RESEARCH ARTICLE

Corporate Social Responsibility and Environmental Management · ERP ENVIRONMENT   **WILEY**

Environmental disclosure and stakeholder engagement via social media: State of the art and potential in public utilities

Davide Giacomini PhD[1] ⓘ | **Paola Zola PhD**[2] | **Diego Paredi**[1] | **Mario Mazzoleni**[1]

[1]Department of Economics and Management, University of Brescia, Brescia, Italy

[2]Institute of Informatic and Telematics, National Research Council, Pisa, Italy

Correspondence
Davide Giacomini, Department of Economics and Management, University of Brescia, Contrada S. Chiara 50, 25122 Brescia, Italy.
Email: davide.giacomini@unibs.it

Abstract

The concept of sustainable development has become dominant in the current socio-economic debate at the global level. In particular, environmental issues have become increasingly central in the action of all organisations: private, public, and hybrid. Analysing a sample of Italian public utilities, we studied the level of disclosure regarding environmental topics via public Facebook pages. The aim of this study is to evaluate the impact of Web 2.0 on municipally owned public utilities' voluntary disclosure of environmental issues and stakeholder interest in this field. The findings show that the use of Facebook by public utilities to disclose environmental issues is still at an early stage. However, it is constantly growing, especially in the larger companies and in those with mixed public/private ownership.

KEYWORDS

corporate social responsibility, dialogic accounting, environmental disclosure, organisational legitimacy, social media, stakeholder engagement, sustainability

1 | INTRODUCTION

Thanks to the UN Brundtland Commission and the 1992 Rio Earth Summit, sustainability has become a key concept for global public policies. At the Rio Earth Summit, 172 governments defined a common action plan (Agenda 21) and a Declaration on Environment and Development (The Rio Declaration) in order to reinforce the focus on environmental and social sustainability.

Public utility companies (PUs) as providers of essential public services such as energy, water supply, waste collection systems, and so on, represent the core of a nation's infrastructure. Therefore, as the PU sector involves a variety of services that play a key role in developing a modern and sustainable society (i.e., renewable sources, water distribution, etc.; Konrad, Truffer, & Voß, 2008), it represents a suitable empirical field for analysing environmental disclosure. A vast majority of Italian PUs are controlled by the public sector and, in particular, by local governments (LGOs). Hence, they are part of the broader set of municipally owned companies (MOCs).

It is important for PUs and public-owned enterprises to be accountable to social and environmental objectives: accountability expectations and obligations are greater in the public than in the private sector (Cormier & Gordon, 2001; Greiling, Traxler, & Stötzer, 2015). Organisations owned by the state or by LGOs require a specific commitment regarding sustainability reporting and corporate responsibility (Garde-Sanchez, López-Pérez, & López-Hernández, 2018; Greiling & Grüb, 2014). According to Bruton, Peng, Ahlstrom, Stan, and Xu (2015), more research on state-owned enterprises (SOEs) and MOCs is needed to gain a better understanding of an organisational form that has a significant influence on the gross domestic product. In addition, Grossi, Reichard, Thomasson, and Vakkuri (2017) call for more research to link the governance of hybrid organisations with their reporting and disclosure practices. At the same time, it should be noted that there is very little involvement of society or ecology in most social and environmental accounting practices and theories (Russell, Milne, & Dey, 2017). Consequently, research in this field must go beyond the classic tools of sustainability reporting.

Social media and Web 2.0 have changed the way in which communication takes place not only among individuals but also between citizens and institutions. In addition, social media usage is growing in the public sector, with the result of increasing the level of accountability (Bonsón, Royo, & Ratkai, 2017; Gesuele, 2016; Giacomini, 2019). Despite these premises, many studies focus on the private sector in

order to assess the quality of disclosure (Song & Wen, 2019), whereas only a few studies examine other sectors, such as NGOs, the public sector, LGOs, SOEs and PUs (Mia, Hazelton, & Guthrie, 2018).

Examining in what ways and to what extent PUs use social media in order to disclose environmental issues is a viable way to assess whether, and in what manner, they try to meet environmental stakeholders' expectations. In this paper, we focus our analysis on environmental disclosure that is just one of the dimensions of sustainability disclosure (Elkington, 1999).

The aim of this study is to evaluate the impact of the Web 2.0 and the use of social media by PUs to communicate on environmental issues. In particular, our analysis focuses on the interactions between Facebook (FB) users and PUs. PUs use social media to communicate their strategies and results and to listen and respond to stakeholders (i.e., citizens). Meanwhile, citizens and other stakeholders use social media for many purposes, including as information sources, to evaluate companies' actions, and to express their opinions (Etter, Colleoni, Illia, Meggiorin, & D'Eugenio, 2018).

Accordingly, the first two research questions of this paper are exploratory.

- *What is the extent to which communication via FB regarding environmental issues takes place in the PUs?*
- *What is the stakeholders' reaction to environmental disclosure via FB?*

By drawing upon the literature on social media usage and sustainability disclosure in public and in hybrid organisations, three hypotheses were explored. This study examines whether the following factors affect the sustainability disclosures via FB of PUs: LGO ownership, size, and profitability.

We decided to focus on FB because it is the most used social media platform in Italy (research context), Europe, and the US (Agostino & Arnaboldi, 2015; Cosenza, 2019). Furthermore, as stated by Martin, Greiling, and Wetzelhütter (2018), in recent years, an increasing number of German, Austrian, and Italian PUs have created and started to use FB accounts to interact with their stakeholders.

In the last few years, a wide range of scientific research has aimed to study the large amount of new data generated by internet users. Some applications have already been made in order to evaluate the sentiments of people related to any topic (Estévez-Ortiz, García-Jiménez, & Glösekötter, 2016; Zola, Cortez, Ragno, & Brentari, 2019) and to measure the outcomes of different disclosure strategies (Castelló, Etter, & Årup Nielsen, 2016; Colleoni, 2013; Etter et al., 2018). In this paper, we suggest the use of social media data and sentiment analysis to study the interactions on FB between stakeholders and PUs regarding environmental disclosure. Therefore, this paper combines two research domains: environmental disclosure via social media and stakeholders' reactions to PUs' environmental disclosure.

The article is structured as follows: in Section 2, the theoretical background and the determinants of social media use are introduced (particularly in terms of FB and online communication); in Section 3, the research design, data, and methods are presented; in Section 4, the results of the analysis are described. Finally, conclusions and future research perspectives are presented.

2 | THEORETICAL BACKGROUND

The demand for corporate social and environmental disclosure from public companies has increased over the last 2 decades. Hence, companies are increasingly sensitive to corporate sustainability disclosure strategies (Miller & Skinner, 2015). According to Branco and Rodrigues (2008) organisations invest in CSR disclosure for two reasons: because they believe that improving relations with stakeholders can be profitable and because they consider it essential to be in line with society's expectations in order to obtain legitimacy. Several theories have been used to explain the interest in social and environmental disclosures. The most successful are stakeholder theory and legitimacy theory (Deegan, Rankin, & Tobin, 2002; Garde-Sanchez et al., 2018; Gray, Kouhy, & Lavers, 1995; Tagesson, Klugman, & Ekström, 2011). Stakeholder theory focuses on the importance of creating long-term value through the relationship between companies and its stakeholders (Freeman, Harrison, Wicks, Parmar, & Colle, 2010). As stated by Freeman (1984) a stakeholder is "any group or individual who can affect or is affected by the achievement of the organisation's objectives" such as customers, suppliers, employees, communities, and citizens at large (Pedersen and Neergard, 2009; Freeman et al., 2010; Freeman, 1984). In the context of sustainability, stakeholders and companies must cooperate and negotiate around mutual values and interests, and sustainability is one of the values around which it is necessary to cooperate (Hörisch, Freeman, & Schaltegger, 2014). Social media can help organisations improve stakeholder engagement because it allows one party to interact with another in a two-way dialogue in which both parties can revise their expectations (Bellucci & Manetti, 2017). In this sense, social media is considered an effective tool of dialogic communication (Bebbington, Brown, & Frame, 2007). Although it is not strictly considered an accounting tool, social media has the ability to support dialogical accounting systems by providing information on stakeholders' expectations. This feature of social media makes it even more interesting in the environmental field where it is increasingly fundamental that organisations take stakeholder engagement seriously (Thomson & Bebbington, 2005). The stakeholder theory is closely aligned with the legitimacy theory, and both are often used as complements.

