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Challenges of digitization in the social economy in times of pandemic: the evolution of online presence and e-commerce in agri-food cooperatives

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Abstract

Online presence is essential for companies operating in the social economy. The health crisis resulting from Covid-19 has reinforced the need to access the Internet and develop online commerce. This paper analyses the online presence of Catalan agricultural cooperatives, their level of maturity in the development of e-commerce and the changes that have occurred during the years characterized by the restrictions resulting from the pandemic. To this end, content analysis and the eMICA methodology (Extended Model of Internet Commerce Adoption) were used to study the websites of various Catalan agricultural cooperatives. The model was applied to 104 cooperatives with an online presence in 2022, and the results were compared to a previous study conducted in 2018. The results indicate that although cooperatives have improved their online presence, especially in relation to online commerce, there is still much room for optimal interaction with their target audience. The pandemic and resulting restrictions on mobility forced a rapid deployment of e-commerce, often without sufficiently developing the interactivity of websites. The circumstances within the sample are varied, with wine cooperatives being the most mature in their use of e-commerce compared to olive oil and fruit cooperatives. The latter are the most deficient in their online presence and e-commerce development.

Keywords: Agri-food cooperatives, e-Commerce, Web content analysis, eMICA, Internet, Digital marketing

Introduction

Nowadays, the widespread use of information and communication technologies (ICTs) by both citizens and organizations has changed society's routine behaviour, giving rise to the so-called information society (Ziemba 2019). Additionally, the health crisis resulting from Covid-19 has had a direct impact, both locally and globally, on societies in general and the agri-food industry in particular (Desa and Jia 2020; Phillipson et al. 2020).

It is likely that some of the effects the pandemic has had on agri-food will become commonplace and this will lead to a change in the management strategies employed

by agri-food companies (Apostolopoulos et al. 2021). Although the pandemic has at times created difficult and complex situations, at the same time it has created opportunities for entrepreneurship in the agri-food sector and enhanced market-oriented strategies. These include improving the online presence of agricultural organizations and businesses (Altarturi et al. 2023; Mastronardi et al. 2020).

Organizations integrate social media into their marketing strategy and use it mainly to contact and provide information to their customers (Hofacker and Belanche 2016). Thus, the use of ICTs by companies improves their access to the external market, providing them, in turn, with more and better access to foreign trade (Burststein and Vogel 2017). Since e-commerce reduces transaction costs and eliminates geographical barriers, it facilitates contact between users anywhere in the world (Cristobal-Fransi et al. 2015). The use of ICTs is important for any type of organization, not least for cooperatives, as their limited human and financial resources restrict their access to the international market. In this situation, ICTs are essential for minimizing these effects (Montegut et al. 2013; Wen 2007).

This is the situation on which this paper places its focus, analysing online presence and levels of maturity with respect to the use of e-commerce in olive oil, fruit and wine agro-industrial cooperatives in Catalonia. There are two main reasons for this choice:

Firstly, the economic and social importance of cooperatives in Catalonia and Spain. The business activity of agricultural cooperatives has a major impact on the Spanish economy. In 2019, there were 3369 cooperatives in Spain with a turnover of 34,367 million euros and 1,165,595 members. At the time these data were collected, cooperatives employed 111,584 direct workers. They are mostly located in rural areas, so they represent an economic and social engine in rural and sparsely populated areas. The sector represents around 3% of the GDP of the Spanish economy. Catalan agri-food cooperatives account for 9.2% of Spanish cooperatives and 6.9% of the collective turnover (OSCAE 2021).

Regarding the general profile of the sectors explored here, we note that Catalonia only produces 40% of the food consumed in these sectors. Agricultural cooperatives represent 33% of the final agricultural production (53% of agricultural and 24% of livestock production). The sectors with the most cooperatives are almonds (cooperatives produce 75% of all almonds in Catalonia), olive oil (73% of the total) and rice (72%). They also have a relevant presence when it comes to citrus fruits (52%), wine (45%) and stone fruit (45%) (FCAC 2023). There are almost a hundred cooperatives in the olive oil sector in Catalonia. They are mainly located in Tarragona and Lleida and most produce and bottle their own oil. Overall, they represent more than 70% of the oil production obtained in Catalonia and have an average turnover of around 80 million euros. As for the wine sector, there are around sixty cooperative wineries in Catalonia, mostly based in Tarragona and, to a lesser extent, Barcelona, Girona and Lleida. Cooperative wine production amounts to around 1.5 million hectoliters, approximately half of the total production in Catalonia. The fruit sector consists of more than fifty cooperatives, most of which are located in the province of Lleida. This is a very export-oriented sector. The total turnover of these cooperatives is around 300 million euros, and they sell more than 500 million kilos of fruit (FCAC 2023).

