Agri-food Cooperatives' Online Marketing: Evaluation of the Strategies Utilized by Spanish and UK Food Retailers Pre- and Post-COVID-19 Pandemic

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ABSTRACT: The use of big data by large food retailers is increasing their bargaining power against the agri-food cooperative sector. The aim of this study was to determine the social media behaviour of food retailers in Spain and the UK, and to identify significant changes pre- and post-COVID-19 pandemic. The study analysed Twitter data collected from 16 food retailers; a total of 102,200 valid tweets were extracted from their official Twitter accounts. A term frequency analysis and a social network analysis of food retailers' Twitter behaviour were carried out. The results obtained show differences for both UK and Spanish retailers before and during the COVID-19 pandemic. For agri-food cooperatives with little bargaining power in the supply chain of fresh produce, data analysis is a key factor in improving their competitive positioning. These findings should be of value to data scientists as well as managers responsible for forming strategies in agri-food firms that have large food retailers as clients. Finally, the study also confirms that, for agri-food cooperatives, analysing tweet content is a cheap and useful tool for understanding customer behaviour.

KEYWORDS: Social network analysis, twitter, food retailers, text mining, social media marketing, content analysis, agri-food cooperatives.

ECONLIT DESCRIPTORS: D82, D85, M31, Q13.

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RESUMEN: El uso del Big Data por las grandes cadenas de alimentación está aumentando su poder de negociación frente al sector cooperativo productor agroalimentario. Este trabajo tiene como objetivo determinar el comportamiento en las redes sociales de los minoristas de alimentos que operan en España y el Reino Unido en las redes sociales, así como identificar cambios significativos antes y después de la pandemia de COVID-19. El estudio analiza los datos de Twitter de 16 minoristas de alimentos de los que se extrajo un total de 102.200 tweets válidos de sus cuentas oficiales. El análisis de contenido y de redes sociales mostró diferencias tanto en el comportamiento en Twitter de los supermercados del Reino Unido y de España, así como antes y durante la pandemia de COVID-19. Para las cooperativas agroalimentarias con poco poder de negociación en la cadena de suministro de productos frescos, el análisis de datos de redes sociales en internet es un factor clave para mejorar su posición competitiva. Estos hallazgos deberían ser valiosos para los científicos de datos y gerentes responsables de la formación de estrategias de las empresas agroalimentarias que tienen como clientes a grandes cadenas de alimentación. Finalmente, el estudio también confirma que, para las cooperativas agroalimentarias, el análisis de contenido de los tweets es una herramienta barata y útil para entender el comportamiento de sus clientes.

PALABRAS CLAVE: Análisis de redes sociales, Twitter, Cadenas de supermercados agroolimentarios, Minería de texto, Márketing de medios sociales, Análisis de contenido, Cooperativas agroalimentarias.

170

Resumen ampliado

Marketing online en las cooperativas agroalimentarias: evaluación de las estrategias utilizadas por los minoristas de alimentos españoles y británicos antes y después de la pandemia de COVID-19

Objetivos

El análisis del Big Data por las grandes cadenas de supermercados de alimentación está aumentando su poder de negociación frente a los pequeños productores agroalimentarios.

Para las cooperativas agroalimentarias, conocer los intereses de estos minoristas es vital para definir sus estrategias de producción y comercialización y, en el contexto de las redes sociales online, podemos interpretar que la comunicación de los minoristas con sus usuarios podría muy bien reflejar sus intereses.

Este estudio tiene como principal objetivo determinar el comportamiento en Twitter de las grandes cadenas de supermercados de alimentos que operan en España y Reino Unido. Para ello se abordan dos preguntas de investigación: ¿Existen diferencias en el uso de Twitter entre los minoristas de alimentación que operan en los mercados español y británico?; y ¿Hay diferencias en su comportamiento en Twitter antes y después de la pandemia de COVID-19?

Metodología

Se realizó una selección de los 16 principales minoristas de alimentación que operan en Reino Unido y España, dos de los principales países europeos productores y consumidores de alimentos frescos, descartando aquellos que no disponen de página oficial de Twitter o un número mínimo de seguidores o tweets para ser relevante en este análisis (10.000 seguidores y 6.000 tweets publicados).

Para verificar la autenticidad del perfil de cada usuario, se analizó el número de seguidores, el número de tweets, la antigüedad de la cuenta y la frecuencia de tweets.

Los tweets se extrajeron mediante un algoritmo automático a partir de la API de Twitter. Dicha extracción se realizó en octubre de 2019 (antes de la pandemia de COVID-19) y febrero de 2022 (después de la pandemia de COVID-19), obteniendo un dataset final de 102.200 tweets originales. Los datos longitudinales para el análisis cubrieron períodos de dos años:

de octubre de 2017 a octubre de 2019 (antes del brote) y de enero de 2020 a enero de 2022 (durante la pandemia).

Se aplicaron métodos automáticos de procesamiento de texto basados en técnicas de tokenización, agrupamiento, clasificación, así como de análisis de redes para conocer las frecuencias de los hashtags y sus asociaciones.

Por último, las redes se visualizaron con un gráfico donde el tamaño de las aristas y nodos se representaron proporcionalmente a la cantidad de hashtags que comparten y las comunidades mediante colores.

