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Social media on the route to circular economy transition from a dialogic perspective: evidence from the agri-food industry

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Abstract

Purpose – This paper investigates circular economy communications and stakeholder dialogic engagement with circular economy posts published by European agri-food companies on Twitter from the spread of the COVID-19 pandemic. It explores the use of social media as a dialogic tool to activate circular economy engagement in order to involve all supply-chain actors on the route to a circular transition.

Design/methodology/approach – A coding framework based on the reclassification of the Glossary of Circular Economy, according to a 4-R paradigm (reduce, reuse, recycle and recover), was developed for the analysis. All tweets published by a sample of European agri-food companies, starting from the start of the COVID-19 pandemic until data extraction, were collected, purified and analysed.

Findings – Agri-food companies showed a higher level of engagement through social media, even if mainly focused on "recycling" and "general circular economy" issues. In general, awareness among social network users of the need to be part of the circular economy transition emerged. Moreover, the highest percentage of posts published by the companies' Twitter accounts was informative rather than interactive. In addition, starting with the COVID-19 pandemic crisis, the circular economy has arisen as a central topic of debate and a driver for the rethinking process of the agri-food business community.

Originality/value – To the best of the authors' knowledge, this research represents the first study focused on circular economy engagement through social media from the company perspective in the agri-food industry.

Keywords Circular economy, Agri-food industry, Stakeholder dialogic engagement, Social media, Pandemic and post-pandemic era

Paper type Research paper

1. Introduction

In recent decades, a great deal of attention has been paid to circular economy (CE) strategies worldwide to overcome the current model of production and consumption based on growth linked to a continuous increase in the use of resources, which causes excessive pressure on the environment (Stahel, 2016).

The CE paradigm encourages decoupling economic development from environmental degradation, promoting the adoption of closed-loop production models within an economic

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system that aims to increase resource efficiency to achieve better balance and harmony between the economy, the environment and social dimensions (Merli *et al.*, 2018).

CE principles are becoming an important issue for organisations, in order to become more resilient to crises – such as COVID-19 – as well; they are focusing their strategies towards innovative solutions, aimed at combining economic, environmental and social needs. The transition to a CE paradigm is particularly relevant for the agri-food sector (AFS), as outlined by the European Commission in the European food security emergency plan during the crisis.

Moreover, AFS organisations are called upon to develop tailored circular models taking into account the complexities and peculiarities of each chain of the system, making the ongoing circular transition process more complex.

In addition to primary producers, this process involves other stakeholders, such as customers and consumers, investors, public decision-makers and retailers.

The AFS is one of the most relevant systems for the environment due to the resulting burdens (such as the loss of biodiversity, soil degradation, climate change, water use and pollution), but it is also significant for its social, cultural and economic dimensions (Brankatschk and Finkbeiner, 2014). This is due to the evolution in tastes, traditions and, more generally, life and consumption patterns.

A wide range of activities revolves around the food industry, whose effects manifest a plurality of spheres relating to quality of life and psychophysical well-being as well as social relationships and local customs.

Therefore, sustainability involves complex problems regarding multidisciplinary issues, regulatory aspects and empirical knowledge, requiring the active participation of all the above-mentioned actors. The decision-making process regarding sustainability, in particular, must be supported and informed by scientifically valid quantitative information to foster a fair allocation of responsibilities along the entire supply chain.

In this context, it becomes important for organisations to "make visible" improvement of the eco-efficiency of a process or a product and communicate to stakeholders their strategic choices of environmental value. Moreover, correct information, conveyed clearly and transparently, guides purchasing choices, encouraging the spread of more conscious consumption patterns and lifestyles.

The implementation of these strategies represents an excellent opportunity to carry out a radical revision of the paradigm of production and consumption and, therefore, create suitable conditions for the full implementation of Goal 12, "Sustainable production and consumption", of the 2030 Agenda for Sustainable Development (Amicarelli *et al.*, 2020; Sica *et al.*, 2022).

Based on these considerations, AFS organisations adopting CE business models pay particular attention to communicating information about their CE strategies, policies and practices for consumers ever-more sensitive to these issues, but also to increase stakeholder awareness of sustainability issues. In this way, a virtuous circle is generated that stimulates a collaborative relationship in achieving company objectives. Communication modes, however, have undergone significant changes during the COVID-19 pandemic, accelerating the pervasiveness of digital technologies.

