

L'Abate, Vitiana; Raimo, Nicola; Vitolla, Filippo

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Circular Economy Disclosure through Social Media: An Empirical Analysis on Twitter

Vitiana L'Abate

LUM University
Casamassima (BA), Italy
S.S. 100 km 18

Nicola Raimo*

LUM University
Casamassima (BA), Italy
S.S. 100 km 18

Filippo Vitolla

LUM University
Casamassima (BA), Italy
S.S. 100 km 18

** Corresponding author*

Abstract

In recent years, to solve the problems related to sustainability, there is an increasing need for a transition from linear production and consumption systems to new models oriented towards recycling, reuse, reuse and reuse. In the academic field, several scholars have turned their attention to the adoption by companies of the new circular economy models. Due to the interest of a large number of stakeholders in issues related to the circular economy, several scholars have begun to explore the circular economy disclosure practices of companies. Despite this, studies on the topic are still limited. The purpose of this study is firstly to examine the level of circular economy information disseminated through Twitter by companies and, secondly, to examine the impact of some characteristics of companies on the level of circular economy disclosure. Empirical results show that the most profitable and most indebted companies disclose a greater amount of circular economy information through their official Twitter accounts. This study contributes to enriching the academic literature and provides important practical contributions.

Keywords – Circular economy, Disclosure, Social media, Twitter

Paper type – Academic Research Paper

1 Introduction

Ecosystems are crucial for sustaining life on the planet, but they have not always been treated with care. Overuse, overconsumption and neglect have caused harm to many vital ecosystems (García-Sánchez et al., 2021; L'Abate et al., 2023). The current events of the COVID-19 pandemic and the Russia-Ukraine war have further highlighted the need to use resources responsibly and avoid waste. In this context, the circular economy is gaining more attention as a solution to environmental problems, especially in terms of recycling and recovering resources. In many countries and particularly in the European Union, it is considered a fundamental aspect of sustainable policies and a key driver of the transition towards global sustainability (García-Sánchez et al., 2022a). The NextGenerationEU Plan also recognizes the circular economy as a way to aid economic recovery following the COVID-19 pandemic (García-Sánchez et al., 2022a). The circular economy is an economic model in which materials and resources are used, recovered and regenerated in a continuous manner to maintain the value of resources within the economy for as long as possible (Gunarathne et al., 2021). The goal is to reduce waste and environmental impact, create resilient local economies and support sustainable development. The circular economy is based on three fundamental principles: designing out waste and pollution, keeping resources in use for as long as possible and regenerating natural systems (Millar et al., 2019). Despite the importance of the circular economy for stakeholders, companies are not effectively and clearly communicating data and information about this production and consumption model (Barnabè & Nazir, 2021). Even though more companies are starting to adopt circular economy disclosure practices, there are still issues and delays due to a lack of specific measurement tools and reporting standards (Elia et al., 2017), as well as a lack of a commonly accepted language for discussing these topics (Ünal et al., 2019; Barnabè & Nazir, 2021). These circumstances have led to a variety of different ways of measuring and presenting information about the circular economy, using different techniques and tools (Garza-Reyes et al., 2018; Barnabè & Nazir, 2021).

In recent years, the advent of digitalization has provided new digital platforms for the dissemination of circular economy information. In particular, one way is the use of social media (Dumay, 2016). Social media have changed the disclosure landscape, offering further opportunities for research on the role of disclosure.

They facilitate firm-directed, one-to-many communications that bypass traditional media and allow a firm to broadcast its intended message to a large network of stakeholders (Lee et al., 2015).

In light of the relevance of the circular economy and social media, this study, firstly, intends to analyze the amount of circular economy information disseminated by companies through Twitter and, secondly, the factors capable of favoring or hindering circular economy disclosure through this social platform. In this regard, this study, in the wake of Barnabè and Nazir (2021), uses the glossary provided by the U.S. Chamber of Commerce Foundation to identify terms related to the circular economy and a count of the number of tweets provided by companies on their official Twitter account containing those terms. Furthermore, it provides for the implementation of an econometric model aimed at identifying the determinants of circular economy disclosure through the Twitter social platform.