Resultados, limitaciones a la investigación e implicaciones

Con el análisis de contenido se quiso comparar el comportamiento de los minoristas antes y después de la pandemia de COVID-19 tratando de identificar variaciones significativas en sus comunicaciones y convertirlo en conocimiento nuevo y útil para las cooperativas agroalimentarias.

Aunque los supermercados que operan en Reino Unido tienen más actividad en Twitter, los supermercados en España registran un mayor número de hashtags, un total de 6.234 frente a 2.087 antes del COVID-19. En ambos mercados, el número de hashtags se redujo durante el periodo de pandemia, aunque más pronunciado en Reino Unido.

Antes de la pandemia, en el Reino Unido la frecuencia de los términos indicaba cuatro aspectos principales, estilo de vida, cocina, salud y eventos o días especiales; mientras que durante la pandemia de COVID-19 surgieron temas relacionados con la seguridad y llamadas al ánimo de los usuarios. En el mercado español, los hashtags se relacionaban con la marca, cocina, salud y eventos o días especiales, reforzándose durante el periodo de pandemia la comunicación de marca, así como otros nuevos relacionados con la fidelización del consumidor y llamadas a la solidaridad.

Aunque con preocupaciones comunes, se detectan diferencias entre los mercados, con el Reino Unido ofreciendo mayor contenido en aspectos relacionados con el estilo de vida y en España con la marca en España.

El elemento longitudinal añade también una dimensión especialmente importante a los datos debido a la mayor importancia otorgada a nuevos temas. Todos los minoristas de alimentos del Reino Unido y España, durante el período de pandemia, reforzaron los hashtags relacionados con brindar información, aumentar la lealtad y describir sus mejores prácticas de seguridad. Entre las diferencias, notamos que los minoristas de alimentos del Reino Unido están más centrados en alentar a las personas, mientras que los minoristas de alimentos españoles abogan por la marca y la solidaridad.

En cuanto a los resultados de la red de Twitter en Reino Unido, Asda y Aldi son los supermercados con mayor importancia en la red por los vínculos de hashtags que tienen en común. Durante la pandemia, con la excepción de Tesco, todos los minoristas de alimentos del Reino Unido pertenecen a la misma comunidad con Morrison y Sainsbury's perdiendo relevancia en la red.

Un resultado similar se obtiene de la red española, donde Carrefour destaca por su importancia y su fuerte relación con Consum, Eroski y Alcampo. Al igual que Tesco en Reino Unido, Mercadona, que es la cuenta más activa en Twitter, no está conectada con el resto de supermercados. Durante la pandemia todos los minoristas españoles de alimentación pertenecen a la misma comunidad, aumentando su relevancia Aldi y disminuyendo Consum, Lidl, Dia y Mercadona.

Estos hallazgos podrían validarse a partir de un estudio de caso para otros productos relacionados con la industria agroalimentaria, extrayendo datos de otros sitios de redes sociales en Internet o utilizando otros algoritmos de análisis de contenido basados en aprendizaje automático.

Conclusiones prácticas y valor original

Al aceptar que las redes sociales han transformado y seguirán transformando la forma en que las empresas y los consumidores se comunican, las cooperativas agroalimentarias deberían utilizarlas como parte de sus esfuerzos generales de marketing, ya que los datos son numerosos y baratos de obtener. Así, los resultados de este estudio ofrecen un primer paso muy necesario para proporcionar conocimiento nuevo a los proveedores de productos frescos y perecederos a partir del uso de Twitter por los minoristas de alimentos.

Nuestro estudio realiza contribuciones sustanciales al descubrir patrones de comunicación y diferentes estrategias entre los minoristas de alimentos antes y durante el período pandémico de COVID-19

Los resultados apuntan a dos ejes de reflexión: la afinidad de algunos supermercados, y las diferencias y cambios en cuanto a su tipo de comunicación antes y durante la pandemia de COVID-19.

Todos los minoristas de alimentos otorgan gran importancia al estilo de vida y la dieta saludable. A su vez, la mención de días o fechas especiales, como el Día del Padre, y las campañas solidarias también son de interés en la estrategia de comunicación de los comercios de alimentación. El análisis de los datos extraídos y la topología de la red revelan que Asda en Reino Unido y Carrefour en España son los minoristas de alimentación con más presencia y relaciones más sólidas en la red. También es destacable que Tesco y Mercadona tienen una posición diferente al resto de minoristas de alimentación. Conocer esta información es importante para las cooperativas agroalimentarias, que pueden identificar qué canal de distribución, en este caso un minorista de alimentación, puede ser el más adecuado para desarrollar su estrategia de marketing y ganar una ventaja competitiva o un mejor posicionamiento en el mercado.

En términos generales, todos los minoristas de alimentos tuitearon con menos frecuencia durante la pandemia y cambiaron sus estrategias de comunicación. Sin embargo, vale la pena señalar que hubo minoristas que exhibieron un patrón de comportamiento opuesto al de otros. Los dos grupos de minoristas analizados en el presente trabajo también diferían en la importancia relativa atribuida a otros temas.

173

Con la mejor comprensión que ofrece esta investigación de las principales diferencias de la participación activa de los minoristas de alimentos en Twitter (que representan las redes sociales más amplias) en un momento de crisis, utilizando las técnicas presentadas en esta investigación, los gerentes de las cooperativas podrán usarlas para ganar una ventaja competitiva en el mercado.