The consumer-to-business (C2B) relationship has been empowered by social media (SM), creating a large amount of online data to be transformed into knowledge of people's needs and expectations (Amicarelli *et al.*, 2022; Recuero-Virto and Valilla-Arróspide, 2022). Through SM, customers can quickly report their feedback/experiences publicly online, generating data and information that can improve the image and reputation of an organisation. Similarly, customer expectations are taken into account to improve the organisations' competitiveness.

The use of SM, therefore, can support the agri-food industry (AFI) in improving stakeholder engagement, as it can be considered a tool to enhance dialogue between companies and their stakeholders (Bellucci and Manetti, 2017).

Companies face new challenges in maintaining their competitive advantage: a new need to rethink and transform their organisational culture, processes and business models is emerging, widely adopting SM to meet the new demand from consumers.

Moreover, in the COVID-19 and post-pandemic era, the use of SM, previously a prerogative principally of younger consumers, has involved wider population segments. As a result, SM are becoming increasingly strategic in marketing, communication and disclosure strategies. They enable companies to directly reach their stakeholders, allowing two-way communication, thus accelerating opportunities for interactivity, discussion and interpersonal relationships, more complex with traditional disclosure media.

In this scenario, companies committed to the CE transition are also exploiting the potential of SM to activate stakeholder dialogic engagement dynamics, in order to catalyse the shifting process involving the entire supply chain.

This phenomenon is also relevant for AFS organisations, which operate within complex supply chains and are increasingly called upon to involve stakeholders in ongoing CE transition processes.

From this background, the present research paper aims to investigate AFI CE communication activities through SM from a company perspective. Based on the literature review conducted, this topic has not yet been explored. To fill this gap, this study aims to investigate how agri-food companies engaged with stakeholders on CE communication during the pandemic and post-pandemic period, through content analysis of posts published on Twitter by a sample of European agri-food companies.

The paper starts with a literature review focused on the use of SM as a tool for CE engagement. The aim is to analyse and synthesise the knowledge gained from scientific studies focused on the main implications of correct information that, if conveyed clearly and transparently, can guide purchasing choices, encouraging the spread of more conscious consumption patterns and lifestyles.

The bibliographic research, performed in September 2022, was carried out on the following scientific databases: Science Direct, Scopus, CASPUR Virtual Library (a search engine of Italian inter-university databases) and Google Scholar. The papers were selected by identifying those that focused on communication strategies adopted by organisations to "make visible" improvements of the processes or product eco-efficiency.

The study proceeds with an in-depth analysis of the methodology used, based on a content analysis developed into two stages: a supervised machine learning analysis using the NVivo software, combined with a manual content analysis performed by two coders independently.

The third part provides the main results, which show that starting with the COVID-19 pandemic crisis, the CE has arisen as a central topic of debate and a driver for the rethinking process of the agri-food business community.

Finally, discussions, conclusions, implications, limitations and future research directions are presented. They may be useful both for scholars, agri-food managers and policymakers, to accelerate the development of strategies and studies, but also the stakeholder engagement on CE through SM.

2. Literature review

During the last decade, researchers have demonstrated the need to involve all an ecosystem's actors to activate virtuous cycles for waste, loss and pollution reduction (Gusmerotti *et al.*, 2019). In the wake of CE relevance, stakeholders have called for extensive, reliable information on sustainable and circular business models from both public and private institutions (Tiscini *et al.*, 2022). Moreover, companies are called upon to assess the results of CE investments in order to develop improvements and enhance their circular value. Information concerning sustainable and circular issues is emerging as a relevant point for a successful CE transition.

Accordingly, scholars have demonstrated that the CE represents a collective solution that cannot be effectively reached in isolation and that information asymmetries are one of the principal barriers to its successful implementation (Antikainen and Valkokari, 2016). Therefore, "a stakeholder perspective is critical and can provide the required framework for a shift towards the CE paradigm" (Gupta *et al.*, 2019, p. 469). Accordingly, information pooling and sharing could be considered the best approach to reducing asymmetries and succeeding in shifting towards sustainable business models (Gusmerotti *et al.*, 2019).