The rest of this work is organized as follows: Section 2 presents the literature review and hypotheses development, Section 3 introduces the research design, while Section 4 presents the results and draws conclusions.

2 Literature review and hypotheses development

Due to the recent relevance of the circular economy, several scholars have begun to explore the way companies communicate circular economy information (Istudor & Suciu, 2020; Dagiliene et al., 2020; Barnabè & Nazir, 2021; Opferkuch et al., 2021; Tiscini et al., 2022; Vitolla et al., 2023). Specifically, several studies have examined the different channels through which companies provide circular economy information to stakeholders. In this regard, they focused their attention on the various company documents, including integrated report, sustainability report and annual report, examining not only the level and type of circular economy information contained in them but also the drivers of circular economy disclosure. Instead, in the academic literature there is a paucity of studies exploring other communication channels, such as websites and social media.

With reference to the integrated reports, scholars have begun to explore the communication methods of circular economy information in the light of integrated thinking, as it allows to capture the interconnections between the different categories of capitals and to provide a holistic view of this information (Kunc et al., 2021; Myeza et al., 2021; Barnabè & Nazir, 2021; 2022). In this regard,

Barnabè and Nazir (2021) conducted a content analysis on the content of the integrated report and a case study in order to examine the role of the <IR> framework in the dissemination of circular economy information. The authors demonstrated the presence of important differences in the communication practices of circular economy information, highlighting the relevance and potential of integrated reporting in representing such information. Kunc et al. (2021) came to the same conclusion about the relationship between integrated reporting and circular economy disclosure. In addition, Barnabè and Nazir (2022), through a case study conducted in the agri-food sector, explored how the principles of integrated thinking are applied in the communication and representation of circular economy information within integrated reports. Finally, Myeza et al. (2021), examining the integrated reports of South African mining companies, provided a regulatory framework for integrating circular economy practices into corporate strategy and observed the level of circular economy information contained within this document.

Other studies have examined the relationship between sustainability reporting and circular economy information (Janik et al., 2020; Marco-Fondevila et al., 2021; Opferkuch et al., 2021; 2022; Tiscini et al., 2022). In this regard, Opferkuch et al. (2021) observed that, due to the absence of guidelines for the identification and representation of circular economy information, there is a disconnect between sustainability disclosure and the circular economy. In this regard, Opferkuch et al. (2022), have highlighted that still few companies disseminate circular economy information within sustainability reports. Indeed, the authors observe that the information included in the sustainability reports concern circular economy indicators and objectives. In addition, Tiscini et al. (2022) highlighted that companies still disclose little circular economy information in relation to the circular economy strategy, governance, performance and management within the sustainability reports. Janik et al. (2020), by analyzing the sustainability reports of companies operating in the energy sector, found a focus on greenhouse gas emissions, while little attention was given to circular economy information. Finally, Marco-Fondevila et al. (2021), examining the largest Spanish companies, found that only half of them disseminate circular economy information in their sustainability reports. Other authors have instead explored the content of circular economy information communicated through sustainability reports (Stewart & Niero, 2018; Istudor & Suci, 2020; García-Sánchez et al., 2022a). In this regard, Stewart and Niero (2018), by analyzing a sample of 49 companies operating in the

consumer goods sector, discovered that business model tactics and circular product design received less attention than other aspects such as core product, procurement strategies, packaging, and end-of-life management. In addition, Istudor and Suci (2020) examined the sector of food and observed that companies disseminate information regarding emissions, waste reduction and recycling, correct use of resources and sustainable development. Furthermore, García-Sánchez et al. (2022a) found that companies focus their attention on information relating to the reduction of greenhouse gases, the correct use of resources and in general the role of the circular economy in the sustainable development goals. Finally, other authors have examined the drivers of circular economy disclosure (Wang et al., 2014; Dagiliene et al., 2020; Vitolla et al., 2023). In this regard, Wang et al. (2014) found that ownership concentration, institutional ownership and environmental institutional protecting pressures have a positive impact on the level of circular economy information disseminated within sustainability reports. External pressure was also examined by Dagiliene et al. (2020). In fact, the authors observed that the levels of circular economy disclosure are positively influenced by regulations and mimetic pressures, while coercive factors have no significant impact. Finally, Vitolla et al., (2023), examining the sustainability reports of 88 international companies, observed that firm size, firm profitability and firm financial leverage have a positive impact on the amount of circular economy information disclosed.