Más allá de encontrar las respuestas a las preguntas propuestas, también surgen otras nuevas: ¿Las estrategias de los supermercados en Twitter son consistentes con sus estrategias de marketing? ¿El análisis de las redes sociales podría ayudar a las cooperativas agroalimentarias a elegir el tipo de minorista más adecuado que facilite las estrategias de colaboración? ¿Existe una comunicación diferente por tipo de producto alimentario? Dejamos estas cuestiones para futuros estudios.

174

1. Introduction

People use social networking sites (SNSs) (e.g., Facebook, Instagram, TikTok, and Twitter) to express and share their opinions and feelings (Appel, Grewal, Hadi, and Stephen, 2020). SNSs are also changing the way companies communicate with consumers (Constantinides, 2014). In fact, 90% of marketing professionals recognize them as a competitive factor (Stelzner, 2016). These marketing professionals have learned that, due to the large volume of users and the time they actively spend on SNSs, social networks are a powerful tool for communicating with customers. Thus, just as people create profiles on online social networks, so do companies.

Among SNSs, Twitter has become one that has most attracted the interest of companies, which use it to manage interactions with consumers (Andzulis et al., 2012; Sashittal and Jassawalla, 2019; Zanini et al., 2019). In the field of agri-food, some authors have analysed tweets in areas such as consumer food preferences or habits (Moreno-Sandoval, 2018; Vidal et al., 2015) or food companies communicating their corporate social responsibility (CSR) efforts (Araujo and Kollat, 2018). However, in food research they have not been explored as appropriate (Moreno-Sandoval et al., 2018), and, to date, we have not found any research investigating the usefulness of social media for agri-food cooperative enterprises.

These new business resources allow companies such as large food retailers to carry out new types of marketing research, since information obtained in this way can be valuable when conversations and interactions with consumers occur in an open and natural environment.

The fresh food value chain is asymmetric, in which small agri-food coops depend on retailers (Cucagna and Goldsmith, 2018), and the use of big data by food retailers could increase their bargaining power against the agri-food cooperative sector.

For agri-food cooperatives, knowing retailers' interests is vital in order to define production and marketing strategies, and in the context of SNSs, we can infer that the communication of retailers with consumers through Twitter could very well reflect their interests.

The UK is one of the biggest consumers of fresh food, with Spain being its main supplier (Messe Berlin GmbH, 2018), and this paper helps to fill the research gap by assessing the utility of analysing the content of Twitter as a cheap technique for agri-food cooperatives.

The COVID-19 pandemic has been one of the most disruptive events faced by humanity in recent times, modifying our daily life and introducing big changes in consumer behaviour in general (Sheth, 2020) and eating habits in particular (Ben Hassen et al., 2020; Di Renzo et al., 2020; Husain and Ashkanani, 2020; Laguna et al., 2020; Sidor and Rzymski, 2020; Reyes-Olavarría et al., 2020). In this context, Kaya (2020) asserted that social media has been the foremost communication channel throughout the pandemic.

As the pandemic has also increased the resilience of the food system (Orden, 2020; Weersink et al., 2021), the focus of the present work was also on whether it changed the meaning of communication by food retailers on social media.

Thus, our study makes a substantial contribution by uncovering communication patterns and different strategies of food retailers before and during the COVID-19 pandemic period.

175

Building on the above, the aims of this exploratory study were to analyse whether food retailers, when faced with the COVID-19 pandemic, changed their communication on social media, and if so, who made the changes and what were the differences. To this end, we addressed two research questions (RQs):

- RQ1: Are there different topics between food retailers operating in the Spanish and UK markets? (The purpose of this question is to identify differences among food retailers.)
- RQ2: Are there differences in their Twitter behaviour before and after the COVID-19 pandemic? (This question aims to explore the differences between the two periods.)

To answer these questions, we performed data extraction and analysis using text mining of tweets written by the main food retailer accounts operating in Spain and the UK. With this content analysis, we tried to compare retailers' behaviour pre- and post-pandemic to identify significant variations in their communication and to provide new and useful knowledge for agri-food cooperatives.

Our results confirm that there are differences among supermarkets and between before and after the COVID-19 outbreak. In this sense, we highlight a lower use of hashtags during the latter, especially by some food retailers, as well as a greater orientation towards reporting on issues related to safe practices, brand reinforcement, and customer loyalty.

2. Literature review

New social media analytics can indicate how other users are experiencing the same or other types of activities (Kristensson, 2019). SNSs, such as Facebook, Twitter, TikTok, and Instagram, are social media Internet services that allow users to create and maintain relationships with other users of those sites (Boyd and Ellison, 2008; Ellison, 2007; Mangold and Faulds, 2009).

The advantages of using SNSs as a marketing tool for companies are well documented; social networks allow them to develop a sustained relationship with consumers (Harris and Rae, 2009). They can use SNSs to promote their brands or values (Araujo and Kollat, 2018; Erdogmus and Tatar, 2015; Ladhari et al., 2019), or cultivate and maintain relationships with users (Clark and Melancon, 2013; Kim and Ko, 2012). SNS marketing strategies can also increase purchase intentions (Hollebeek, Glynn, and Brodie, 2014). Thus, companies such as food retailers can know how the information available on SNSs affects their image (Degeratu, Rangaswamy and Wu, 2000), and to identify and attract new customers (Harris and Rae, 2009; Nobre and Silva, 2014; Taueja and Toombs, 2014).