Legitimacy theory refers to the social contract between organisations and society. A company, in responding to society's expectations, can legitimise its actions or maintain its legitimacy (Brown & Deegan, 1998) and fulfil the social contract (Cormier & Gordon, 2001; Deegan et al., 2002; Dowling & Pfeffer, 1975). Thus, when a company adopts a sustainability disclosure practice, it is trying to conform to society's expectations as incorporated within the social contract (Deegan et al., 2002). Based on legitimacy theory, Michelon (2011) has explored the relationships between sustainability disclosure and financial performance (Filbeck & Gorman, 2004), concluding that profitability and market return are not associated with sustainability disclosure.

Garde-Sanchez et al. (2018) have conducted an interesting literature review in which they analyse the theoretical approaches used from 2000 to 2017 by scholars to justify social responsibility in state-owned enterprises. They conclude that the main theoretical approaches used by scholars are the same as those presented previously, but around 30% of the articles analysed in the research are not based on a theoretical approach explaining corporate social responsibility actions. This is because CSR as a line of research in the public sector is quite recent, and there is still not enough research to define a generally accepted theoretical framework (Garde-Sanchez et al., 2018).

It can be problematic if theories are looked upon as competitive instead of complementary (Gray et al., 1995; Tagesson et al., 2011). Therefore, as stated by Cormier, Magnan, and Van Velthoven (2005), when we analyse environmental disclosure, we use a multitheoretical framework. With a multitiered theoretical framework, a company's environmental disclosure is analysed according to its responsiveness to different levels of influence. The first level concerns financial stakeholders, the second refers to society's environmental concerns (which translate into public pressure), and the third affects constraints and institutional processes (Cormier et al., 2005).

As previously mentioned, sustainable development objectives often overlap with the objectives of public sector organisations (Ball & Bebbington, 2008); therefore, they have more opportunities than private corporations to communicate sustainable development issues to broader stakeholders. Nevertheless, public sector disclosure studies focus solely on some government organisations (Grossi, Papenfuß, & Tremblay, 2015; Guthrie & Farneti, 2008) and some LGOs (Goswami & Lodhia, 2014; Williams, Wilmshurst, & Clift, 2011), whereas they neglect other relevant actors such as SOEs, MOCs, and PUs.

2.1 | Environmental disclosure and social media

Environmental disclosure can find a strong ally on the web, able to make the information available to an indefinite number of subjects and to promote a new form of stakeholder involvement called co-creation (Jurietti, Mandelli, & Fudurić, 2017). According to Kaplan and Haenlein (2010), "social media allow firms to engage in timely and direct end-consumer contact at relatively low cost and higher levels of efficiency than can be achieved with more traditional communication tools."

It is well recognised in literature (Adams & Frost, 2006; Kaplan & Haenlein, 2010; Lee, Hutton, & SHU, 2015; Miller & Skinner, 2015) that the internet, through its Web 2.0 platforms, has revolutionised how organisations disseminate information to their stakeholders. It is also noted that social media can facilitate the influence of stakeholder groups on the corporate agenda (Bedard & Tolmie, 2018; Hoffmann & Lutz, 2014). The growth of Web 2.0, in fact, not only reorganised the way in which companies collected information, but also redefined stakeholders' expectations and actions (Manetti & Bellucci, 2016). Even in the specific field of environmental and CSR disclosures, social media may be an effective communication channel, as it offers many opportunities for interaction with stakeholders (Lodhia & Stone,

2017). Nevertheless, to date, it has received poor attention (Bellucci & Manetti, 2017).

2.2 | Hypotheses development

By drawing upon the literature on social media usage and environmental disclosure in PUs, a number of hypotheses were deduced.

2.2.1 | Public ownership

Hypothesised that an organisation's ownership structure influences its sustainability. A company with a significant share of ownership held by public organisations must respond to a higher degree of transparency (Sancino, Sicilia, & Grossi, 2017). With regard to sustainability issues, publicly owned organisations usually disclose more than private companies (Gallo & Christensen, 2011; Huang & Watson, 2015).

Therefore, it is conceivable that companies with a high percentage of government ownership suffer greater pressure to be socially answerable and consequently communicate more about environmental issues.

H1: Full public ownership positively affects the environmental information disclosed via FB.

This hypothesis has already been tested by Argento, Grossi, Persson, and Vingren (2019) about sustainability reports but has not been confirmed.

2.2.2 | Size

Previous studies have suggested that larger Public Sector Organisations (PSOs) and SOEs tend to report more sustainability information (Argento et al., 2019; Giacomini et al., 2018; Garde Sanchez et al. 2018). Larger organisations have more resources than smaller ones (e.g., time and human and financial capital), which makes a commitment to sustainability disclosure and social and environmental reporting easier (Gallo & Christensen, 2011; Giacomini, 2016). This paper attempts to discern whether larger PUs disclose more sustainability information via FB than smaller ones.

H2: Larger PUs disclose more environmental information via FB.

2.2.3 | Profitability

The relationship between profitability and disclosure policy has been widely investigated (Tagesson et al, 2009; Michelon, 2011; Argento et al., 2019), although the results are quite divergent. For example, Michelon (2011) and Argento et al. (2019) found that profitability does not have a relationship with sustainability disclosure. On the other hand, Tagesson et al. (2009) found a positive relationship. The starting assumption is that the most profitable organisations can devote more resources to environmental disclosure.

H3: Profitable PUs disclose more environmental information via FB.

2.2.4 | Background: The Italian context

In Italy there is a relevant phenomenon called "municipal capitalism" (Carini, Giacomini, & Teodori, 2018; Scarpa & Pellizzola, 2009). MOCs are governed by appointed boards of directors and have an independent company statute, and LGOs retain ultimate control through ownership (Bel & Fageda, 2006). In a recent study, Voorn, van Genugten, and van Thiel (2017) find through a systematic literature review that MOCs are often more efficient than local bureaucracies in providing local public services, although they also have high initial failure rates. Furthermore, this efficiency can increase through public–private partnerships or intermunicipal cooperation (Voorn et al., 2017, Giacomini et al., 2018).

In Italy, the total turnover of the 100 largest main utilities was around 115 billion euros, equal to 7% of the country's GDP (Top Utility Analysis, 2018). These companies were expected to promote, more than others, accountability and transparency on sustainability matters (Cormier & Gordon, 2001; Greiling et al., 2015). This research analyses how and to what extent Italian PUs use the official FB page to communicate on environmental sustainability. In Italy, around 48 million people are online or use the internet regularly. Among these, more than 80% also have a social media profile (Agenzia per l'Italia Digitale, 2018).