Finally, other studies have instead examined more types of corporate documents, focusing on the amount of circular economy information disclosed, on the drivers and on the effects of circular economy disclosure (Gunarathne et al., 2021; Kuo & Chang, 2021; Roberts et al., 2022). Specifically, Gunarathne et al. (2021), by analyzing the integrated and sustainability reports, found that Sri Lankan companies disclose a low level of circular economy information. Instead, Roberts et al. (2022), by examining the sustainability reports and annual reports, found higher levels of circular economy disclosure in companies in the automotive sector than in those operating in the aerospace and defense sectors. Still focusing on the sustainability and annual reports, Kuo and Chang (2021) examined the determinants and effects of circular economy disclosure in the Chinese context. More in detail, in relation to the determinants, the authors found that larger firms, state-owned enterprises and firms operating in environmentally-sensitive industries disseminate more circular economy information. Furthermore, in relation to the effects, the authors observed that the dissemination of circular

economy information has a positive impact on the profitability and growth rate of companies.

Instead, the academic literature has paid little attention to the dissemination of circular economy information through social media. Specifically, there is only one study conducted by Esposito et al. (2023) who explored social networks as a communication channel for circular economy information. In this regard, examining the agri-food sector, the authors found that Twitter represents a good channel for the dissemination of circular economy information. Despite this, the companies operating in the agri-food sector have dealt with only a few aspects, communicating on this social network only information on recycling and the circular economy in general.

The literature review shows limited attention to social media as potential communication channels for circular economy information. In addition, the absence of studies aimed at examining the drivers of circular economy disclosure through social media is evident. This study aims to fill this gap by focusing attention on three different corporate characteristics which, by increasing the pressures to which companies are exposed and the stakeholder base, could favor a wider circular economy disclosure. In particular, it examines the impact of three corporate characteristics: size, profitability, and financial leverage. In fact, these variables, for various reasons, influence the attention that companies dedicate to the interests of stakeholders and therefore could influence the level of circular economy information disclosed via Twitter. In fact, larger companies are more visible and have a greater impact on the external environment (Reverte, 2009; Vitolla et al., 2019; Nicolò et al., 2022) while the most profitable companies have a greater availability of monetary resources and want to distinguish themselves from their competitors also through a broad disclosure (Brammer & Millington, 2006; Schreck & Raithel, 2018). Finally, the most indebted companies have a greater need to consolidate a relationship of trust with stakeholders (Branco & Rodrigues, 2008; Andrikopoulos et al., 2014; Sharif & Rashid, 2014; Raimo et al., 2022). In light of this, it is reasonable to expect a positive impact of these variables on the level of circular economy disclosure via Twitter and it is possible to introduce the following hypotheses:

HP1: Firm size has a positive influence on the circular economy disclosure level via Twitter

HP2: Firm profitability has a positive influence on the circular economy disclosure level via Twitter

HP3: Firm financial leverage has a positive influence on the circular economy disclosure level via Twitter

3 Research design

The sample of this study includes 141 companies belonging to the S&P 500 index. The choice of this index is justified by the need to examine larger companies as they are exposed to greater pressure from stakeholders in relation to transparency (Watts & Zimmerman, 1978; Manita et al., 2018). For the purposes of this analysis, only companies operating in the energy (or energy utilities), industrial and basic materials sectors were selected from the initial list. Subsequently, the companies that did not have an official Twitter account and those for which it was not possible to retrieve the data relating to the independent and control variables from the Bloomberg database were excluded. In light of this, the final sample is made up of 141 companies.