In relation to the way users interact on social networks, compared with other SNSs, Twitter has the highest usage for businesses (78%) (Go and You 2016), as it is oriented to asking and answering questions (Smith, Fischer, and Yongjian, 2012).

During the COVID-19 pandemic, an increase in the consumption of fresh food was observed (Güney and Sangün, 2021; Janssen et al., 2021), in line with an increase in healthier dietary patterns (Laguna et al., 2020; Rodríguez-Pérez et al., 2020).

Likewise, research points out a reduction in shopping frequency (Janssen et al., 2021), although among the products purchased with higher frequency were vegetables (Ben Hassen et al., 2020; Rodríguez-Pérez et al., 2020). Indeed, the importance of vitamin intake to fight against COVID-19 has been found to affect consumers' preference for fresh and nutrition-rich foods (Galanakis, 2020; Jayawardena et al., 2020; Wang et al., 2020). This change in consumer behaviour is an opportunity to expand the export markets for these products by producer countries (Güney and Sangün, 2021).

These identified changes in eating habits during the pandemic resulted in changes related to food purchasing behaviour. Consumers mainly bought food from discount stores, local grocery stores, and online shops (Marinković and Lazarević, 2021). Thus, the trend of using a variety of ways to obtain food generated a demand for "omnichannel" shopping (the ability to shop by different methods such as online, in physical stores, or order and pickup), which will likely become permanent (The Economist, 2021).

On the other hand, having to adjust eating habits to the actual pandemic situation mostly influenced consumers to take precautions when shopping for food, such as using disinfectants and practicing social distancing (Precioso and Samorinha, 2021), not staying long in stores and shopping in as few stores as possible (Yang et al., 2020), and buying food with later expiration dates (Hall et al., 2020; Laguna et al., 2020). Producers and food retailers must pay attention to these shopping behaviour changes under similar pandemic circumstances in the future.

Using text mining on its own (Hannigan et al., 2019) or in conjunction with social network analysis (SNA) (Angelopoulos and Merali, 2017), large volumes of text can be summarized into closely grouped themes, making it possible to discuss the nature of their connections (Zuo et al., 2020).

Researchers have employed numerous methods to extract information from agri-food-related tweets, such as word-count analysis (Carr et al., 2015; Fried et al., 2014; Ruggeri and Samoggia, 2018), content analysis (Bearth, Cousin, and Siegrist, 2014; Vidal, Ares, and Giménez, 2013), sentiment analysis (Kontopoulos et al., 2013; Mattila and Salman, 2018; Mishra and Singh, 2018, Mostafa, 2019), and machine learning (ML) (Moreno-Sandoval et al., 2018; Singha, Shuklab, and Mishrac, 2018). However, it was found that research on SNSs remains fragmented, and in the domain of agri-business it is in a preliminary stage.

3. Methodology

This work followed the steps of theory building in big data-driven research by Kar and Dwivedi (2020):

1. Social media data collection and acquisition with the Application Programming Interface (API).
2. Data transformation and analysis with text meaning (term frequency analysis) and network meaning (community detection) techniques.
3. Data visualization using SNA to identify association rules among hashtags

3.1. Data collection

According to an EAE Business School study (2018), people make food purchases mainly at self-service locations, such as supermarkets and hypermarkets.

We also see that the highest percentage of consumer spending in the food distribution sector in Europe is currently focused on a small number of retailers. According to the "Global Powers of Retailing 2018" study (Deloitte TTL, 2018), of the 250 leading retailers worldwide, 36 are European food retailers (Table 1).

Table 1. Main European food retailers and their world position according to turnover level

ID	World pos.	Retailer	Country	Type of retailer
1	4	Lidl Schwarz Group	Germany	Discount Store
2	8	Aldi Group	Germany	Discount Store
3	9	Carrefour SA	France	Hypermarket/Supercenter/Superstore
4	11	Tesco PLC	UK	Hypermarket/Supercenter/Superstore
5	14	Ahold Delhaize	Netherlands	Supermarket
6	16	Metro Ag	Germany	Cash & Carry/Warehouse Club
7	18	Auchan Holding S.A.	France	Hypermarket/Supercenter
8	19	Edeka Group	Germany	Supermarket
9	22	Rewe Group	Germany	Supermarket
10	24	Casino Guichard-Perrachon SA	France	Hypermarket/Supercenter/Superstore
11	25	Centres Distributeurs E. Leclerc	France	Hypermarket/Supercenter/Superstore
12	31	J Sainsbury PLC	UK	Supermarket
13	33	ITM Development Int. (Intermarché)	France	Supermarket
14	39	Migros-Genossenschafts-Bund	Switzerland	Supermarket
15	43	Coop Group	Switzerland	Supermarket
16	47	Mercadona	Spain	Supermarket
17	48	Morrison	UK	Supermarket
18	50	Systeme U Centrale Nationale	France	Supermarket
19	67	Marks & Spencer Group	UK	Department Store
20	71	El Corte Inglés	Spain	Department Store
21	72	Coop Italia	Italy	Supermarket
22	78	Conad Consorzio Nazionale	Italy	Supermarket
23	80	ICA Gruppen AB	Sweden	Supermarket
24	88	S Group	Finland	Supermarket
25	93	Spar holding AG	Austria	Supermarket
26	98	Distribuidora Intnal de Alimentacion (DIA)	Spain	Discount Store
27	102	Co-operative Group Ltd	UK	Convenience
28	108	Louis Delhaize	Belgium	Hypermarket
29	110	NorgesGruppenASA	Norway	Discount Store
30	114	Dans supermarket (Salling Group)	Denmark	Discount Store
31	163	Jumbo Groep Holding BV	Netherlands	Supermarket
32	168	Grupo Eroski	España	Supermarket
33	171	Coop Danmarl A/S	Denmark	Supermarket
34	180	Coop Norge	Norway	Supermarket
35	242	Coop Sweden	Sweden	Supermarket
36	248	Iceland Topco Limited	UK	Supermarket