3 | METHODS

3.1 | Data

The empirical research of this study focused on the largest Italian PUs that can be included in the definition of MOCs. Thanks to the project *Patrimonio della PA* (Ministero Economia e Finanze, 2017), we identified a sample of the 65 largest (in terms of revenues) multiutility companies owned by Italian municipalities. The sample was then reduced to the 19 PUs that had official public FB pages with more than 100 posts (Appendix Table A1). To download the FB pages' content, we built software written in Python using the Selenium module. The data fetch was done at the end of July 2018.

3.2 | Analysis design

Following Zola, Rocca, Giacomini, and Paredi (2019), we analysed environmental disclosure with respect to five classes: air, energy, territory, waste, and water. Moreover, this work also includes the sustainability reporting class, which refers to the reporting tools in the field of sustainability (Lozano, 2019). The sustainability reporting class is composed of several keywords reported in Appendix Table B1, together with the keyword lists related to the other five environmental disclosure classes.

1. The analysis can be divided into two steps: Analysis of PUs' posts, and
2. Interaction between PUs and stakeholders

In the first step, analysing PUs' FB activity, we investigated if and how PUs use FB to disclose information about environmental topics. Moreover, we measured whenever the greatest environmental disclosure might be related to one of the following features: state ownership, size, and profitability. To guarantee the reliability of this study (Heale & Twycross, 2015), the concepts were measured accurately by referring to well-established operationalisation from previous studies (Argento et al., 2019).

- *Ownership* is measured as the percentage of shares owned by the public sector organisations. Full public sector ownership is coded as "1."
- *Size* is determined by adapting the definition contained in the Barnier Directive 2014/95/EU, which requires large companies to disclose nonfinancial information. PUs are defined as "large" if they have more than 500 employees and a turnover greater than 40 million euros, or more than 20 million euros in their balance sheet total; the others are classified as "small–medium PUs." Large PUs are denoted by "1" and all other PUs are denoted by "0."
- *Profitability* is measured with respect to the Return on Equity (ROE) Index (Tagesson et al., 2009; Argento et al., 2019). Given the sample of 19 PUs, we computed the average ROE to be 8.63%. PUs with ROE greater than the average (8.63%) are denoted by '1', and others with "0."

Thirteen out of the 19 PUs (68% of the sample) are fully owned by Italian LGOs. With regard to the chosen size categorisation, 10 PUs (53%) were classified as large companies, and the remaining 9 (47%) were classified as small companies. Finally, according to the ROE calculations, 9 PUs (47%) emerged as "profitable" (ROE over 8.63%), whereas the remaining 10 (53%) are classified as "less profitable." In the second step of analysis, attention is devoted to stakeholders' interactions on FB with environmental posts published by PUs through a sentiment analysis of stakeholders' likes, shares, and comments.

3.3 | Analysis of PUs' posts

After having gained the information required from the PUs' FB pages, we started analysing the content of their posts. The first investigation consisted of measuring the usefulness of adopting the six different environmental classes to explain different phenomena. To measure this hypothesis, we computed the Kruskal–Wallis nonparametric test (McKnight & Najab, 2010). Then, in order to investigate whether state ownership, size, and profitability impact on the level of environmental sustainability, we performed the Wilcoxon test (Gehan, 1965) to verify the hypothesis of difference between two samples. To conclude the analysis of PUs' FB posts, we investigated the distribution of words among the environmental classes in order to extract the more common words and, thus, the most popular subjects. Applying techniques

of Natural Language Processing, the text was first preprocessed in order to remove stop words, punctuation, and URLs, and then the document term frequency matrix was computed as follows:

$$tf_{i,j} = n_{i,j}/|d_j|,$$

Where:

n_i: number of occurrences of word i in the document j.

d_j: size of document j expresses as total number of words in the document.

The text preprocessing and the document term frequency were performed using the NLTK (Bird & Loper, 2004) module on Python.

3.4 | Interaction between PUs and stakeholders

In this second stage, we focused on stakeholders' interactions with PUs' environmental posts. To measure the stakeholders' opinions, we performed sentiment analysis (SA). Liu (2012: p. 7) said: "Sentiment analysis, also called opinion mining, is the field of study that analyses people's opinions, sentiments, evaluations, appraisals, attitudes, and emotions towards entities such as products, services, organisations, individuals, issues, events, topics, and their attributes. It represents a large problem space." SA has been widely applied to different kinds of problem: product reviews (Bollegala, Weir, & Carroll, 2011), stock dynamics (Oliveira, Cortez, & Areal, 2016), political elections (Ceron, Curini, Iacus, & Porro, 2014), English Premier League soccer wins (Schumaker, Jarmoszko, & Labedz, 2016), dynamics (Oliveira et al., 2016), and political elections (Ceron et al., 2014).

Before implementing any SA, we cleaned the comments' text, removing stopwords, URLs, excessive punctuation, and tags. Once the comments were cleaned, we also distinguished between stakeholders' comments and LGOs' replies to stakeholders. The sentiment was then computed only with respect to the stakeholders' comments.

We decided to apply a lexicon database (LD) approach, a special dictionary in which words are assigned to sentiment scores (Ghosh & Kar, 2013; Ravi et al., 2015). The main advantage of this is that, once a lexicon is built, a fast and unsupervised sentiment classification can be achieved by summing the overall word scores.

We implemented a LD SA using the Syuzhet package on R software. The LD used is the NRC, because it supports Italian language (Mohammad & Turney, 2010). The NRC lexicon is based on the emotions of joy, sadness, anger, fear, trust, disgust, surprise, and anticipation; then for each sentence belonging to the words included, a score is assigned to each of the eight feelings. Subsequently, the overall sentiment is divided into positive or negative feelings.

4 | RESULTS AND DISCUSSION

4.1 | Descriptive analysis

4.1.1 | Analysis of PUs' posts

Of the total number of public posts published by the companies in the samples (10,538), 24% relate to environmental issues whereas the remaining 76% have been classified as generic posts. Table 1 shows the distribution of PUs' FB posts (#posts) during the year 2012 to July 2018. Moreover, Table 1 also reports the dynamics of stakeholders' interactions in terms of likes (#likes), shares (#shares), and comments (#comments) in absolute value given our sample of data. The column named "Inter/Posts" in Table 1 expresses the ratio of the number of interactions (as sum of likes, share, and comments) and the number of posts. Overall, it is possible to notice an increase in the use of the FB channel to communicate between PUs and stakeholders, both for generic and environmental posts.

Figure 1 reports the distribution of posts for the six environmental classes while Table 2 illustrates the environmental disclosure via Facebook according to the characteristics of the public service companies (PU) analyzed.