Considering the relevance of these issues, researchers have started inquiring about the function of CE communication strategies and disclosure practices (i.e. Jakhar *et al.*, 2019; Unal *et al.*, 2019; Scarpellini *et al.*, 2020). In particular, Jakhar *et al.* (2019) have investigated how companies' CE practices might be influenced by stakeholder pressures and the resultant disclosure activities. Unal *et al.* (2019) analysed how companies can build value by implementing a CE business model and how they disclose this value externally. Scarpellini *et al.* (2020) investigated the environmental accounting practices of industries involved in CE models intended to engage their stakeholders.

Other researchers have focused on the role of the CE in non-financial reporting practices in order to investigate CE disclosure, specifically in corporate social responsibility (CSR) reports (i.e. Wang *et al.*, 2014; Stewart and Niero, 2018; Kuo and Chang, 2021), sustainability reports (i.e. Dagiliene *et al.*, 2020; Opferkuch *et al.*, 2021; Tiscini *et al.*, 2022) and integrated reports (i.e. Barnabè and Nazir, 2020; Gunarathne *et al.*, 2021; Myeza *et al.*, 2021; Barnabè and Nazir, 2021).

To successfully reach the circular transition, a need for an integrated commitment from all stakeholders is emerging. Therefore, the disclosure of companies' commitment to CE initiatives is acquiring a pivotal role in activating stakeholder engagement. However, traditional communication channels – such as the press, corporate reports and websites – based on a one-way communication approach do not allow companies to engage with internal and external stakeholders in a dialogic dimension (Gori *et al.*, 2020; Schroder, 2021).

In this context, SM – which have completely transformed communication paradigms – have emerged, founded on "mobile and web-based technologies to create highly interactive platforms via which individuals and communities share, co-create, discuss, and modify user-generated content" (Kietzmann *et al.* 2011, p. 241). Scholars have defined SM as supporting dialogic instruments for information pooling and sharing to grasp stakeholder expectations (Bebbington *et al.*, 2007). Hence, SM are becoming incrementally vital for the CE transition due to the compelling need to involve all supply-chain actors in this paradigm shift (Esposito *et al.*, 2021).

Accordingly, the disclosure of CE information has shifted from a one-directional approach to a bidirectional one (Reilly and Hynan, 2014). Companies have begun to adopt SM not only to advertise their products and promote their presence on the market, but also to stimulate two-way symmetrical interactions and – in turn – engage with stakeholders (Bellucci and Manetti, 2017). Furthermore, SM assist companies in obtaining stakeholder collaboration and bring legitimacy and competitiveness.

In keeping with these arguments, scholars have started to investigate the role of SM in the CE field.

Most articles have investigated CE sentiment and engagement from SM user perspectives. In them, the most explored SM platform is Twitter. Grover and Kar (2020) explored the discussion of CE topics and the polarity of sentiment among Twitter users, highlighting that the economic benefits of CE, environmental impacts and resource scarcity have been extensively discussed. De Lima (2022) demonstrated that Twitter users are more likely to adopt reactive approaches to address global sustainability challenges than proactive and collaborative approaches to catalyse the CE transition. By contrast, Shahidzadeh and Shokouhyar (2022) provided evidence on the leveraging power of SM to convert supply chains into consumer-centric circular supply chains within the electronics industry.

Mirzaei and Shokouhyar (2022), instead, highlighted that in the mobile industry, customer attention is mainly focused on environmental practices rather than other, triple-bottom-line dimensions. Giudice *et al.* (2020) investigated the effects of the COVID-19 pandemic on the AFS from a CE perspective, highlighting that the approach to CE topics changed before (focused on food safety issues), during (focusing on food security issues) and after (focused on food sustainability and circular management), the pandemic. Finally, Loia *et al.* (2021) showed that CE has emerged as a category of words retrieved from sentiment analysis.

Always from the perspective of SM users, other researchers have used SM platforms to investigate CE topics. In particular, Jiang *et al.* (2021) used multiple platforms to test the engagement of Shanghai households with waste segregation and recycling issues, showing that the engagement level had increased from 2019 after the introduction of a national policy on the CE and waste management. Arman and Mark-Herbert (2022) investigated the use of SM to activate reuse-oriented practices among customers, allowing the involvement of the last actors of the supply chains in the virtuous cycle of value co-creation. Lastly, Gong *et al.* (2022) explored the role of SM widely disseminated in China (i.e. Sina Weibo; Wechat; Qzone) in monitoring and assessing environmental communication.