Source: Deloitte, 2018.

178

From this list, we first selected food retailers that operate in the UK and Spain, as they are two of the main fresh food producing and consuming countries in Europe. Those that did not have an official Twitter page or a minimum number of followers (10,000) or published tweets (600) were left out, as they were irrelevant to this analysis. Under these criteria, the sample was reduced to 15 user accounts.

To verify the authenticity of user profiles, we analysed the number of followers, the followee/friends count, tweet count, age of account, and tweet frequency statistics, including the number of tweets posted every day.

Adding the Consum supermarket (Kantar Worldpanel, 2018) to the Spanish list, we had a final sample of 16 food retailers, 8 in the UK and 8 in Spain.

Table 2. Main European food retailers and their world position according to turnover level

User account	Twitter join date	Number of tweets	Number of followers
UK			
AldiUK	04-2009	183,000	371,000
Tesco	03-2011	2,170,000	549,000
Sainsburys	10-2009	790,000	523,000
Morrisons	12-2010	335,000	282,000
Coopuk	06-2009	115,000	141,000
IcelandFoods	03-2009	86,700	168,000
Waitrose	06-2009	175,000	325,000
Asda	02-2009	16,900	460,000
Spain			
Lidlespana	07-2011	19,300	135,000
Aldi_es	07-2014	6,966	12,300
CarrefourEs	04-2011	49,100	225,000
Alcampo	10-2012	23,200	67,800
Mercadona	07-2011	88,500	170,000
DIA_esp	07-2012	14,600	59,600
EROSKI	10-2010	25,300	55,400
Consum	07-2010	27,600	16,600

Source: Twitter.com. Data extracted 27-6-2019.

As can be seen in Table 2, the data show that most of the Twitter accounts of the main UK supermarkets were started in 2009, whereas the Spanish were started between 2010 and 2012. The UK food retailers were also more active than the Spanish ones: while the Tesco and Sainsbury's accounts have published the most tweets, with 2,170,000 and 790,000 respectively, the most active Spanish accounts are Mercadona, with 88,500, and Carrefour, with 49,100.

179

3.2. Data extraction, cleaning, and tokenization

Every tweet (an individual message posted on the Twitter platform) was extracted using the rtweet package (Kearney, 2018) from R software (R Core Team, 2016) via Twitter's API.

From the automatically retrieved information, only the author of the tweet, the date of publication, the tweet identifier, and the content of the message were used in this analysis. Extraction was carried out twice, in October 2019 (before the COVID-19 pandemic) and in February 2022 (after the COVID-19 pandemic), and a dataset with 102,200 tweets was obtained. The number of tweets recovered in previous research was very variable, ranging from a few thousand to millions (Fried et al., 2014; Vidal et al., 2015).

The longitudinal data for the analysis involving the same retailers covered two 2-year periods: October 2017 through October 2019 (pre-pandemic) and January 2020 to January 2022 (during the pandemic).

The tweet cleaning process entailed removing from the text everything that did not provide information. In this study, we removed duplicate tweets, converted all text to lowercase, and eliminated non-informative patterns such as URLs, punctuation marks, HTML tags, and Arabic or Cyrillic characters.

The next step was to tokenize, or to divide the tweet content into minimal units with their own meaning (e.g., words), which for this analysis was hashtags. Prior to dividing the text, as every tweet was in a unique row, fulfilling the condition of an observation as a record, and several hashtags could be found in the same record, each token list had to be unnested, doubling the number of records as many times as there were hashtags in the same tweet. The entire cleaning and tokenization process was automated by a function designed to be implemented in R code.

3.3. Data extraction, cleaning, and tokenization

As any human labelling process can be time-consuming, or even impossible, automatic text processing methods based on tokenization and clustering techniques were used to determine hashtag frequencies and their associations. The unstructured texts (tweets) captured by the above method and transformed into structured texts (hashtags) by tokenization were utilized for exploratory analysis (word frequency) employing classification (Yanai and Kawano, 2014) and SNA (Barábasi, 2016) techniques.

Lastly, using open-source Gephi visualization software (Bastian, Heymann and Jacomy, 2009), the retailers' network was represented by a graph.

4. Results

4.1. Tag frequency

When it comes to understanding what retailers choose to communicate and, therefore, what interests them, it is interesting to first determine what hashtags they use and how often, as well as to interpret their meaning.