4.2 | Stakeholders' interactions regarding the environment

The last step of the analysis involves the study of stakeholders' interactions with the environmental posts previously identified. Recalling the results in Table 1, it is possible to notice an increase in the number

TABLE 1 Environmental disclosure via Facebook (FB) and stakeholders' interaction

| Year	Environmental FB interactions					Generic FB interactions				
	#posts	#likes	#shares	#comments	Inter/ posts	#posts	#likes	#shares	#comments	Inter/posts
2012	17	1	2	4	0.41	159	50	35	190	1.73
2013	19	67	11	23	5.32	201	605	65	383	5.24
2014	191	3,634	220	122	20.82	542	1,459	769	471	4.98
2015	356	5,166	1,032	283	18.21	1,446	3,331	333	2,104	3.99
2016	643	7,046	1863	227	14.21	1913	25,229	3,686	827	15.55
2017	824	10,730	1853	508	15.89	2,260	71,254	7,124	3,390	36.18
2018 (July)	469	10,023	1,628	463	25.83	1,498	59,799	1,409	2,243	42.36
Total	2,519	36,667	6,609	1,630	17.83	8,019	161,727	13,421	9,608	23.04
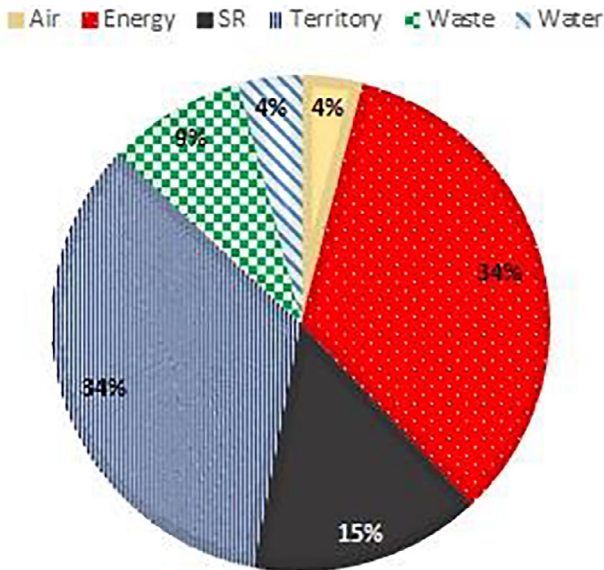
FIGURE 1 Published posts for each environmental class (data in Appendix Table C1)

of interactions by stakeholders during the year 2012 to July 2018 and, in particular, the high impact of likes as form of interaction. However, even given the growing participation by stakeholders with PUs' environmental disclosure, the interactions with generic posts are still greater (ratio of Interactions/Posts is 23.04 for generic posts but only 17.83 for environmental posts). Figure 2 is composed of three series: PU posts, stakeholder interest, and the ratio of stakeholder interest to PU posts. The PU posts for the *i*th environmental class denotes the incidence of posts for the *i*th class given the total amount of environmental posts. Similarly, the stakeholders' interest series represents the effect of likes, comments, and shares for the *i*th environmental class given the overall sum of interaction (likes, comments, and shares) for all the environmental class. Therefore, the two series (PU posts and stakeholder interest) represent two phenomena without considering the fact that these stakeholders' interactions are related to the PUs' FB activity. To describe the stakeholders' interactions taking into

account the PUs' social activity, the third series in Figure 2 reports the ratio between stakeholders' interest in the *i*th class and PU posts in the same class. In this way, we are able to evaluate the gap between PUs' environmental disclosure and stakeholders' environmental concerns and interactions.

From Figure 2, there is an obvious divergence between companies and stakeholders regarding the main topics of environmental disclosure.

The last step of the analysis of interactions is SA. As described in the Methods section, SA was performed using the LD approach using the NRC database. The SA was computed using comments related to the PUs' posts on the six aforementioned environmental topics. The results are reported in Table 3. The values indicate the percentage of relative feeling assigned to each sentiment after evaluating the stakeholders' comments in the given classes (as reported in the Methods section). However, analysing the results in Table 3 is not simple because there are feelings such as "anticipation" or "surprise" that are not easy to impute to a specific negative or positive opinion. Given that we report in Table 4, the overall sentiment simply computes as positive versus negative opinions.

The overall sentiment towards environmental topics is positive, as shown in Table 4. However, as Table 4 shows, the difference between negative and positive sentiment is not very marked, especially for such classes as air, sustainability reporting, and waste. For the water class, meanwhile, the sentiment is neutral.

PUs' environmental disclosure via FB has increased notably from 10% of posts to 24%. This is the first important result of this analysis, and it confirms that there has been an increase in attention to the environment, probably partly for the purpose of strengthening legitimacy and meeting the expectations of society.

A more detailed reading of this growing trend also makes it possible to understand whether some characteristics of the PUs have an influence. As shown in Table 3, in PUs that are fully owned by LGOs, the environmental disclosure is equal to 13.89% of the total amount of posts, whereas in the others it is 41.14%. This difference is significant: PUs fully owned by LGOs had a lower percentage of posts disclosing environmental issues (H1 not

TABLE 2 Environmental disclosure via Facebook (FB) and public utility companies (PUs) features

Number of posts regarding the environmental issues	Incidence (%) of environmental posts given the total amount of posts	Number of posts regarding the environmental issues	Incidence (%) of environmental posts given the total amount of posts	Wilcoxon test statistical difference (two-sided test)
Ownership				
100% public		Less than 100% public		p value
1,079	13,89	1,437	41.14	9.39E-06
Size				
Large		Small and medium		p value
2075	27	441	17.49	6.66E-06
Profitability				
ROE over 8.63%		ROE under 8.63%		p value
1,345	26.86	1,171	21.2	5.64E-06

FIGURE 2 Published posts and stakeholders' interest for each environmental class (data in Appendix Table C1). PU, public utility company; SR, sustainability report
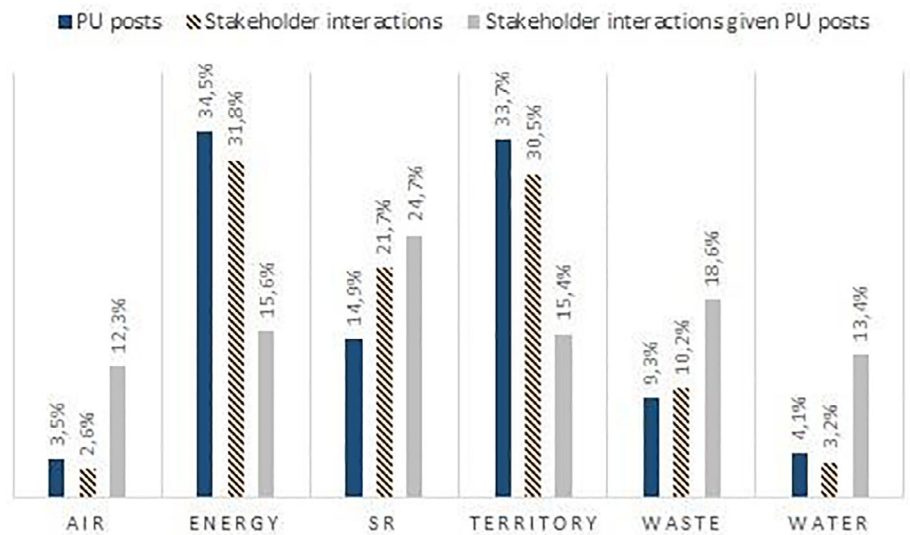

TABLE 3 Sentiment distribution for stakeholders' comments

Sustainable class/ sentiment	Air	Energy	Sustainability reporting	Territory	Waste	Water	Total environmental disclosure via FB
Anger	0%	5%	9%	7%	9%	14%	7%
Anticipation	40%	20%	15%	15%	13%	14%	16%
Disgust	0%	3%	9%	9%	11%	11%	9%
Fear	20%	12%	10%	5%	9%	11%	6%
Joy	0%	12%	10%	13%	11%	14%	12%
Sadness	30%	13%	20%	20%	18%	17%	19%
Surprise	0%	8%	3%	6%	4%	6%	6%
Trust	10%	27%	23%	25%	25%	14%	25%
Total	100%	100%	100%	100%	100%	100%	100%

Abbreviation: Facebook.

confirmed). This result appears to be counterintuitive considering that accountability expectations are higher for enterprises with public ownership and objectives associated with the public mission (Greiling & Grüb, 2014). Argento et al. (2019) analysed environmental disclosure in SOEs and achieved the same result. They hypothesised that hybrid capital companies should respond to more organised and influential groups of stakeholders.