The dependent variable of this study is represented by circular economy disclosure level (*CEDL*). It is measured as the natural logarithm of the number of tweets containing information relating to the circular economy published in 2021 on the official Twitter accounts of the companies included in the sample. A manual content analysis was used to measure this variable (Vitolla et al., 2020a; Raimo et al., 2021). In particular, following Barnabè and Nazir (2021) and Esposito et al. (2023), a dictionary-based content analysis was used. The "Glossary of Circular Economy" developed by the U.S. Chamber of Commerce Foundation was chosen as the source for term identification. Following previous studies, the selected glossary was expanded with other concepts leading to the identification of 54 terms related to the circular economy. The terms related to the circular economy were considered both singular and plural form.

In line with the objectives of this study, the recording unit is represented by the individual tweets published by companies through their official accounts in 2021. The data collection was conducted through the "All My Tweets" web application. Each tweet was assigned a score equal to 1 in the event of the presence of one or more terms relating to the circular economy and a score equal to 0 otherwise (Massaro et al., 2017).

The independent variables included in this analysis are: *Firm Size*, *Firm Profitability*, and *Firm Financial Leverage*. *Firm Size* was calculated in terms of the natural logarithm of total assets (Vitolla et al., 2020b; Salvi et al., 2022), while *Firm*

Profitability was measured in terms of return-on-equity (Raimo et al., 2020), calculated as the ratio between net income and shareholders' equity. *Firm Financial Leverage* is a measure of the firm's debt and was measured as the ratio of total debt to total assets (García-Sánchez et al., 2022b; Salvi et al., 2022).

The control variables are: *Energy Sector*, *Board Size*, *Board Gender Diversity*, *Board Independence*, *Audit Committee Size*, *Number of Tweets*, and *Number of Followers*. *Energy Sector* is a dummy variable which assumes the value 1 if the company operates in the energy sector, and 0 otherwise. *Board size* was calculated as the total number of members who make up the board of directors, while *Board Gender Diversity* was measured as the percentage of women on the board of directors. *Board Independence* was calculated as the percentage of non-executive members included within the board of directors, while *Audit Committee Size* was measured in terms of total members who make up this corporate governance body. *Number of Tweets* was calculated as the natural logarithm of tweets posted by the company in 2021 through its official Twitter account, while *Number of Followers* was calculated as the natural logarithm of the number of individuals who follow the company's official Twitter account.

The model of analysis proposed by this study is reflected in the following equation:

$$CEDL = \beta_0 + \beta_1 \text{ Firm Size} + \beta_2 \text{ Firm Profitability} + \beta_3 \text{ Firm Financial Leverage} + \beta_4 \text{ Energy Sector} + \beta_5 \text{ Board Size} + \beta_6 \text{ Board Gender Diversity} + \beta_7 \text{ Board Independence} + \beta_8 \text{ Audit Committee Size} + \beta_9 \text{ Number of Tweets} + \beta_{10} \text{ Number of Followers} + \varepsilon$$

4 Results and conclusions

Table 1 shows the descriptive statistics. The dependent variable of this study – *CEDL* – has an average value of 2.923. In relation to the independent variables, *Firm Size* shows an average value of 10.132. Furthermore, *Firm Profitability* has an average value equal to 24.330, while *Firm Financial Leverage* has an average value equal to 32.243. Table 1 also shows the results of the correlation analysis and the variance inflation factor (VIF) analysis which allow for the exclusion of multicollinearity issues.