Table 3. Total number of hashtags used by each user account

UK user account	Total hashtags pre-pandemic	Total hashtags during COVID-19
1 AldiUK	119	153
2 asda	1,516	912
3 coopuk	118	243
4 IcelandFoods	96	21
5 Morrisons	74	6
6 sainsburys	2	3
7 Tesco	154	33
8 waitrose	8	24
Spanish User account	**Total Hashtags pre-pandemic**	**Total Hashtags during COVID-19**
1 alcampo	653	572
2 Aldi_es	228	1,586
3 CarrefourES	2,388	2,026
4 Consum	1,548	493
5 DIA_Esp	420	232
6 EROSKI	636	465
7 lidlespana	332	204
8 Mercadona	29	84

Although UK supermarkets were more active on Twitter, Spanish supermarket accounts registered a greater number of hashtags, 6,234 compared to 2,087, before COVID-19. In both markets, the number of hashtags was reduced during the pandemic, and this was more pronounced in the UK (Table 3).

While the supermarkets with the highest number of hashtags were Asda in the UK and Carrefour in Spain, it is worth mentioning that during the COVID-19 pandemic, Tesco surprisingly had a reduced number of hashtags in its tweets, while Coop, Aldi (in both markets), and Mercadona had an increased number (Table 3).

The food retailers that used the most hashtags were Asda in UK and Carrefour and Consum in Spain. These results make sense if we put the number of hashtags with their meanings in context (Tables 4 and 5).

Table 4. Top 20 hashtags in UK food retailer accounts

Pos.	Pre-pandemic	n	During COVID-19	n
1	goodliving	368	timetotalk	136
2	recipe	127	everydayamazing	113
3	freefrom	87	goodliving	113
4	vegan	75	itswhatwedo	88
5	meatfreemonday	54	freefrom	79
6	bankholiday	54	recipe	69
7	itswhatwedo	40	vegan	67
8	glasgow	38	meatfreemonday	38
9	retail	33	clubcardprices	31
10	unicorn	33	unicorn	24
11	fathersday	32	glutenfree	21
12	christmasbreakfas	29	fishfriday	18
13	glutenfree	29	asda	12
14	everylittlehelps	25	veganuary	12
15	win	24	vegetarian	12
16	fishfriday	22	tickledpink	11
17	tesco	20	easter	10
18	easter	18	disney	9
19	asda	17	bbq	8
20	bbq	10	christmasatwaitrose	7

182

Table 5. Top 20 hashtags in Spanish food retailer accounts

Pos.	Pre-pandemic	n	During COVID-19	n
1	alcampo	143	alcampo	224
2	yonavideo	135	aldi	140
3	concorazón	106	lavuelta	122
4	sushicarrefour	100	eroskiclub	101
5	recetaeroski	96	elclubcarrefour	80
6	carrefourtex	84	vueltaalcolesolidaria	80
7	navidad	81	kilosdesolidaridad	69
8	reto	79	fundacionsolidaridadcarrefour	66
9	millones	78	navidad	64
10	bio	73	zeroplasticos	64
11	eroskiclub	69	carrefourconlavuelta	62
12	carrefourbio	59	sabiasque	48
13	vivebio	56	crfdisasterchefs	45
14	recetaeroskiconsumer	55	blackfriday	41
15	navidear	53	disasterchefs	38
16	buenosdías	49	tokio	34
17	recetasconsum	48	alcampoproduccioncontrolada	30
18	ofertas	46	ofertas	28
19	receta	44	lacocinadealcampo	27
20	marcacarrefour	41	alimentos	26

Before COVID-19, the frequency of terms indicated four main aspects concerning retailers in UK: lifestyle (e.g., "goodliving"), cooking (e.g., "recipe"), health aspects (e.g., "freefrom", "vegan", "meatfreemonday"), and special days, campaigns, or events (e.g., "bankholiday", "fathersday", "christmasbreakfast"), while during the pandemic, hashtags related to safe information (e.g., "timetotalk") or encouraging people (e.g., "everydayamazing") emerged. The hashtags that Spanish food retailers used the most before the pandemic were related to brand (e.g., "alcampo" and hashtags that combine a word with a brand), cooking (e.g., "recipe"/"receta"), health (e.g., "bio"), and campaigns (e.g., "concorazon", "navidad"). During the pandemic, brand communication was reinforced (e.g., "alcampo", "aldi"), and other hashtags related to loyalty (e.g., "club") or calls for solidarity (e.g., "solidarity") appeared.

With regard to retailers, although they all seem to care about health, we can see a difference between the markets, with tweets in the UK having a greater emphasis on special days and lifestyle and in Spain on health and recipes (Table 6, left). However, the longitudinal element (pre- and post-outbreak) adds an especially important dimension to the data. During the pandemic, all of the UK and Spanish food retailers emphasised hashtags related to giving information, increasing loyalty, and describing their best safety practices. Among the differences, we noted that UK food retailers were more focused on encouraging people while Spanish food retailers advocated for brands, solidarity, and sustainability (Table 6).