The second reason for choosing these cooperatives is their importance as a means of economic, social and environmental development in the area where they are located. Their activity is both sustainable and responsible, as they use local resources, create stable employment, foster progress in rural areas, achieve better redistribution of resources and effectively provide services of a social nature (Iliopoulos and Valentinov 2018; Trejo-Pech et al. 2023).

We therefore believe an analysis of the online presence of agri-food cooperatives is merited, determining the current situation in a post-pandemic setting and comparing it with the situation prior to the pandemic described by Cristobal-Fransi et al. (2020). With this comparison, we seek to contrast the improvement in online presence indicated in the study by Mastronardi et al. (2020) in the case of Catalonia (Spain). To this end, a longitudinal comparison was carried out between 2018 (pre-pandemic period) and 2022 (when the most severe restrictions of the pandemic ended), based on web content analysis (WCA) and the Extended Model of Internet Commerce Adoption (eMICA). In addition, a top-down cluster analysis (Santesmases 2009) was carried out on the 2022 data, complete with several ANOVA tables to determine the different circumstances within the Catalan agri-food cooperatives in relation to their online presence.

Online presence of the agri-food industry

The effects of adopting technology have been studied for different sectors of the agricultural industry, including the olive sector (Giagnocavo et al. 2017; Mozas et al. 2020), the wine sector (Gil et al. 2015) and the fruit and vegetable sector (Granollers et al. 2013). As market-based organizations, agricultural cooperatives cannot and should not remain on the sidelines. If these entities wish to compete successfully and gain a foothold against competitors in the marketplace, they must be at the forefront of this technological revolution (Bernal et al. 2018; Luo and Hu 2015; Montegut et al. 2013; Zeng et al. 2017).

Different studies have been conducted for the fruit and vegetable sector, such as that carried out by Montegut and Cristóbal-Fransi (2012), which reviewed different aspects of how Catalan sweet fruit cooperatives are managed. The study by Granollers et al. (2013) included a usability analysis of the websites of agri-food cooperatives in the fruit sector. The results of this study showed that the websites used by this type of organization were aimed more at informing the user about different aspects of the cooperative than at selling the product itself. Furthermore, they stated that there was a great deal of room for improvement in terms of usability. On the demand side, Jin et al. (2017) conducted research analysing customers' preferences when buying fresh fruit online. The results showed that the diversity of the products on offer and their certification had significant effects on willingness to pay, especially for products labelled as 'green' and 'organic'.

As for the oil sector, Perlines et al. (2013) stated that the Internet provides cooperative enterprises with a powerful tool for participation and managing organizational knowledge. This allows for a decentralization of information to aid decision-making, providing quick solutions and increasing agility and responsiveness. Klonaris and Agiangkatzoglou (2018) addressed different aspects of the olive oil export process from a multidisciplinary perspective. These authors analysed elements of competitiveness in different markets where the use of ICTs is prevalent. E-commerce offers a powerful tool for cooperatives

to carry out some of their most important functions, such as promoting, coordinating and developing the common economic goals of their members, and strengthening and integrating their members' economic activity (Burke and Sewake 2008).