In terms of size, the Wilcoxon tests showed a significant difference in environmental disclosure via FB for large PUs (27%) and small PUs (17%). H2 is confirmed: larger PUs have greater environmental disclosure via FB. This finding is consistent with previous research claiming that large organisations face more pressure from society to behave in a socially responsible way, because they are under deeper scrutiny from the media and consequently tend to report more environmental information (Argento et al., 2019; Garde-Sanchez et al., 2018). Larger organisations also have more resources to devote to disclosure and accountability (Giacomini, 2016).

In relation to profitability, the Wilcoxon test confirms a result: environmental disclosure is higher in the most profitable companies

(26 vs. 21%), although it should be emphasised that the differences between the two samples, although statistically verified, are minimal. This controversial result is in line with the literature on the subject, which is quite divergent as there are positions that found a negative relation (Argento et al., 2019; Michelon, 2011) and a positive relation (Tagesson, 2009, Li, Luo, Wang, & Wu, 2013), whereas Rahman, Mohamed Zain, and Hanim Yaakop Yahaya Al-Haj (2011) found that profitability does not have a relationship with sustainability disclosures.

The last step of the analysis of interactions, the SA, provides further interesting indications: the approach to environmental sustainability should be unitary and central in the strategic choices of a PU, but, it is essential, in a dialogue with the stakeholders, to analyse separately the individual areas that make up the environmental dimension. For each area, even if a common tendency emerges, different facets of stakeholders' sentiments emerge. In this regard, a systematic use of SA can facilitate the development of the two-way dialogue able to make both parties grow, improving expectations and goals (Bellucci & Manetti, 2017) as advocated by the proponents of stakeholder theory.

TABLE 4 Binary overall sentiment for stakeholders' comments

Overall sentiment	Air	Energy	Sustainability reporting	Territory	Waste	Water	Total environmental disclosure via FB
Negative	45%	25%	46%	35%	45%	50%	36%
Positive	55%	75%	54%	65%	55%	50%	64%

Abbreviation: Facebook.

5 | CONCLUSIONS AND FUTURE DEVELOPMENT

Environmental issues are currently a cause of immense concern. With growing social focus on the environment, accounting fills an expectation role, to measure and disclose environmental performance (Yakhou & Dorweiler, 2004). There is a growing awareness of the need for new accountings that foster democracy and pave the way for more participatory forms of social organisation. It is particularly evident in the sustainable development and social and environmental accounting fields, with calls for more dialogic forms of accounting (Brown, 2008). Although it is not considered a proper accounting tool, social media has the characteristics suitable for sustaining dialogic accounting systems, allowing them to obtain and communicate information from and to stakeholders (Bellucci & Manetti, 2017). Moreover, it has long been suggested that an analysis of both the quantity and the quality of CSR and environmental disclosure and their determinants is needful in order to increase quantity and quality of disclosure (Ali, Frynas, & Mahmood, 2017). The continuous diffusion and the significant impact of social media on and in society mean that it is unthinkable to neglect its analysis when dealing with the issue of environmental disclosure.

This study explores the use of FB as a tool for environmental disclosure, also taking into consideration the interactions of stakeholders. The results show a marked growth in the relevance of environmental disclosure via FB by the PUs and a growing interest of stakeholders in interaction on these issues. This result seems to be in line with the legitimacy theory, so that in the face of greater overall interest in the environment, the disclosure of PUs on environmental issues also increases.

However, a more in-depth analysis of the areas that belong to the environmental dimension has revealed a discrepancy between PUs' environmental disclosure via FB and stakeholder interaction. This confirms that in the PUs, as in other companies and organisations, the use of social media is still partial and does not exploit its full potential. The data seem to indicate, in fact, that most FB use features a one-way communication approach that is still far from the principles of dialogic accounting (Bellucci & Manetti, 2017; Waters & Jamal, 2011). This topic deserves further future research, as the public nature, total or partial, of the analysed PUs obliges them to implement strategies of using social media, in particular in the field of environmental sustainability. This is because social media is considered to be one of the most effective tools for promoting stakeholder engagement (Rybako & Seltzer, 2010). In accordance with stakeholder and legitimacy theories, public companies should promote transparency and accountability on sustainability issues, and, to an extent, this is the case. A first analysis shows that about a fifth of the posts mention environmental sustainability: a remarkable result. It should be remembered that, in comparison with private sector organisations, PUs may have an increased necessity to communicate environmental sustainability information in order to gain legitimacy (Argento et al., 2019; Rodríguez-Bolívar et al., 2015).

A more dedicated and pluralistic use of social media by PUs, and by organisations more generally, could also make it possible to overcome the difficulties, in terms of diffusion (Giacomini, Rocca, Carini, & Mazzoleni, 2018; Stubbs, Higgins, & Milne, 2013), effectiveness, and credibility (Niemann & Hoppe, 2017; Mia et al., 2018; Deegan, 2002; Gray, 2010; Gray, 1997), that the sustainability report has encountered as a legitimacy and stakeholder engagement tool.

The analysis of environmental disclosure via FB depending on the factors identified (size, profitability, and ownership) provides further interesting information. First, the results confirm that size generally has an influence on the levels of disclosure: the larger the size, the greater the disclosure, as observed in several studies (Argento et al., 2019; Garde Sánchez, Rodríguez Bolívar, & López Hernández, 2017; Giacomini, 2016; Inchausti, 1997; Soliman, 2013; Zheng & Zhang, 2016). This result touches both disclosure and the adoption of new technologies (Bonsòn et al., 2017, Smith, Blazovich, & Smith, 2015). Second, fully municipally owned PUs disclose less environmental information via FB than partially municipally owned PUs. This result is consistent with Argento et al. (2019) and with other works that have shown that in the face of a heterogeneous ownership structure, the propensity to provide information increases in order to reduce information asymmetries and conflicts (Huafang & Jianguo, 2007). However, this result requires further development to understand the specific dynamics of disclosure via social media that are not perfectly comparable with the disclosure via sustainability report analysed in most of the literature mentioned here. No clear and incontestable evidence was found about the relationship between profitability and disclosure via FB; this issue deserves further insight, with research that looks at larger samples and longer periods.

This work sought to implement the most robust research design with the data available and with one of the most advanced techniques to study social media and stakeholders' opinions. However, there are a number of limitations that must be accounted for when interpreting the results. First, the growth of social media and its interactions is exponential, and therefore, within a few years, the results could change significantly. Furthermore, other factors may have an influence on the level of environmental disclosure via FB and on the opinions of stakeholders. Future research with larger sample sizes could

enrich our findings by examining a wider range of other factors. Finally, the results are exploratory and may reflect the specific country, type, and size of PUs where the analysis was performed. Further research in different settings and in different contexts is required to ascertain if our results are still valid.

Disclosure has limited value without stakeholder dialogue (Mia et al., 2018). The results of this paper show how social media is increasingly important in cultivating a fruitful dialogue with stakeholders. Organisations, peculiarly public ones, must communicate, listen, and dialogue with stakeholders with particular attention to environmental issues. Social media is confirmed as one of the most suitable means, but it is not enough; techniques capable of enhancing its potential in terms of dialogic disclosure, such as SA, must also be used. It is therefore desirable that studies on this subject increase, both in order to understand, through the SA, what the stakeholders' perceptions with respect to environmental disclosure are and to understand how the use of social media in a dialogic accounting perspective, can contribute to influencing behaviours, choices, and strategies of companies in the environmental field and beyond.