However, in the literature review performed, only one study analysed CE communication through the lens of SM from a company perspective. Tsironis *et al.* (2022) performed a data-driven analysis to assess CE topics as LinkedIn activities in EU companies, providing insights on the engagement and information sharing of a wide array of companies operating in different countries and industrial sectors.

Table 1 provides a summary of the principal outcomes of the literature review.

To the best of the authors' knowledge, no scientific articles have investigated CE engagement in the AFS through SM from firm perspectives. To fill this gap, the present research aims to explore how agri-food firms engaged with stakeholders on CE communication during the pandemic and post-pandemic period via Twitter posts published by European agri-food companies.

3. Research methodology

Twitter is an SM platform composed of 229 million users who post approximately 500 million tweets a day (Statista, 2022). Users can publish different types of posts: a "tweet" (a message in a maximum of 280 characters); a "mention" (a tweet in which the name of another user is contained preceded by "@"); a "reply" (a response to another user's tweet); or a "re-tweet" (a sharing of a tweet already posted by another user) (De Lima, 2022).

This platform was chosen for multiple reasons. First, Twitter is considered one of the most extensively used social networks globally (Huang *et al.*, 2019). Furthermore, unlike other social networks, being an open-source platform, it supports researchers in data collection and analysis. Finally, despite the limitations of tweets, the brevity of the content allows for reaching a broader audience from different backgrounds and geographical locations, enabling a holistic comprehension of the CE debate (De Lima, 2022). Accordingly, companies are more likely to disclose information and share posts frequently. Given these characteristics, Twitter was considered suitable for our research purpose.

A sample of European agri-food companies was extracted from the "ORBIS Bureau van Dijk International" database using the ATECO code "10- food processing industries". The first one hundred companies per capital market were selected. The dimension criterion was chosen since a company's size principally affects its attitude towards circular and environmental investments (Giacomini *et al.*, 2020). Moreover, larger companies are more willing to disclose CE practices. For each company selected, the presence of a Twitter account has been verified. Accordingly, six companies that did not have an account were eliminated from the sample. In addition, the activity of the Twitter profiles was considered in order to

Authors	Year	Sector	Actor	Focus	Social media	Main findings
Giudice *et al*	2020	Agri-food	Twitter users	Causes and effects of Covid-19 on the AFS.	Twitter	COVID-19 has affected discourse around the AFS. The dominant theme in the pre-pandemic was food safety; during the lockdown, food security; in the post-lockdown, food sustainable management theme
Grover and Kar	2020	n.d	Twitter users	Understanding the main discussed topics on CE and the polarity of the sentiment	Twitter	The most popular discussed themes were the economic benefits of CE, the environmental impacts and resource scarcity
Jiang *et al*	2021	n.d	Shanghai SM users	Sentiment and engagement of households on waste segregation and recycling	Several SM	The engagement level has increased after the introduction of a national policy on waste management in 2019
Loia *et al*	2022	Oil and gas	Twitter/ Instagram users	To investigate the collective perception regarding the future of offshore platforms	Twitter/ Instagram	CE is one of the homogeneous categories of words retrieved from the sentiment analysis performed
Arman and Mark-Herbert	2022	n.d	Consumers	To investigate consumers' behaviour in second-hand product trading experiences	Facebook	The SM can support consumers in activating reuse-oriented behaviours
De Lima	2022	n.d	Twitter users	To investigate how and why the CE is debated on Twitter	Twitter	Users stressed reactive approaches to address climate change and global sustainability challenges. A minority of users have highlighted the need of proactive and collaborative approaches to empower the CE transition

(*continued*)

Table 1.
Prior research on the circular economy through social media

Authors	Year	Sector	Actor	Focus	Social media	Main findings
Gong *et al*	2022	n.d	China SM users	To investigate the role of SM in monitoring and assessing environmental communication.	Sina Weibo/ Wechat/ Qzone	A 'zero-waste city' public environment policy is constantly promoted on SM.
Tsironis *et al*	2022	All sectors	EU companies	Potential trends in CE activities and regional differences in EU companies	LinkedIn	Companies give collective information on CE among the countries they operate in and on CE entrepreneurship in EU.
Shahidzadeh and Shokouhyar	2022	Electronic	Twitter users	To investigate the reverse logistics decision-making in the circular economy context by comparing developing and developed countries	Twitter	SM analytics is a low-cost and fast strategy to convert the supply-chains into consumer-centric circular supply chains
Mirzaei and Shokouhyar	2022	Mobile	Customers	To investigate customers' points of view on the role of CE in sustainable supply chain practices	Twitter	Customers' attention is mainly focused on environmental practices compared to other triple-bottom-line dimensions

Table 1.

analyse only companies that actively use SM. As a result, five companies with zero posts on their Twitter account were excluded.