Finally, with regard to the wine sector, as wine is a complex product, consumers tend to seek information and opinions on social media and the Internet before purchasing (Szolnoki et al. 2018). Kolb and Thach (2016) studied the adoption of Web 2.0 and social media by German wineries, focusing on the relationship between winery size, social network use and response time to consumer emails. The results showed a relatively low adoption of Web 2.0 by German wineries, with size being relevant in explaining a higher level of ICT use. In a similar vein, Marzo-Navarro & Pedraja-Iglesias (2021) analysed the online presence of wineries in La Rioja, Spain. The elements studied were grouped into the following dimensions: information, integration, transactional and interactive communication and navigation design. The study concluded that the websites could be improved by including more information about the wines themselves, boosting their e-commerce platforms and interactivity, and including more information about the wine tourism destination. Neilson and Madill (2014) analysed the extent to which the websites of wineries in different wine regions in five countries were influential in attracting visitors and increasing sales. Thus, they investigated the adoption of social networking and Web 2.0 activities at wineries located in Australia, Canada, Chile, France and the USA. The results showed that Facebook was the main platform used by wineries to interact with consumers, but the reasons for consulting their social media profiles varied widely (Table 1).

In the previous sections we have shown the economic weight of agri-food cooperatives and their influence on territorial, social and environmental development. We have also justified the importance of an optimal online presence of the agri-food industry. All this leads us to propose the following research questions:

RQ1 Has the level of online presence of agri-food cooperatives improved in recent years?

As a result of the review of the specialized literature carried out previously, we can state that Internet presence and level of e-commerce among these cooperatives has improved in recent years. One of the possible reasons for this may be their need to diversify the marketing of agricultural products through the Internet due to mobility constraints imposed by the pandemic (Mastronardi et al. 2020; Zanetti et al. 2022).

RQ2 Is the combined approach formed by WCA and eMICA useful for measuring the development of agri-food cooperative websites?

The use of a combined approach consisting of WCA and eMICA to study the online presence and maturity of ski resort websites was developed and tested in a paper by Ramon-Cardona et al. (2022). However, this mixed methodology has also been used in other fields, such as in the tourism industry (Choochinprakarn 2016; Cristobal-Fransi et al. 2017; Ting et al. 2013), sports (Daries et al. 2021), culture (Cristobal-Fransi et al. 2021) and agriculture (Bernal et al. 2018).

Table 1 Main studies on Internet adoption in the agricultural sector *Source:* authors' own work

Work	Sector	Findings
Burke and Sewake (2008)	Olive Oil	E-commerce promotes common economic goals of the cooperative's partners and strengthens their economic activity
Granollers et al. (2013)	Fruits	Websites are more informative than commercial. Usability of the websites could be improved
Klonaris and Agiangkatzoglou (2018)	Olive Oil	Internet facilitates cooperatives' export process
Kolb and Thach (2016)	Wine	The German wineries had a relatively low adoption of Web 2.0, with size being relevant to explain a higher level of ICT usage
Marzo-Navarro and Pedraja-Iglesias (2021)	Wine	The websites of Rioja wineries should provide more information on wines and improve their use of social networks and e-commerce platforms
Montegut and Cristóbal-Fransi (2012)	Fruits	The main obstacles to doing business on the Internet are a lack of qualified personnel, a lack of financing and ignorance of the medium
Mozas et al. (2020)	Olive Oil	Age, size, ICT-training among management, social network activity and outsourced ICT management are associated with greater online sales of olive oil by second-tier cooperatives
Neilson and Madill (2014)	Wine	Facebook was the main platform used by wineries to interact with consumers, but the reasons for consulting wineries' social media profiles varied widely
Perlines et al. (2013)	Olive Oil	Internet allows cooperatives to decentralize information for decision-making, providing quick solutions and gaining agility and responsiveness
Szolnoki et al. (2018)	Wine	Internet improves cooperative product sales as consumers seek information and opinions on social networks and on the web before buying

Methodology

The development of a methodology for the evaluation of the ideal characteristics of a website is a topic of great interest for both researchers and practitioners. Different works agree that there is no single, universally recognized methodology for evaluating a website (Bauer and Scharl 2000; Camprubí and Coromina 2016; Gaur and Kumar 2018; Law et al. 2010; Ramon-Cardona et al. 2022), website evaluation currently mainly being based on the use of surveys, experimental evaluation and content analysis (Chiou et al. 2010). According to the research by Law et al. (2010), five methodological approaches are most commonly used in website measurement: a) the accounting method; b) the automatic method; c) the numerical computation method; d) the user opinion method; and e) the combined method. This research employs the accounting method.