ORCID

Davide Giacomini https://orcid.org/0000-0002-5504-4313

REFERENCES

Adams, C., & Frost, G. (2006). The internet and change in corporate stakeholder engagement and communication strategies on social and environmental performance. *Journal of Accounting & Organisational Change*, *2*(3), 281–303.

Agenzia per l'Italia digitale. (2018). Relazione Commissione Digitale/Digital Commission Report. Rome.

Agostino, D., & Arnaboldi, M. (2015). A measurement framework for assessing the contribution of social media to public engagement: An empirical analysis on FB. *Public Management Review*, *18*(9), 1289–1307.

Ali, W., Frynas, J., & Mahmood, Z. (2017). Determinants of corporate social responsibility (CSR) disclosure in developed and developing countries: A literature review. *Corporate Social Responsibility and Environmental Management*, *24*(4), 273–294.

Argento, D., Grossi, G., Persson, K., & Vingren, T. (2019). Sustainability disclosures of hybrid organisations: Swedish state-owned enterprises. *Meditari Accountancy Research*, *27*(4), 505–533.

Ball, A., & Bebbington, J. (2008). Editorial: Accounting and reporting for sustainable development in public service organisations. *Public Money & Management*, *28*(6), 323–326.

Bebbington, J., Brown, J., & Frame, B. (2007). Accounting technologies and sustainability assessment models. *Ecological Economics*, *61*(2–3), 224–236.

Bedard, S., & Tolmie, C. (2018). Millennials' green consumption behaviour: Exploring the role of social media. *Corporate Social Responsibility And Environmental Management*, *25*(6), 1388–1396.

Bel, G., & Fageda, X. (2006). Between privatisation and intermunicipal cooperation: Small municipalities, scale economies and transaction costs. *Urban Public Economics Review*, *6*, 13–31.

Bellucci, M., & Manetti, G. (2017). FB as a tool for supporting dialogic accounting? Evidence from large philanthropic foundations in the United States. *Accounting, Auditing & Accountability Journal*, *30*(4), 874–905.

Bird, S. & Loper, E. (2004). NLTK: The natural language toolkit. In *Proceedings of the ACL 2004 on Interactive Poster and Demonstration Sessions* (p. 31). Morristown, N.J.: Association for Computing Linguistics.

Bollegala, D., Weir, D., & Carroll, J. (2011). Using multiple sources to construct a sentiment sensitive thesaurus for cross-domain sentiment classification. In *Proceedings of the 49th Annual Meeting of the Association for Computational Linguistics: Human Language Technologies* (pp. 132–141). Association for Computational Linguistics.

Bonsón, E., Royo, S., & Ratkai, M. (2017). FB practices in western European municipalities. *Administration & Society*, *49*(3), 320–347.

Branco, M., & Rodrigues, L. (2008). Factors influencing social responsibility disclosure by Portuguese companies. *Journal Of Business Ethics*, *83*(4), 685–701. https://doi.org/10.1007/s10551-007-9658-z

Brown, J. (2008). Democracy, sustainability and dialogic accounting technologies: Taking pluralism seriously. *Critical Perspectives on Accounting*, *20*(3), 313–342.

Brown, N., & Deegan, C. (1998). The public disclosure of environmental performance information—A dual test of media agenda setting theory and legitimacy theory. *Accounting And Business Research*, *29*(1), 21–41. https://doi.org/10.1080/00014788.1998.9729564

Bruton, G., Peng, M., Ahlstrom, D., Stan, C., & Xu, K. (2015). State-owned enterprises around the WORLD as hybrid organisations. *Academy of Management Perspectives*, *29*(1), 92–114.

Carini, C., Giacomini, D., & Teodori, C. (2018). Accounting reform in Italy and perceptions on the local government consolidated report. *International Journal of Public Administration*, *42*(3), 195–204.

Castelló, I., Etter, M., & Årup Nielsen, F. (2016). Strategies of legitimacy through social media: The networked strategy. *Journal of Management Studies*, *53*(3), 402–432.

Ceron, A., Curini, L., Iacus, S., & Porro, G. (2014). Every tweet counts? How sentiment analysis of social media can improve our knowledge of citizens' political preferences with an application to Italy and France. *New Media & Society*, *16*(2), 340–358.

Colleoni, E. (2013). CSR communication strategies for organisational legitimacy in social media. *Corporate Communications: An International Journal*, *18*(2), 228–248.

Cormier, D., & Gordon, I. (2001). An examination of social and environmental reporting strategies. *Accounting, Auditing & Accountability Journal*, *14*(5), 587–617.

Cormier, D., Magnan, M., & Van Velthoven, B. (2005). Environmental disclosure quality in large German companies: Economic incentives, public pressures or institutional conditions? *European Accounting Review*, *14*(1), 3–39.

Cosenza, V. (2019). World map of social networks. Retrieved January 2, 2019, from http://vincos.it/world-map-of-social-networks/

Deegan, C. (2002). Introduction: The legitimising effect of social and environmental disclosures – a theoretical foundation. *Accounting, Auditing & Accountability Journal*, *15*(3), 282–311. https://doi.org/10.1108/09513570210435852

Deegan, C., Rankin, M., & Tobin, J. (2002). An examination of the corporate social and environmental disclosures of BHP from 1983–1997. *Accounting, Auditing & Accountability Journal*, *15*(3), 312–343.

Dowling, J., & Pfeffer, J. (1975). Organisational legitimacy: Social values and organisational behavior. *The Pacific Sociological Review*, *18*(1), 122–136.

Elkington, J. (1999). *Cannibals with forks*. Oxford, U.K.: Capstone.

Estévez-Ortiz, F., García-Jiménez, A., & Glösekötter, P. (2016). An application of people's sentiment from social media to smart cities. *El Profesional De La Información*, *25*(6), 851.

Etter, M., Colleoni, E., Illia, L., Meggiorin, K., & D'Eugenio, A. (2018). Measuring organisational legitimacy in social media: Assessing citizens' judgments with sentiment analysis. *Business & Society*, *57*(1), 60–97.

Filbeck, G., & Gorman, R. (2004). The relationship between the environmental and financial performance of public utilities. *Environmental & Resource Economics*, *29*(2), 137–157.

Freeman, R. (1984). *Stakeholder management: Framework and philosophy*. Boston: Mansfield: Pitman.

Freeman, R., Harrison, J., Wicks, A., Parmar, B., & Colle, S. (2010). *Stakeholder theory: The state of the art*. Cambridge: Cambridge University Press.

Gallo, P., & Christensen, L. (2011). Firm size matters: An empirical investigation of organisational size and ownership on sustainability-related behaviors. *Business & Society*, *50*(2), 315–349.

Garde Sánchez, R., Rodríguez Bolívar, M., & López Hernández, A. (2017). Corporate and managerial characteristics as drivers of social responsibility disclosure by state-owned enterprises. *Review of Managerial Science*, *11*(3), 633–659.

Garde-Sanchez, R., López-Pérez, M., & López-Hernández, A. (2018). Current trends in research on social responsibility in state-owned enterprises: A review of the literature from 2000 to 2017. *Sustainability*, *10*(7), 2403.

Gehan, E. (1965). A generalized Wilcoxon test for comparing arbitrarily singly-censored samples. *Biometrika*, *52*(1–2), 203–224.