The final sample was composed of eighty-eight companies. The highest number of the selected companies operating in the production (i.e. 31) and transformation (i.e. 46) stages of the agri-food supply chain. Only one company is located in the distribution stage. While ten AFS firms work in more stages (production-transformation and transformation-distribution stages). The geographical location of the sample is predominantly fairly distributed among European countries, with a higher concentration in France (i.e. 16 companies), United Kingdom (i.e. 14) and Netherlands (i.e. 11).

In order to explore CE engagement level of Twitter's accounts in the AFS during the pandemic and post-pandemic period, all tweets published by each company from 9 March 2020 until 19 June 2022 were collected (i.e. 17,759), purified and analysed using data mining techniques.

Data mining was performed using NVivo software. More specifically, the open-source extension "NCapture" drawing on Application Programming Interface (API) was adopted in order to easily access Twitter accounts (Reyes-Mendez *et al.*, 2018). The tweet's publication date, the number of "likes" and the number of "re-tweets" were extracted for each post.

The number of likes provided insight into the level of the user agreement with specific content, whereas the number of re-tweets was used to interpret the degree of debate among Twitter users.

Data analysis was structured into three phases: 1) dictionary-based content analysis with NVivo, 2) manual content analysis performed by two coders independently and 3) results integration and assessment.

The authors developed a coding framework based on the 4-R paradigm proposed by Kirchherr *et al.* (2017), reclassifying the Circular Economic Glossary accordingly. Furthermore, a "general" CE bracket was added for two reasons: on the one hand, to enclose tweets linked to the CE but not related to the other "reduce", "reuse", "recycle" and "recover" categories. On the other hand, considering that several words not contained in the Circular Economy Glossary could be used by companies (such as synonyms and other words always related to sustainability and the CE), other keywords were added to the coding framework for greater comprehensiveness.

The NVivo software identified tweets in which the defined words occurred. The extracted tweets were then manually analysed, with a thematic content analysis (referring to the five categories of the developed coding framework) performed.

Table 2 presents the coding framework adopted in performing both the supervised and manual content analysis.

Automated measurement of occurrences was allowed by implementing a supervised machine learning technique, through NVivo software. Moreover, an additional analysis focused on the connection between the COVID-19 pandemic and CE was performed. The posts classified as CE tweets were analysed again with NVivo in order to extrapolate co-occurrences of the terms "circular economy" AND "Covid-19" OR "pandemic". Furthermore, to strengthen the analysis and investigate the type of content, in terms of its informing or interacting nature (Schroder, 2021), two independent researchers carried out a manual content analysis through an empirically grounded approach. The coders classified

Categories	Concept	Words
Reduce	Discussion around refusing, rethinking, redesigning, minimisation, reduction, preventing resource use and/or preservation of natural capital	carbon footprint reduction; environmental impact reduction; raw materials reduction; waste reduction; emissions reduction; design; reduce
Reuse	Discussion reusing (excluding waste), closing the loop, cycling, repairing and/or refurbishing resources	alternate materials; disassembly; durability; maintain; redistribute; refurbish; remanufacture; repair; reuse; upcycling; waste diversion:
Recycle	Discussion around remanufacturing, recycling, closing the loop, cycling and/or reusing waste	anaerobic digestion; compostable; composting; end-of-life; Radio-Frequency Identification; recyclability; recycle
Recover	Discussion around the incineration of materials with energy recovery	dematerialisation; Raw Material Conversion; water conservation; waste conversion
General	Discussion around the general concept of circular economy and sustainability not englobed within the previous categories	circular economy; biodiversity; closed-loop; finite materials; green financing; regenerative production; renewable energy; renewable materials; renewable source; reverse logistics; sharing virgin materials; sustainability; SDGs; sustainable development; sustainable production; sustainable consumption

Source(s): Table adapted from Kirchherr *et al.*, 2017 and Barnabè and Nazir (2020)

Table 2. Glossary of circular economy reclassification according to the 4-R paradigm

tweets as "informing" if they communicate an action, an initiative, a goal, a policy or a performance. By contrast, posts that showed an engagement with stakeholders were classified as "interacting" (Esposito *et al.*, 2021).