Most studies use a series of indicators divided into four broad groups to perform the analysis: technical, commercial, content-related and design-related (Benbunan, 2001; Chiou et al. 2010; Cristobal-Fransi et al. 2021; Daries et al. 2021). The market orientation approach evaluates websites by considering users as potential customers, meaning the evaluation focuses more on aspects related to the promotion of activities, online transactions and features of the products and services offered (Álvarez 2014). We have opted to use this research perspective in this article.

The methodology employed in this research therefore includes both Web Content Analysis (WCA) and eMICA adapted to agri-food cooperatives (Cristobal-Fransi et al.,

2020). The items used to assess the level of e-commerce adoption in agri-food cooperatives' websites were adapted from the eMICA model and selected from a review of the literature. In turn, it was determined that in order to move from one level to another and consolidate its position, the website has to possess a minimum number of attributes (Álvarez 2014; Cristobal-Fransi et al. 2017; Daries et al. 2018). Levels are therefore determined by the corresponding variables present on the website. The scale is dichotomous for all variables.

In order to achieve the proposed objectives, the websites of all the cooperatives belonging to the Federation of Agrarian Cooperatives of Catalonia (FCAC) were analysed. After discarding those cooperatives that do not have a website, 104 websites from a total of 158 were obtained for the year 2022 (it should be noted that information was obtained from 106 websites in 2018). The fact that there are two fewer websites may be due to the fact that those cooperatives have disappeared (there are very small in size) or because they have been integrated into a second-tier cooperative that has taken over the functions of web design and maintenance. The first fact that stands out is that only 65.8% of Catalan cooperatives have an online presence. The aim of this paper is to analyse the use they make of this online presence and its evolution by comparing the data for 2018 and 2022. To determine the degree of significance of the differences between the two samples, the Phi coefficient was used as a statistical test.

In addition, a top-down cluster analysis was applied to the 2022 data, corresponding to the FCAC cooperatives with a website, using the Howard-Harris algorithm (Santesmases 2009), complete with several ANOVA tables. The aim of the cluster analysis is to look for typologies in terms of the online presence of agri-food cooperatives and thus obtain a more detailed view than the mean values. The group of cooperatives with no online presence should be added to the groups created in this analysis.

Web content analysis

A review of the existing literature was carried out with the aim of developing a model to analyse the content of websites belonging to agricultural cooperatives (Álvarez 2014; Camprubí and Coromina 2016; Ciruela-Lorenzo et al. 2020; Lee and Morrison 2010; Lim et al. 2009; Platania 2014; Sparacino et al. 2023). This model presents a vision of the element's cooperatives include on their websites so as to provide users with the information they require and interact with them, either to offer e-commerce activities such as selling products or services to members, or to maintain contact on a secure platform that guarantees compliance with the quality standards of a website.

The model presented is composed of four blocks of web page analysis: Information, Communication, e-Commerce and Additional Functions, as shown in Table 2. Each of the blocks has its own characteristics and items to be evaluated. We chose to evaluate the websites from a marketing perspective, identifying the contents and services offered online. The analysis was carried out by identifying a series of informative items and interactive services that are considered useful or attractive to a website user (Álvarez 2014; Montegut et al. 2013; Lee and Morrison 2010; Marzo-Navarro & Pedraja-Iglesias 2021). Each of the items was selected from the literature review by adding new elements to adapt them to the context of agricultural cooperatives (Cristobal-Fransi et al. 2020).