Gesuele, B. (2016). Municipalities and FB use: Which key drivers? Empirical evidence from Italian municipalities. *International Journal of Public Administration*, *39*(10), 771–777.

Ghosh, M., & Kar, A. (2013). Unsupervised linguistic approach for sentiment classification from online reviews using SentiWordNet 3.0. *International Journal of Engineering Research & Technology*, *2*(9), 55–60.

Giacomini, D. (2016). Accountability in Italian local governments: State of the art and future perspective. In B. Cuadrado-Ballesteros & I. G. Sánchez (Eds.), *Local governments in the digital era: Looking for accountability* (1st ed., pp. 17–32). New York: Nova Publishers.

Giacomini, D. (2019). Debate: Should there be rules governing social media use for accountability in the public sector? *Public Money & Management*, 1–2. https://doi.org/10.1080/09540962.2019.1687826

Giacomini, D., Rocca, L., Carini, C., & Mazzoleni, M. (2018). Overcoming the barriers to the diffusion of sustainability reporting in Italian LGOs: Better stick or carrot? *Sustainability*, *10*(2), 131.

Goswami, K., & Lodhia, S. (2014). Sustainability disclosure patterns of south Australian local councils: A case study. *Public Money & Management*, *34*(4), 273–280.

Gray, R. (1997), The silent practice of social and environmental accounting and corporate social reporting in companies", in S., Zadek R. Evans, P. P. Pruzan (Eds), *Building corporate accountability: emerging practices in social and ethical accounting auditing and reporting*, pp. 201–217. London: Earthscan.

Gray, R. (2010). Is accounting for sustainability actually accounting for sustainability. and How would we know? An exploration of narratives of organizations and the planet. *Accounting, Organizations and Society*, *35*(1), 47–62.

Gray, R., Kouhy, R., & Lavers, S. (1995). Corporate social and environmental reporting. *Accounting, Auditing & Accountability Journal*, *8*(2), 47–77.

Greiling, D., & Grüb, B. (2014). Sustainability reporting in Austrian and German local public enterprises. *Journal of Economic Policy Reform*, *17*(3), 209–223.

Greiling, D., Traxler, A., & Stötzer, S. (2015). Sustainability reporting in the Austrian, German and Swiss public sector. *International Journal of Public Sector Management*, *28*(4/5), 404–428.

Grossi, G., Papenfuß, U., & Tremblay, M. (2015). Corporate governance and accountability of state-owned enterprises. *International Journal of Public Sector Management*, *28*(4/5), 274–285.

Grossi, G., Reichard, C., Thomasson, A., & Vakkuri, J. (2017). Theme: Performance measurement of hybrid organisations: Emerging issues and future research perspectives. *Public Money & Management*, *37*(6), 379–386.

Guthrie, J., & Farneti, F. (2008). GRI sustainability reporting by Australian public sector organisations. *Public Money & Management*, *28*(6), 361–366.

Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative studies. *Evidence Based Nursing*, *18*(3), 66–67.

Hoffmann, C., & Lutz, C. (2014). The impact of online media on stakeholder engagement and the governance of corporations. *Journal of Public Affairs*, *15*(2), 163–174.

Hörisch, J., Freeman, R., & Schaltegger, S. (2014). Applying stakeholder theory in sustainability management. *Organisation & Environment*, *27*(4), 328–346.

Huafang, X., & Jianguo, Y. (2007). Ownership structure, board composition and corporate voluntary disclosure. *Managerial Auditing Journal*, *22*(6), 604–619.

Huang, X., & Watson, L. (2015). Corporate social responsibility research in accounting. *Journal of Accounting Literature*, *34*, 1–16.

Inchausti, B. (1997). The influence of company characteristics and accounting regulation on information disclosed by Spanish firms. *European Accounting Review*, *6*(1), 45–68.

Jurietti, E., Mandelli, A., & Fuduric, M. (2017). How do virtual corporate social responsibility dialogs generate value? A case study of the Unilever Sustainable Living Lab. *Corporate Social Responsibility and Environmental Management*, *24*(5), 357–367. https://doi.org/10.1002/csr.1407

Kaplan, A., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of social media. *Business Horizons*, *53*(1), 59–68.

Konrad, K., Truffer, B., & Voß, J. (2008). Multi-regime dynamics in the analysis of sectoral transformation potentials: Evidence from German utility sectors. *Journal of Cleaner Production*, *16*(11), 1190–1202.

Lee, L., Hutton, A., & SHU, S. (2015). The role of social media in the capital market: Evidence from consumer product recalls. *Journal of Accounting Research*, *53*(2), 367–404.

Li, Q., Luo, W., Wang, Y., & Wu, L. (2013). Firm performance, corporate ownership, and corporate social responsibility disclosure in China. *Business Ethics: A European Review*, *22*(2), 159–173.

Liu, B. (2012). *Sentiment analysis and opinion mining*. San Rafael, Calif: Morgan & Claypool.

Lodhia, S., & Stone, G. (2017). Integrated reporting in an internet and social media communication environment: Conceptual insights. *Australian Accounting Review*, *27*(1), 17–33.

Lozano, R. (2019). Analysing the use of tools, initiatives, and approaches to promote sustainability in corporations. *Corporate Social Responsibility and Environmental Management*. https://doi.org/10.1002/csr.1860

Manetti, G., & Bellucci, M. (2016). The use of social media for engaging stakeholders in sustainability reporting. *Accounting, Auditing & Accountability Journal*, *29*(6), 985–1011.

Martin, S., Greiling, D., & Wetzelhütter, D. (2018). Expectations of FB users towards a virtual dialogue with their public utility. *International Journal of Energy Sector Management*, *12*(3), 408–425.

McKnight, P., & Najab, J. (2010). Kruskal–Wallis Test. In *The Corsini encyclopedia of psychology*, London: John Wiley & Sons, 1(1).

Mia, P., Hazelton, J., & Guthrie, J. (2018). Measuring for climate actions: A disclosure study of ten megacities. *Meditari Accountancy Research*, *26*(4), 550–575.

Michelon, G. (2011). Sustainability disclosure and reputation: A comparative study. *Corporate Reputation Review*, *14*(2), 79–96.

Miller, G., & Skinner, D. (2015). The evolving disclosure landscape: How changes in technology, the media, and capital markets are affecting disclosure. *Journal of Accounting Research*, *53*(2), 221–239.

Ministero Economia e Finanze. (2017). Open data partecipazioni PA. Retrieved September 22, 2019, from http://www.dt.tesoro.it/it/attivita_istituzionali/partecipazioni_pubbliche/censimento_parteciazioni_pubbliche/open_data_partecipazioni/dati_partecipazioni_2015.html

Mohammad, S. & Turney, P. (2010). Emotions evoked by common words and phrases: Using Mechanical Turk to create an emotion lexicon. In *Proceedings of the NAACL HLT 2010 Workshop on Computational Approaches to Analysis and Generation of Emotion in Text* (pp. 26–34). Association for Computational Linguistics.

Oliveira, N., Cortez, P., & Areal, N. (2016). Stock market sentiment lexicon acquisition using microblogging data and statistical measures. *Decision Support Systems*, *85*, 62–73.

Rahman, N. H. W. A., Mohamed Zain, M., & Hanim Yaakop Yahaya Al-Haj, N. (2011). CSR disclosures and its determinants: Evidence from Malaysian government link companies. *Social Responsibility Journal*, *7*(2), 181–201.