Table 1 - Descriptive statistics, VIF and correlation analyses

Variable	Mean	Std. dev.	VIF	1	2	3	4	5	6	7	8	9	10	11
1 <i>CEDL</i>	2.923	1.382	-	1										
2 <i>Firm Size</i>	10.132	0.986	1.97	0.107	1									
3 <i>Firm Profitability</i>	24.330	39.059	1.39	0.271***	-	1								
4 <i>Firm Financial Leverage</i>	32.243	12.320	1.46	0.399***	0.134	0.279***	1							
5 <i>Energy Sector</i>	0.404	0.492	1.36	-0.077	0.362***	-	0.188**	1						
6 <i>Board Size</i>	10.844	1.712	1.41	0.224***	0.441***	-0.193**	-0.007	0.135	1					
7 <i>Board Gender Diversity</i>	27.945	9.176	1.20	0.198**	0.223***	-0.151*	0.067	0.077	0.215**	1				
8 <i>Board Independence</i>	86.408	8.044	1.41	0.292***	0.275***	-0.179**	0.244***	0.022	0.333***	0.335***	1			
9 <i>Audit Committee Size</i>	4.638	1.091	1.09	-0.016	0.195**	-0.119	-0.043	0.048	0.203**	0.048	0.106	1		
10 <i>Number of Tweets</i>	5.351	1.751	1.82	0.802***	0.220***	0.139*	0.356***	0.088	0.223***	0.247***	0.231***	0.010	1	
11 <i>Number of Followers</i>	9.390	1.850	1.98	0.438***	0.470***	0.041	0.164*	0.022	0.214**	0.190**	0.210**	-	0.570***	1

Notes: ***Significant at the 1% level; **Significant at the 5% level; *Significant at the 10% level

Table 2 instead shows the results of the linear regression analysis. The results obtained in the regression model almost totally support the hypotheses postulated in this study.

The results do not support hypothesis 1 (HP1). Indeed, they show a non-significant relationship between *Firm Size* and *CEDL*. In light of this, company size does not have a significant impact on the level of circular economy information disseminated by companies through their official Twitter accounts. In addition, the results support hypothesis 2 (HP2). Indeed, they show a positive and significant relationship between *Firm Profitability* and *CEDL*. In light of this, the most profitable companies tend to disclose a higher amount of circular economy information through their Twitter accounts. Finally, the results support hypothesis 3 (HP3). Indeed, they show a positive and significant relationship between *Firm Financial Leverage* and *CEDL*. In light of this, the most indebted companies tend to disseminate a higher amount of circular economy information through their Twitter accounts.

Table 2 - Regression model results

Variables	Coefficient	Standard error	p-value	Sign.
<i>Cons</i>	-2.034	0.926	0.030	**
<i>Firm Size</i>	-0.076	0.092	0.413	
<i>Firm Profitability</i>	0.005	0.002	0.018	**
<i>Firm Financial Leverage</i>	0.012	0.006	0.057	*
<i>Energy Sector</i>	-0.344	0.153	0.026	**
<i>Board Size</i>	0.079	0.045	0.081	*
<i>Board Gender Diversity</i>	-0.001	0.008	0.973	
<i>Board Independence</i>	0.019	0.010	0.047	**
<i>Audit Committee Size</i>	-0.023	0.062	0.708	
<i>Number of Tweets</i>	0.577	0.050	0.000	***
<i>Number of Followers</i>	-0.013	0.049	0.785	
N	141			
Adj. R ²	0.693			

Notes: ***Significant at the 1% level; **Significant at the 5% level; *Significant at the 10% level

This study aimed to investigate the drivers of the circular economy disclosure via Twitter. More in detail, this study investigated the effect of some characteristics of companies such as size, profitability and financial leverage on the level of circular economy information contained in the tweets published through the company official account. The results of this study showed that the most profitable and most indebted companies disclose a greater amount of circular economy information through their official Twitter accounts.

This study provides important contributions to the academic literature and practice. From an academic point of view, it first of all contributes to enriching the debate on disclosure policies relating to the circular economy which has become the object of interest of numerous scholars. Another important contribution is represented by the analysis of the factors capable of influencing the circular economy disclosure policies of companies. With reference to the practical contributions, this study first of all shows the need for certain types of companies to disclose circular economy information in order to mitigate the pressures to which they are exposed and satisfy the information needs of stakeholders. Furthermore, this study demonstrates the goodness of social networks and in particular of Twitter for the dissemination of circular economy information.

In conclusion, it is necessary to point out the limitations of this study. The main limitation concerns the focus of the econometric analysis on a single year. This limitation represents a starting point for future research. In fact, they will be able to extend the time horizon of the econometric analysis and allow the understanding of the evolution over time of the circular economy disclosure via Twitter.

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