Table 2 Proposed web content analysis model *Source:* authors' own work

Dimensions	Definition	Authors
Information	To evaluate the information available on agricultural cooperative websites and how easy it is for the user to find	Álvarez (2014), Carmona et al. (2012), Chiou et al. (2010), Cristobal-Fransi et al. (2020), Daries et al. (2018), Escobar and Carvajal (2013), Granollers et al. (2013), Heinze & Hu (2006), Lee & Morrison (2010), Liao et al. (2006), Marzo-Navarro & Pedraja-Iglesias (2021), Ramon Cardona et al. (2022), Robbins & Stylianou (2003)
Communication	To measure the capability of the website to interact with customers, whether through communication mechanisms, Web 2.0 resources or availability of information in different languages	Álvarez (2014), Chiou et al. (2010), Cristobal-Fransi et al. (2020), Daries et al. (2018), Escobar & Carvajal (2013), Heinze & Hu (2006); Lee & Morrison (2010), Marzo-Navarro & Pedraja-Iglesias (2021), Ramon Cardona et al., (2022); Walcott (2007); Sparacino et al., (2023)
E-commerce	To assess the capability of the website to conduct secure business activities	Álvarez (2014), Chiou et al. (2010), Cristobal-Fransi et al. (2020), Daries et al. (2018), Escobar & Carvajal (2013), Lee & Morrison (2010), Marzo-Navarro & Pedraja-Iglesias (2021), Ramon Cardona et al. (2022); Ting et al. (2013)
Additional functions	To measure the capability of the website to convey trust through elements of data protection, certifications and the use of new media such as the mobile version of the website or apps	Álvarez (2014), Cristobal-Fransi et al. (2020), Daries et al. (2018), Ramon Cardona et al., (2022); Ting et al. (2013), Walcott (2007)

The eMICA model

Burgess and Cooper (1998) developed the Model of Internet Commerce Adoption (MICA). This model proposed that, when implementing websites, companies usually start with a simple web page on the Internet. This presence becomes more complex over time as they incorporate new processes due to their increasing experience and knowledge in the use of ICTs. MICA consists of three stages, incorporating three levels of business processes: (a) web-based promotion, (b) information and service provision, and (c) transaction processing. The stages of development provide a roadmap indicating at which level businesses, in our case, agricultural cooperatives, find themselves in terms of their development of e-commerce applications.

As websites gradually evolve, this movement is reflected through the different stages of development from inception (promotion), through consolidation (provision) and finally maturity (processing). Levels of website complexity and functionality are added in the model. This addition of levels reflects the evolution of the company from a static Internet presence to a dynamic website through increasing levels of interactivity (Burgess 2016).

The MICA model has been applied to different sectors, mainly in the tourism industry (Doolin et al. 2002; Burgess et al. 2011; Cristobal-Fransi et al. 2017; Daries et al. 2021; Lin et al. 2009; Ramon-Cardona et al. 2022; Ting et al. 2013), but also in others such as the agri-food industry (Bernal et al. 2018; Cristobal-Fransi et al., 2019; Platania 2014). This has allowed for the starting model to be enhanced via the use of an Extended Model of Internet Commerce Adoption (eMICA), where several layers of sophistication have been added and the MICA model adapted to the new virtual environment and the particularities of the Internet (Table 3). This model, based on a combined evaluation, allows

Table 3 Extended model of e-commerce adoption (eMICA) *Source:* Burgess et al. (2011) based on Burgess and Cooper (2000)

		Examples of functionality
Phase 1	Promotion	
	Level 1 Basic information	Name, history, origins, physical address, contact details and activities carried out
	Level 2 Information rich	Email and/or contact form, information about products, events, trade fairs, website languages, certifications, news and online promotions
Phase 2	Provision	
	Level 1 Low interactivity	Basic product information, links to other information, recipes, visitor information, training, promotion, online surveys, memory download and page sharing
	Level 2 Medium Interactivity	FAQs, site maps, webcam, brochure download, word search, email news, online shop as a showcase
	Level 3 High interactivity	Exclusive web area for customer consultation, chat, discussion forums, multimedia, social networks, possibility of collecting online comments, voting on quality, satisfaction of products offered, virtual tour, mobile web version or app
Phase 3	Process	Complete purchasing process, secure transactions, digital signature and encryption, interaction with the server, consultation of databases, status and tracking of orders. Existence of a private registration area

websites to be evaluated from a basic level to the most advanced level, defined by transactional processes.

We can state that organizations in the field of agri-food have not been pioneers in the intensive use of digital resources and, therefore, they do not take full advantage of the possibilities derived from ICTs (Cristobal-Fransi et al. 2019). In the case of agricultural cooperatives, the studies carried out indicate that their websites do not incorporate advanced functions for maintaining relationships with their customers, rather using their websites as communication tools and ignoring the possibility of interactivity with the customer (Bernal, et al. 2018).