Furthermore, stakeholder engagement was investigated by analysing the communication direction of each post. The tweets that enabled a comment by an account were classified as "two-way communication"; else, posts were categorised as "one-way communication" (Schroder, 2021).

To prevent subjective interpretation and to evaluate inter-coder reliability, Krippendorff's alpha index (α) was calculated. The coefficient, computed on 20 June 2022 on the first 20% of posts, is equal to 0.86. This value can be considered satisfactory since it is within the range of 1.00 (equivalent) and 0.00 (entirely different) (Krippendorf, 1980). The results were combined and are systemically illustrated in the following section.

4. Results

Table 3 provides descriptive statistics of the posts extracted from the agri-food company profiles from 9 March 2020 to 19 June 2022. The results show that only 18.52% of the extracted tweets can be categorised as CE content, compared with 81.47% of posts classified as "NO-CE" content. However, the findings display that non-CE messages had a lower level of stakeholder engagement than CE messages. In particular, the mean value of likes for CE tweets (i.e. 0.598) was higher than the "NO-CE" tweets (i.e. 0.189).

Furthermore, Table 3 provides the results for the frequency of likes and re-tweets retrieved from the sample, classified according to supply-chain stage. Companies that operate within multiple stages of the AFSC were more likely to publish posts focused on the CE (i.e. 34.53%), while companies that operate in the production stage disclosed CE information in 18.20% of published posts. The transformation (i.e. 15.35%) and distribution (i.e. 14.81%) stages display similar levels of CE disclosure. Also, the greatest number of likes and re-tweets for CE messages were retrieved for posts published by companies settled in the production stage (i.e. 0.621; 1.528) and in the combined stage (i.e. 0.701; 1.928) categories. The distribution stage showed lower levels of likes and re-tweets.

From the results reported in Figure 1, it is possible to assume that companies are showing increasing attention to sustainability and CE-related issues after the spread of the COVID-19 virus, especially in the post-pandemic period, with an uptick in 2021 for all the analysed companies, passing from 126 posts to 2430 CE posts.

The CE tweets were classified according to the analytical framework. Table 4 shows the descriptive statistics of each CE dimension ("reduce", "reuse", "recycle", "recover" and "general CE" categories). The results indicate that the CE disclosure of the agri-food companies was mainly focused on the "general CE" (i.e. 932; 28.33%) and "recycling" dimensions (i.e. 757; 23.02%). By contrast, the "reuse" dimension was less disclosed by agri-food companies on Twitter (i.e. 440; 13.38%).

To investigate whether the agri-food companies disclosed CE information about the COVID-19 virus, a co-occurrences analysis of the words "Covid-19" or "pandemic" within the tweets classified as CE posts was performed. Table 5 shows the results per year and CE dimension. Not surprisingly, in line with the previous findings, agri-food companies published the highest number of posts on COVID-19 in 2021 (i.e. 518) and in relationship with the "general CE" dimension (i.e. 621).

Table 6 presents the direction and balance of communication of the CE tweets as regards engagement. Most of the published CE posts showed two-way communication (i.e. 67.13%). However, agri-food companies were more likely to disclose CE issues through posts of an informative nature (i.e. 73.88%) without formulating messages to obtain an active approach from stakeholders.

	Tweets classification							
	CE tweets		NO-CE tweets		Total tweets			
	Mean	SD	Mean	SD	Mean	SD		
Like	0.598	1.942	0.189	6.340	0.538	1.893		
Re-tweet	1.646	4.970	1.189	1.498	1.901	5.982		
Obs	3,289		14,470		17,759			
Obs %	18.52%		81.47%		100%			

	Tweets classification per supply-chain stage											
	Production				Transformation			Distribution			Combined stages			
	CE		Total		CE		Total	CE		Total	CE		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Like	0.621	1.823	0.215	1.947	0.539	1.785	0.287	4.323	0.421	2.582	0.342	1.739	0.701	1.899	0.321	2.157
Re-tweet	1.528	3.257	1.489	4.012	1.792	2.989	1.322	3.218	1.622	1.987	1.598	2.008	1.982	4.327	1.523	3.986
Obs	1,142		6,275		1,425		9,285		28		189		694		2010	
Obs %	18.20%		100%		15.35%		100%		14.81%		100%		34.53%		100%	

Note(s): *SD = Standard Deviation

Table 3.
Classification of the extracted tweets

Furthermore, it emerged that in 2020, agri-food companies published the highest percentage of posts considered two-way communications to engage with followers (i.e. 80.16%). 2022 saw the highest percentage of posts with an interactive nature published (i.e. 51.43%).