Rodríguez-Bolívar, M., Garde-Sánchez, R., & Lopez-Hernández, A. M. (2015). Managers as drivers of CSR in state-owned enterprises. *Journal of Environmental Planning and Management*, *58*(5), 771–801.

Russell, S., Milne, M., & Dey, C. (2017). Accounts of nature and the nature of accounts. *Accounting, Auditing & Accountability Journal*, *30*(7), 1426–1458.

Sancino, A., Sicilia, M., & Grossi, G. (2017). Between patronage and good governance: Organizational arrangements in (local) public appointment processes. *International Review Of Administrative Sciences*, *84*(4), 785–802. https://doi.org/10.1177/0020852316675944

Scarpa, C., & Pellizzola, L. (2009). *Comuni SpA: Il capitalismo municipale in Italia*. Bologna: Il Mulino.

Schumaker, R., Jarmoszko, A., & Labedz, C. (2016). Predicting wins and spread in the Premier League using a sentiment analysis of twitter. *Decision Support Systems*, *88*, 76–84.

Smith, K., Blazovich, J., & Smith, L. (2015). Social media adoption by corporations: An examination by platform, industry, size, and financial performance. *Academy of Marketing Studies Journal*, *19*(2), 127–143.

Soliman, M. (2013). Firm characteristics and the extent of voluntary disclosure: The case of Egypt. *Research Journal of Finance and Accounting*, *4*(17), 71–80 https://doi.org/10.2139/ssrn.2311005

Song, B., & Wen, J. (2019). Online corporate social responsibility communication strategies and stakeholder engagements: A comparison of controversial versus noncontroversial industries. *Corporate Social Responsibility and Environmental Management*.

Stubbs, W., Higgins, C., & Milne, M. (2013). Why do companies not produce sustainability reports? *Business Strategy and the Environment*, *22*(7), 456–470. https://doi.org/10.1002/bse.1756

Tagesson, T., Blank, V., Broberg, P., & Collin, S. O. (2009). What explains the extent and content of social and environmental disclosures on corporate websites: A study of social and environmental sustainability disclosures of hybrid organizations reporting in Swedish listed corporations. *Corporate Social Responsibility and Environmental Management*, *16*(6), 352–364.

Tagesson, T., Klugman, M., & Ekström, M. (2011). What explains the extent and content of social disclosures in Swedish municipalities' annual reports. *Journal of Management & Governance*, *17*(2), 217–235.

Thomson, I., & Bebbington, J. (2005). Social and environmental reporting in the UK: A pedagogic evaluation. *Critical Perspectives on Accounting*, *16*(5), 507–533.

Top Utility Analysis. (2018). Le performance delle utility italiane. Milano. Retrieved from http://www.toputility.it/wp-content/uploads/2018/01/Sintesi-dei-risultati-Top-Utility-VIEDstamp.pdf

Voorn, B., van Genugten, M., & van Thiel, S. (2017). The efficiency and effectiveness of municipally owned corporations: A systematic review. *Local Government Studies*, *43*(5), 820–841.

Waters, R., & Jamal, J. (2011). Tweet, tweet, tweet: A content analysis of nonprofit organisations' Twitter updates. *Public Relations Review*, *37*(3), 321–324.

Williams, B., Wilmshurst, T., & Clift, R. (2011). Sustainability reporting by local government in Australia: Current and future prospects. *Accounting Forum*, *35*(3), 176–186.

Yakhou, M., & Dorweiler, V. (2004). Environmental accounting: An essential component of business strategy. *Business Strategy and the Environment*, *13*(2), 65–77.

Zheng, H., & Zhang, Y. (2016). Do SOEs outperform private enterprises in CSR? Evidence from China. *Chinese Management Studies*, *10*(3), 435–457.

Zola, P., Cortez, P., Ragno, C., & Brentari, E. (2019). Social media cross-source and cross domain sentiment classification. *International Journal of Information Technology & Decision Making*, *18*(05), 1469–1499.

Zola, P., Rocca, L., Giacomini, D., & Paredi, D. (2019). The "Sentability": Sentiment analysis for social media's accountability. The case of environmental issues in Italian municipalities. In *Book of Abstracts* (p. 129). Milan, Italy: Data Science & Social Research 2019.

APPENDIX A

TABLE A1   Public utility companies analysed

Name	Older post date
A2A Energia	April 14, 2017
A2A S.p.a.	November 19, 2013
Acam S.p.a.	March 24, 2017
Acam acque	March 21, 2017
ACEA S.p.a.	February 28, 2012
ACEA Pinerolese	February 28, 2017
AGESP S.p.a.	April 19, 2016
AGSM Verona S.p.a.	November 30, 2013
AIM Vicenza	May 07, 2015
AIMAG S.p.a.	April 16, 2015
Alperia	January 01, 2016
AMAG S.p.a.	May 21, 2015
ASM Voghera S.p.a.	June 28, 2014
Astea S.p.a.	November 03, 2017
Astea Energia	June 24, 2014
Consorzio Servizi Valle Camonica	September 18, 2015
Estra S.p.a.	December 21, 2014
Gelsia	November 14, 2016
Iren S.p.a.	August 10, 2015
Lario Reti Holding	March 22, 2015
Tea Mantova	May 17, 2018
VUS S.p.a.	May 18, 2013

APPENDIX B

TABLE B1   Coding scheme

Area	Items	Keywords
Water	Wastewater treatment	Pollutant loads, wastewater, sewage
	Water supply	Water cycle
	Recycled water	Recycled water, recovered water, reused water, water savings
Air	Emissions of CO_2 and other climate-altering gases	Emissions
	Urban air quality	Control units, PM 10, nitrogen, air, breathe
Energy	Reduction of energy consumption	Energy, energy consumption, energy savings, energy efficiency, efficiency, consumption
	Energy production from renewable sources	Renewable sources, savings, photovoltaic, panels, heat pump, white certificates
	Environmental investments	Environmental investments, green investments, hydroelectric, photovoltaic, solar, wind, geothermal, energy, plantings

(Continues)

Corporate Social Responsibility and
Environmental Management

TABLE B1 (Continued)

Area	Items	Keywords
Territory	Concern for the loss of biodiversity	Biodiversity
	Availability of parks	Square metres of urban green per inhabitant
	Limitation of environmental impact	Environmental impact, green procurement, environmental footprint, environmental sustainability
	Contaminated sites	Extension of sites of national interest in hectares
	Areas with hydrogeological problems	Landslides, hydrogeological security, regional planning
	Protected areas	Natural areas, protected areas
Waste	Conferment of urban waste to landfills	Percentage of municipal waste sent to landfills on total urban waste collected
	Separate collection of municipal waste	Waste, separate waste collection, door to door, cap, bins
Sustainabilityreport	Sustainability report	Social report, sustainability report, environmental report

APPENDIX C

TABLE C1 Interest distribution for public utility companies

	PU posts	Stakeholder engagement	PU post distribution	Stakeholder engagement distribution	Unitary PU post stakeholder engagement	Stakeholder engagement given PU posts
Air	89	1,155	3.5%	2.6%	12.98	12.3%
Energy	869	14,259	34.5%	31.8%	16.41	15.6%
Territory	849	13,715	33.7%	30.5%	16.15	15.4%
Reporting	375	9,755	14.9%	21.7%	26.01	24.7%
Waste	234	4,575	9.3%	10.2%	19.55	18.6%
Water	103	1,447	4.1%	3.2%	14.05	13.4%
Total	2,519	44,906	100.0%	100.0%	105.15	100.0%