Results

As previously mentioned, in order to evaluate the online presence of agri-food cooperatives, this research has applied Web Content Analysis and eMICA adapted to this type of entity. To determine whether the levels of implementation of a certain element varied between the 2018 sample and the 2022 sample, the Phi coefficient was used. A cluster analysis was then applied to the 2022 sample to determine the different circumstances within the Catalan agri-food cooperative sector.

Web content analysis (WCA)

In order to identify the presence of each of the elements and to facilitate the analysis, the results shown represent the percentage of agricultural cooperatives using each tool proposed for the WCA.

The information dimension analyses the mechanisms established by agricultural cooperatives to share information about their main characteristics, facilities, environment and product promotions. As can be seen in Table 4, the contents relating to information about Catalan cooperatives are better represented than the information

Table 4 Web content analysis (information and communication variables). Source: Prepared by the authors

Variable information	Oil 2018	Oil 2022	Phi coefficient	Fruit 2018	Fruit 2022	Phi coefficient	Wine 2018	Wine 2022	Phi coefficient	Total 2018	Total 2022	Phi coefficient
1. Information on cooperatives												
I.1.1- Description of the cooperative	93.5%	95.8%		96.2%	100.0%		91.2%	97.0%		93.4%	97.1%	
I.1.2- Contact: telephone number, fax or email address	95.7%	97.9%		96.2%	100.0%		97.1%	100.0%		96.2%	99.0%	
I.1.3- Images of the cooperative	65.2%	68.8%		84.6%	91.3%		79.4%	93.9%	-0.213 ^o	74.5%	81.7%	
I.1.4- Information on products, qualities, prices, etc	100.0%	97.9%		96.2%	100.0%		88.2%	90.9%		95.3%	96.2%	
I.1.5- Communication of news/events	54.3%	56.3%		38.5%	43.5%		70.6%	72.7%		55.7%	58.7%	
I.1.6- Information about the location of the cooperative	97.8%	100.0%		96.2%	100.0%		97.1%	100.0%		97.2%	100.0%	-0.119 ^o
I.1.7- Links to rating websites	0.0%	2.1%		0.0%	0.0%		0.0%	0.0%		0.0%	1.0%	
I.1.8- Virtual Tour	0.0%	0.0%		0.0%	0.0%		5.9%	3.0%		1.9%	1.0%	
I.1.9- Opening hours of the cooperative or farm shop	54.3%	58.3%		23.1%	34.8%		55.9%	69.7%		47.2%	56.7%	
2. Cooperative facilities												
I.2.1- Location of fields	89.1%	91.7%		88.5%	95.7%		82.4%	90.9%		86.8%	92.3%	
I.2.2- Information on field quality	63.0%	62.5%		46.2%	43.5%		67.6%	75.8%		60.4%	62.5%	
I.2.3- Information on the processes followed in the elaboration of the product	69.6%	66.7%		65.4%	69.6%		52.9%	57.6%		63.2%	64.4%	
I.2.4- Information on the different operational areas of the cooperative	15.2%	20.8%		46.2%	52.2%		17.6%	24.2%		23.6%	28.8%	

Table 4 (continued)

	Oil 2018	Oil 2022	Phi coefficient	Fruit 2018	Fruit 2022	Phi coefficient	Wine 2018	Wine 2022	Phi coefficient	Total 2018	Total 2022	Phi coefficient
I2.5- Information on the cooperative's shop(s)	45.7%	45.8%		42.3%	47.8%		79.4%	84.8%		55.7%	58.7%	
3. Environment of the cooperative												
I3.1- Links to different crop information websites	21.7%	20.8%		15.4%	17.4%		29.4%	27.3%		22.6%	22.1%	
I3.2- Tourist information about the area	26.1%	31.3%		30.8%	30.4%		61.8%	60.6%		38.7%	40.4%	
I3.3- Links to other related businesses	10.9%	10.4%		42.3%	43.5%		38.2%	36.4%		27.4%	26.0%	
4. Promotion												
I4.1- Event promotions, advertising campaigns, advertisements, trade fairs, etc	43.5%	41.7%		23.1%	26.1%		58.8%	60.6%		43.4%	44.2%	
I4.2- Incentives: vouchers/ coupons, exclusive internet offers, promotions	21.7%	25.0%		11.5%	13.0%		14.7%	21.2%		17.0%	21.2%	
I4.3- Information on guided tours	10.9%	12.5%		7.7%	8.7%		41.2%	48.5%		19.8%	23.1%	
<i>Communication variable</i>												
1. Interaction with customers												
C1.1- E-mail and telephone of the establishment	97.8%	97.9%		96.2%	100.0%		97.1%	100.0%		97.2%	99.0%	
C1.2- Ability to collect comments online	10.9%	70.8%	−0.608***	7.7%	69.6%	−0.641***	11.8%	78.8%	−0.674***	10.4%	73.1%	−0.636***
C1.3- Instant messaging	6.5%	8.3%		0.0%	4.3%		0.0%	6.1%		2.8%	6.7%	
C1.4- On-line surveys	0.0%	0.0%		0.0%	0.0%		0.0%	0.0%		0.0%	0.0%	
C1.5- Frequently asked questions area	0.0%	0.0%		0.0%	0.0%		0.0%	0.0%		0.0%	0.0%	