Lastly, communication direction and balance per CE dimension are presented in Table 7. Contrary to our expectation, the "recover" category had the highest percentage of messages of a two-way nature (i.e. 82.77%), while the "reduce" category exhibited a more interactive nature (i.e. 37.66%) compared with the other dimensions of the analytical framework.

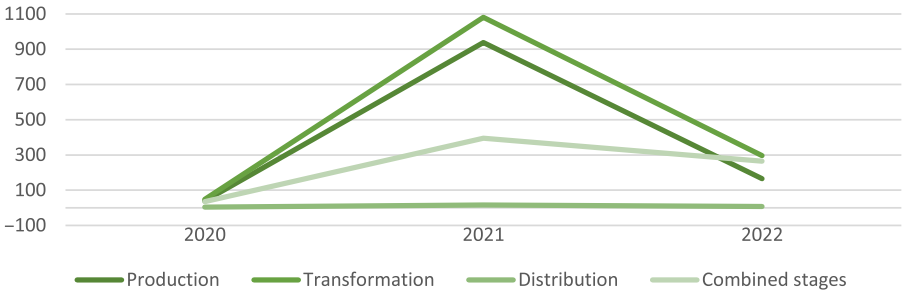

Figure 1.
Evolution of CE tweets from 2020 to 2022 (as of 19th of June 2022)

	Reduce		Reuse		Recycle		Recover		General CE	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Like	0.798	1.523	0.321	1.231	0.821	1.852	0.352	1.678	0.888	1.321
Re-tweet	1.452	3.214	1.120	2.120	1.991	1.821	1.779	2.452	1.912	3.325
Obs	632		440		757		528		932	
Obs%	19.22		13.38		23.02		16.05		28.33	

Note(s): *SD = Standard Deviation

Table 4.
Classification of tweets according to the CE framework

	Reuse	Reduce	Recycle	Recover	General CE	Total
2020	–	–	–	8	11	*19*
2021	–	121	87	21	289	*518*
2022	12	24	38	3	321	*398*
Total	*12*	*145*	*125*	*32*	*621*	*935*

Table 5.
Analysis of co-occurrences of "Covid-19" or "pandemic" within extracted CE tweets

	2020		2021		2022		Total	
Direction type	*n*	%	*n*	%	*n*	%	*n*	%
One-way communication	25	19.84	836	34.40	220	30.01	1,081	32.87
Two-way communication	101	80.16	1,594	65.60	513	69.99	2,208	67.13
Informative communication	89	70.64	1985	81.69	356	48.57	2,430	73.88
Interacting communication	37	29.36	445	18.31	377	51.43	859	26.12
Total CE tweets	*126*	*100*	*2,430*	*100*	*733*	*100*	3,289	100

Note(s): **n* = number of posts

Table 6.
Direction and balance of communication of CE tweets from 2020 to 2022 (as of 19 June 2022)

5. Discussion

The transition from a linear to a circular model needs a cooperative approach for reinforcing natural capital, streamlining resource outputs and reducing the adverse effects of the linear economic model on the environment and society in general (Poponi *et al.*, 2022). Any weak link in the supply chain, not inspired by CE principles, could negatively affect the closed-loop capacity of the entire supply chain. As a result, if one actor, or only a few actors, of an AFS system adopts rigorous 4-R policies while other actors do not share the corresponding principles and initiatives, the whole system will have a loss of circular efficiency (Christopher, 2011).

The diffusion of information related to CE and sustainable practices is becoming increasingly relevant for policymakers, shareholders and other stakeholders, due to the rise in interest and sensitivity to sustainability issues (Kazancoglu *et al.*, 2021). Sharing information on the CE and sustainability with a broad panel of stakeholders can support companies in building a corporate image in line with the market and consumer requests and – in turn – reach stakeholder legitimacy (Barnabè and Nazir, 2020). Furthermore, the dissemination of CE information can activate collaborative actions and associations among all supply-chain actors, positively affecting CE practice implementation (Gupta *et al.*, 2019).

