez et al. (2013) and Prado-Lorenzo et al. (2012). However, the municipalities with the highest employment rate must focus on the environment, since an environmental tax reform reduces unemployment (Aronsson, 2005; Schneider, 1997), as shown by 'double dividend hypothesis' (Bosquet, 2000; Carraro et al., 1996).

Population has been chosen as a possible factor for TEDI based on the assumption that larger municipalities face greater environmental concerns, such as pollution and therefore, based on the premise of legitimacy theory, might use this alternative platform for environmental disclosure. Nevertheless, previous research (Sánchez de Miguel, 2019) showed that the problem of pollution is not only a major issue in large provincial capitals; smaller municipalities face high levels of pollution as well. Similarly, as Prado-Lorenzo et al. (2012) concluded, this study the size of the municipality measured by the population was not associated with the TEDI.

Regarding geolocation, it was assumed that the coastal municipalities would disclose more environmental information to legitimize the environmental impacts of tourism in their environment, but it has not been significant with respect to TEDI, coinciding with Ribeiro (2007) and Ribeiro and Guzman (2011). Turns out that in Andalusia the tourism in both coastal and inland municipalities is similar; domestic tourism has improved but stays in sun and beach destinations have decreased (Agencia EFE, 2018). Therefore, the municipalities of both destinations must disclose environmental



information. The coastal municipalities must legitimize the environmental situation because their higher seasonal component, which threatens sustainability (Martín et al., 2014) and the interior municipalities because the loss of quality of the 'climate' resource will make these regions go from excellent to unfavourable conditions for tourism (Moreno, 2010).

As for the ideology of the municipal government team, Greenpeace (2019) in its analysis of the electoral programs of the leading Spanish political parties, concluded that the left-wing political parties have better environmental proposals, while the right-wing political parties did not have environmental concerns as a priority. However, the findings do not indicate that a municipality under a left-wing government would have higher TEDI. Despite the fact that the Spanish government parties are among the most committed to their electoral promises, behind the British and Swedes, and significantly ahead of, for example, Austrians and Italians (Lapuente Giné, 2015), in their political programs there is still a lack of commitment and urgency in addressing the climate crisis and other environmental concerns (Greenpeace, 2019). This coincides with Navarro et al. (2010) that find that the political tendency of a government party does not explain the environmental disclosure of the public sector.

The factors that have empirical relationship with TEDI are government budget balance (by inhabitant) and especially sustainable commitments networks attached to each municipality.

The governments with a budget balance surplus tend to disclose more about the environmental than the governments with deficit. Due to the surpluses, governments have more capacity to improve their information systems (Alt et al., 2006) and greater investment capacity, which correspond to higher levels of municipal transparency (Araujo & Tejedo-Romero, 2016; Guillamón, Bastida, et al., 2011).

The governments with a greater number of sustainable commitments networks tend to disclose more about the environmental than the governments with a few numbers of networks. Because the networks have the mission that the governments must mobilize and sensitize society, public institutions and the private sector on sustainable matters (REDS, 2015). The legitimacy is fostered through the increase of embedded networks (Frickel & Davidson, 2004), which are key tools for implementing a set of sustainability policies at local level (Echebarria et al., 2004). In addition, as most of the sustainable commitments networks are international, local governments thus legitimize their role in their own municipality, giving an international projection (Strangis, 2012). As Andalusia (Spain) is a region of the European Union (EU), they adhere to European networks that serve to disseminate and legitimize the environmental regulations of the EU (Kelemen, 2010). Bearing in mind the EU as a global environmental leader and the United States as an assiduous opponent of multilateral environmental agreements (Kelemen & Vogel, 2010). Membership of such networks could be symbolically significant for constructing legitimacy, but they also constitute a resource which municipalities can draw upon in attempting to construct legitimacy for the institutionalization of environmental planning (Cashmore & Wejs, 2014).

## CONCLUSION

According to their knowledge, this is the first study that explores environmental disclosure via Twitter in the largest municipalities in Andalusia. As there is no previous study, this study provides an in-depth analysis and contributes to the debate on the use of SM in the public sector.

The contribution of this study is twofold. First, it fills the gap in the literature on the use of Twitter by municipalities for environmental disclosure and provides a dictionary of environmental keywords in Spanish based on the GRI. Second, it could have practical implications for administrators of public sector communities responsible for online communication. The findings of this study could help local governments to improve their online communication strategy. This paper can also establish the basis of a framework of measures for the dissemination of environmental information on Twitter for the public administration. In this way, local governments would know the best way to tweet about it and it can control how they are doing it through TEDI.

The results show that most of the local governments in Andalusia have an official Twitter account with different levels of activity and audience but with little penetration of their population on Twitter and a publication of recommended tweets. Environmental disclosure on Twitter (TEDI) was still rather scarce in comparison to other content types.

It has been found that among the factors such as government budget balance (by inhabitant), unemployment rates, population, geolocation, political sign and sustainable commitment networks, only government budget balance and mainly sustainable commitment networks shows an association with TEDI. In a nutshell, it can be concluded that both municipalities with surplus and mainly municipalities with a greater number of sustainable commitments networks tweet more environmental content to legitimise their functions and actions.

## LIMITATIONS AND FUTURE RESEARCH

Before closing, a series of limitations must be acknowledged, along with recommendations for future research.

The main limitation of this study is implicit to the creation of a dictionary and a content analysis. There is a possibility of omitting a relevant keyword which might have led to the exclusion of a tweet despite its environmental content. On the other hand, a tweet might have been classified as environmental because of the presence of an environmental keyword, but the context may not have been an environmental disclosure. Therefore, future research could attempt to design a more precise technique to reduce this limitation and get an even more precise environmental dictionary.

It would also be more accurate to be able distinguish between the tweets that report the impact of the municipality on the environment or the tweets that deal with generic environmental information that may be of interest to citizens.

As for the factors, the limitation is in the economic variables that have the peculiarity that they are not very static indicators in time, so they vary from one year

to another. Therefore, for future investigations, a TEDI must be obtained for each year and panel data must be performed.

Regarding future research, the proposed analysis technique can be applied to other regions that have similar numbers of Twitter users, such as Catalonia, Valencia or Castilla y León (Delgado von Eitzen, 2016; The Social Media Family, 2018). To improve the generalisation and understanding of the results, future studies could conduct a comparative analysis on a national or international scale and extend the list of possible factors influencing a municipality's propensity to tweet environmental content. It could also be of great interest to analyse the commitment of citizens on Twitter and their demand for disclosure of different environmental matters by municipality.

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