Table 4 (continued)

	Oil 2018	Oil 2022	Phi coefficient	Fruit 2018	Fruit 2022	Phi coefficient	Wine 2018	Wine 2022	Phi coefficient	Total 2018	Total 2022	Phi coefficient
C.1.6- Option to receive newsletter	13.0%	18.8%		19.2%	17.4%		23.5%	33.3%		17.9%	23.1%	
C.1.7- Restricted area exclusively for customers or partners	60.9%	66.7%		65.4%	69.6%		38.2%	60.6%	− 0.224 ⁰	54.7%	65.4%	
C.1.8- Option to vote on quality/satisfaction with services rendered	15.2%	14.6%		3.8%	4.3%		8.8%	12.1%		10.4%	11.5%	
2. Web 2.0 resources												
C.2.1- Content Syndication (RSS)	6.5%	4.2%		7.7%	4.3%		11.8%	12.1%		8.5%	6.7%	
C.2.2- Podcasting/ vodcasting	2.2%	2.1%		3.8%	0.0%		0.0%	0.0%		1.9%	1.0%	
C.2.3- Applications that allow the publication of content by the user	2.2%	2.1%		0.0%	0.0%		0.0%	0.0%		0.9%	1.0%	
C.2.4- Enabling customers to share content	34.8%	35.4%		30.8%	34.8%		38.2%	42.4%		34.9%	37.5%	
C.2.5- Link to company blog	2.2%	12.5%	− 0.197 ⁰	3.8%	13.0%		0.0%	12.1%	− 0.256*	1.9%	12.5%	− 0.206**
C.2.6- Links to external image and video platforms	13.0%	54.2%	− 0.434***	3.8%	39.1%	− 0.437**	20.6%	63.6%	− 0.436***	13.2%	53.8%	− 0.431***
C.2.7- Links to company social networks	63.0%	62.5%		46.2%	56.5%		64.7%	81.8%		59.4%	67.3%	
C.2.8- Link to Wikipedia	0.0%	0.0%		0.0%	0.0%		2.9%	0.0%		0.9%	0.0%	
3. Language skills												
C.3- Website available in more than one language	78.3%	77.1%		84.6%	87.0%		73.5%	87.9%		78.3%	82.7%	

Phi coefficient in absolute value. *p* value: ⁰*p* < 0.1; **p* < 0.05; ***p* < 0.01; ****p* < 0.001

offered about (I.1) the facilities (I.2), the environment (I.3) and promotions (I.4). The data show a slight improvement in almost all items compared to the 2018 survey, but these are insignificant differences overall. This shows that although the cooperatives are improving their online presence and adopting new online resources, these small improvements seem to be due to normal improvement dynamics rather than the effects of the pandemic, which would be expected to be more radical.

The dissemination of information through websites is implemented differently depending on the variable analysed; firstly, information about the cooperative; secondly, information about the facilities; and thirdly and fourthly, information about the environment and promotions.