Table 6. Top hashtags categorised by food retailer accounts

| Market	Food retailer	Before COVID-19 pandemic	During COVID-19 pandemic
UK	AldiUK	Special days or campaigns ("specialbuys", "fathersday", "bankholiday"), raffles ("win")	Encouragement ("everydayamazing"), special days ("aldinewyear"), lockdown ("backtowork")
UK	Asda	Health ("goodliving", "vegan"), recipes ("recipe"), brand ("asda")	Health ("goodliving", "vegan", "freefrom"), brand ("asda")
UK	IcelandFoods	Special days or events ("icelandcharityweek", "mothersday"), health ("vegan", "realfood")	Special days ("yorkshirepuddingday", "nationalstrawberryicecreamday", "december"), sustainability ("plasticfree"), information ("controversialopinion")
UK	Morrisons	Special days ("fathersday")	Trust ("lettertofarmer")
UK	Tesco	Special days ("fathersday")	Loyalty ("clubcardprices", "clubcardpayplus")
UK	Sainsburys	Special days ("fathersday")	Special days ("valentines", "chinesenewyear")
UK	Coop	Practices ("itswhatwedo"), health ("meatfreemonday", "nationalvegetarianweek")	Information ("timetotalk"), practices ("itswhatwedo")
UK	Waitrose	Practices ("workingwell"), sustainability ("planplastic")	Special days ("christmasatwaitrose"), practices ("strictly")
Spain	Alcampo	Campaigns ("concorazon"), recipes ("receta")	Brand ("alcampo"), food trust ("alcampoproduccioncontrolada"), offers ("lacocinadealcampo")
Spain	Lidlespana	Raffles ("sorteo", "cienesdelidl")	Recipes ("lidlrecetas", "lacocinadelidl"), sustainability ("comprometidosconelmanana", "resetplastic")
Spain	Aldi_es	Special days ("navidad", "verano"), health ("mantenlainocencia")	Brand ("aldi"), information ("sabiasque"), events ("tokio")
Spain	DIA_Esp	Health ("mayosingluten", "singluten")	Events ("olimpiadasdia", "tokio"), raffles ("sorteawortendia")
Spain	CarrefourES	Health ("bio", "carrefourbio"), special days ("navidad")	Events ("lavuelta", "vueltalcolesolidaria", "carrefourconlavuelta"), loyalty ("elclubcarrefour"), solidarity ("kilosdesolidaridad", "fundacionsolidaridadcarrefour"), sustainability ("zeroplasticos"), brand ("carrefour")
Spain	Eroski	Recipes ("recetaeroski"), health ("eroskinatur", "singluten"), brand ("eroski")	Loyalty ("eroskiclub", "eroskiconsumer"), recipes ("recetaeroski"), health ("eroskibio"), events ("navidad"), brand ("eroski")
Spain	Consum	Recipes ("recetasconsum"), special days ("navidad"). brand ("consum")	Practices ("decirhaciendo", "juntosescooperativa"), loyalty ("programaprofit"), information ("comprasegura", "detemporada"), recipes ("recetasconsum")
Spain	Mercadona	Special days ("dianacionaldelceliaco", "diamundialdelzumo", "diamundialdelaleche"), health ("singluten"), sustainability ("medioambiente", "diamundialdelreciclaje")	Brand ("mercadona"), special days ("diadereyes", "sanvalentin"), practices ("lomejorparadarlomejor", "social"), events ("diacontralaviolenciadegenero")

4.2. Social network visualization

In recent years, social media research has begun to look beyond the quantitative perspective to explore other aspects through network theory.

This study used SNA to identify key food retailers and similarities among them based on degree centrality, where nodes with more connections are considered more important (e.g., Borgatti, 2005; Freeman, 1979), and Louvain modularity (Blondel et al., 2008), which splits networks into clusters in order to identify communities, here, food retailers that are indirectly interconnected.

The network (retailer–hashtag) was transformed into a one-way network (retailer–retailer) and visualized using the ForceAtlas2 algorithm (Aggrawal and Arora, 2016) as the criterion for spatialization. The network is represented by a graph in which the sizes of edges and nodes are represented proportional to the number of hashtags they share, and colour represents communities (Figures 1 and 2).

Figure 1. Spatial distribution of retailer network centrality before COVID-19 pandemic: UK (left) and Spain (right)
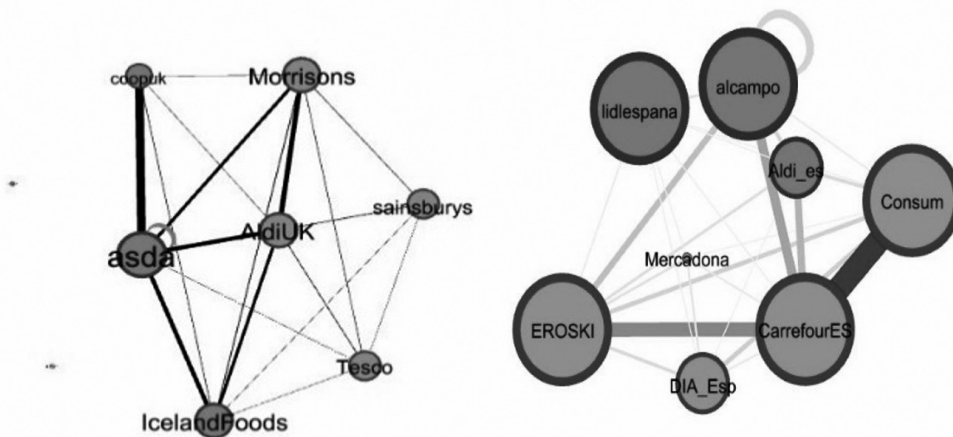
Figure 2. Spatial distribution of retailer network centrality after
COVID-19 pandemic: UK (left) and Spain (right)

In Figure 1 we can see that Asda and Aldi UK are two supermarkets with great importance in their network, with strong links to others by the hashtags they have in common: Asda had a strong relationship with Co-op UK, and Aldi UK with Morrisons. During the COVID-19 pandemic, with the exception of Tesco, all UK food retailers belonged to the same community, with Morrison and Sainsbury's losing relevance in the Twitter network.