The results confirm that in the European AFI, increasing awareness of the role of CE in overcoming crises and restarting of the whole AFSC is arising. Moreover, our findings are in line with previous research on CE disclosure (e.g. Barnabè and Nazir, 2020, 2021), according to which the attention paid to recycling practices has anticipated the spread of CE models. Consequently, as companies are more inclined to implement recycling practices, their disclosure is easier than other 4-R practices and more comprehensive for stakeholders. However, implementing recycling does not imply a company adopting a circular business model. Accordingly, the pathway towards successful circular transition – which requires a long-term journey – can start by sharing recycling practices among the entire AFSC, pushing the circularity of the supply chains, and only after the complete shift of the business models within each stage of the supply chain.

As was highlighted in prior research, CE communication requires an assessment of stakeholder perspectives to reach a proper level of engagement which can enable cooperative mechanisms (Gupta *et al.*, 2019). Data mining of agri-food Twitter communications shows that companies received more interactions on posts focused on CE and sustainable information than the other posts, confirming the high sensitivity level of customers (and stakeholders in general) towards these issues. However, the messages published by agri-food companies are predominantly informative in nature, showing that despite the relevance in creating engagement, agri-food firms are likely to publish CE posts with the purpose only of communicating and disclosing their initiatives and performance, without the specific aim of interacting with stakeholders. Accordingly, the engagement process does not start from the proactive approaches of companies but from the stakeholders, showing how using SM can activate virtuous cycles of value sharing among users. Lastly, in line with the results of Giudice *et al.* (2020), during the post-pandemic period, the topic of CE has been discussed in

	Reuse		Reduce		Recycle		Recover		General CE	
Direction type	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
One-way communication	379	59.97	128	29.09	288	38.05	91	17.23	195	20.92
Two-way communication	253	40.03	312	70.91	469	61.95	437	82.77	737	79.08
Informative communication	394	62.34	341	77.5	563	74.37	408	77.27	724	77.68
Interacting communication	238	37.66	99	22.5	194	25.63	120	22.73	208	22.32
Total CE tweets	632	100	440	100	757	100	528	100	932	100

Note(s): **n* = number of posts

Table 7. Direction and balance of communication of CE tweets per CE category

combination with the COVID-19 crisis, highlighting the relevance of the commitment to sustainable development goals for a resilient restart of the AFI.

6. Conclusions

Application of the principles of the CE in the AFS is an important and, above all, necessary change to transform society, face future challenges and become more resilient to crises. However, this change requires innovative business models that make use of the broad involvement of all AFSC actors as well use SM.

This research has highlighted that SM can communicate and disclose CE-related information, such as practices, initiatives and performances, to a whole forum of stakeholders. Moreover, SM could also be a useful tool to stimulate dialogue among stakeholders and society. Positive dialogic engagement can support agri-food companies in raising awareness among SM users of the need to be part of the CE transition to allow ecosystem survival.

At the same time, stakeholder dialogue arises as a pivotal topic that enables agri-food managers to encompass stakeholder expectations in their strategies, promoting the transition towards an effective CE.

This study can be helpful for both scholars and agri-food managers, who can count on our findings to explore and adopt SM to disclose their commitment to the CE, stimulating digital debate and enhancing stakeholder dialogic engagement. In addition, institutions can establish frameworks and guidelines for CE communication through SM at the European and international levels.

Furthermore, the research attempts to provide theoretical implications. Despite the literature on stakeholder engagement and CE disclosure being poor, SM can be considered one of the most helpful tools for creating a continuous and interactive dialogue between agri-food companies and their stakeholders. Accordingly, scholars can explore this research window in-depth to provide practical recommendations and proposals for agri-food managers to establish engaging disclosure strategies.

Moreover, scholars can explore CE disclosure via SM according to different theoretical perspectives.

Nevertheless, this research has some limitations. First, it is limited to a defined period and was performed with specific software. Future research could employ different instruments to extract and analyse data from other periods and using different analytical frameworks. Furthermore, academics can investigate the use of other SM, like Instagram, Facebook and LinkedIn, or perform the analysis on a larger company sample in different geographic areas.

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Further reading

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