A similar result was obtained for the Spanish network: Carrefour stood out for its importance and its strong relationship with Consum, Eroski, and Alcampo, among others. Similarly to Tesco, Mercadona, which had the most active Twitter account, did not stand out in the network before the pandemic and was not connected to the other supermarkets. It is worth mentioning that Lidl Espana had a strong presence in this network but very few connections with the other supermarkets. During the pandemic, all Spanish food retailers belonged to the same community, with Aldi increasing its relevance, and Consum, Lidl, Dia, and Mercadona decreasing theirs.

5. Discussion

Examining the Twitter activity of food retailers using text content analysis and SNA, some characteristics were detected that could be relevant for coops, which supply these food retailers.

The study confirms differences in the use of Twitter among food retailers. On the one hand, different strategies between supermarkets could be found, even within the same geographic region. In agreement with Kwak et al. (2010), there is positioning or presence in a network

strategy, which seems clear with Tesco, Sainsbury's, Carrefour, and Mercadona, and a communication strategy, which can be divided into brand communication (Erdogmus and Tatar, 2015), such as that used by Asda and Alcampo, whose hashtags were related to their brand, and communication of values (i.e., hashtags related to solidarity or sustainability), such as that used by Waitrose and Iceland Food in the UK and Lidl and Carrefour in Spain (Ladhari et al., 2019; Ruggeri and Samoggia, 2018).

As seen in text meaning, and in line with the literature on food choice (for example, Bisogni et al., 2007; Meiselman, 2008), a large proportion of tweets were motivated by a special event, most often days or special dates such as Father's Day or Christmas.

Other topics were related to healthy food issues, in line with previous studies (Chen, 2013; Samoggia, Bertazzoli, and Ruggeri 2019, Laguna et al., 2020; Rodríguez-Pérez et al., 2020).

Data collected in the two periods showed a behavioural change for the analysed food retailers due to the increased importance attached to new topics. In this sense, the hashtag categories related to information or practices (e.g., security, protocols, or precautions) are generally in line with the findings of previous research (Precioso and Samorinha, 2021; Yang et al. 2020).

Finally, hashtags associated with loyalty are related to a reduction of frequency or purchasing, in line with Janssen et al. (2021).

6. Conclusions

In a society so immersed in social networks, it is increasingly interesting to evaluate agent behaviour through different online platforms. Applying new techniques such as automatic text mining and online SNA, we conducted research on the European retail food industry, focusing on 16 food retailers in the UK and Spain in order to help agri-food cooperatives reduce information asymmetries with large retailers.

By accepting that social media has transformed and will continue to transform the way in which companies and consumers communicate, agri-food cooperatives should use it as part of their overall marketing efforts, as the data are numerous and cheap to obtain. The results of this study offer a necessary first step in providing new and useful knowledge for suppliers of fresh and perishable products from the Twitter data of food retailers.

The results point to two axes of reflection: (a) food retailers' tendencies, and (b) differences and changes regarding their types of communication before and during the COVID-19 pandemic.

In relation to RQ1, all food retailers attach great importance to lifestyle and healthy diet. The mention of special days or dates, such as Father's Day, and solidarity campaigns is also important, and is a relevant element of the communication strategy. The data analysis and network topology reveal that Asda and Carrefour are the food retailers with a greater presence and the strongest relationships in the online network. It is also notable that Tesco and Mercadona have a different position than the other food retailers. This information is important for agri-food

cooperatives, in order to identify which distribution channel, in this case food retailer, is the most appropriate to develop their marketing strategy and place their products on the market.

With respect to RQ2, the behaviour of online retailers has changed considerably from pre- to post-pandemic. Considering that the pandemic period could continue, this situation could become habitual and cooperatives should pay attention to this. Broadly speaking, all food retailers tweeted less frequently during the pandemic and changed their communication strategies. However, it is worth noting that some retailers exhibited an opposite pattern of behaviour (Tesco, Morrisons, Consum, and Aldi). The two groups of retailers analysed in the present work also differed in the relative importance of other factors. For example, the UK group placed more importance on providing safe information and encouraging people, while the Spanish group prioritised solidarity and brand. Thus, retailers' tweet-based behaviour significantly changed due to the pandemic.

With the improved understanding of the principal differences in food retailers' active participation on Twitter (representing social media in general) at a time of crisis that this research offers, by using the techniques presented here, coop managers will be able to gain a competitive advantage on the market.

Beyond finding the answers to the proposed questions, new questions also arise: Are the strategies of supermarkets on Twitter consistent with their marketing strategies? Could an analysis of social networks help agri-food cooperatives choose the most appropriate type of retailer to facilitate collaborative strategies? Are there different types of communication based on the food product? We leave these questions to future studies.

Finally, these findings could be validated either by a case study of other agri-food-related products, extracting data from other SNSs, or using other machine learning-based content analysis algorithms.

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194

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195