There are some notable negatives. When considering information about the cooperative, it is worth highlighting the scarcity of links to websites with evaluations of the products marketed (I.1.7), and virtual tours (I.1.8). When evaluating information on facilities, there is little on the different operational areas of the cooperative (I.2.4). Unquestionably, the presence of links to different crop information websites (I.3.1) or information on online purchasing incentives (I.4.2) needs to be improved. Additionally, tourism-related items such as tourist information on the area (I.3.2), which are present in 40.4% of cases, or information on guided tours (I.4.3), present in 23.1%, have a lot of room for improvement. Cooperatives should strengthen these attributes of the Information dimension, as they are key and can be determining elements in the purchasing behaviour of their online customers.

As Table 4 shows, items related to the communication dimension (tools favouring interaction with the customer) return lower percentages than those of the previous variable. In general, cooperatives do not use all the possibilities offered by the Internet to establish a direct dialogue with their users. The most common means of communication for contacting users are through the traditional channels of telephone and email (C.1.1). This is followed by the ability to collect online customer feedback (C.1.2). The third element to note is the presence of a restricted area exclusively for customers or partners (C.1.7). To a lesser extent, newsletters (C.1.6), the option for customers to vote on the quality and satisfaction of the services provided (C.1.8) and instant messaging (C.1.3) are used. For the remaining variables, the level of presence is quite low or even non-existent, meaning that interaction with customers via the website remains an unresolved issue for the cooperatives analysed. With regard to the use of Web 2.0 resources of particular note are the possibilities for customers to share content (C.2.4), the availability of a blog (C.2.5), links to external image and video platforms (C.2.6) and the availability of social networks (C.2.7).

While most of the items in the communication variable improved slightly compared to 2018, the ability to collect online feedback from customers (C.1.2), which increased from 10.4% to 73.1%, and links to external image and video platforms (C.2.6), which increased from 13.2% to 53.8%, stand out significantly. On a lower average, links to company blogs (C.2.5) also improved from 1.9 to 12.5%, as did the inclusion of exclusive areas for customers and partners (C.1.7), from 54.7 to 65.4%. These dramatic improvements may have been due to the effects of the pandemic and the impossibility of direct contact with clients during periods of lockdown.

To conclude the analysis of the communication variable, we focused on the presentation of the websites in different languages. Presentation in more than one language is widespread in this sector, and 82.7% of the websites offer their information, products and services on the web in at least two different languages, although this tends to be Spanish and Catalan, especially in the case of the smaller cooperatives. This may not be sufficient for international customers, and other languages such as English, French or German need to be added.

The importance of having websites in more than one language is evident, even more so if we take into account that Spain ranks first in the world in terms of surface area and production of olive oil. Spanish production represents approximately 70% of EU production and 45% of world production, making Spain the world's leading exporter of olive oil. As for wine exports, these amounted to 2,897.3 million euros for Spain in 2021, with Catalonia being the leader (620 million euros). Spain is also the leading exporter of fruit and vegetables in the European Union, with a total of 17,000 million euros, and one of the world's three leading exporters together with China and the US (MAPAMA 2022). Therefore, the use of more than one language on websites offers a clear competitive edge, and not investing in this field is an obvious mistake that is currently being made by almost 18% of the cooperatives analysed.

The E-commerce dimension covers online payment services (EC.1), secure online transactions (EC.2) and interaction with the server (EC.3). The analysis of this section shows major advances in online sales for this type of entity in recent years, with significant changes in all three items (Table 5), especially in the case of oil and wine cooperatives. It seems plausible to consider that the major change in this aspect is due to the pandemic and the need to boost online sales of products. It is also possible that the slower advance of e-commerce in fruit cooperatives is due to the fact that these are highly perishable goods and they do not have as much margin for online sales, and the corresponding logistics, as wine and oil.

The last dimension includes those general aspects that may be relevant for a website in today's circumstances. This dimension is divided into three sections: information security, quality certifications and availability of the mobile version. There has been a significant increase in the presence of the privacy policy or legal notice (FA.1.1) compared to 2018 (Table 5), from 61.3 to 82.7%. This indicates a greater awareness of legal regulations and may have improved with the development of e-commerce during the pandemic. In contrast, information on data protection law accounts for only 2.9%. This is a significantly low figure, as a considerable percentage of cooperative websites have restricted access where registration is required, and not assuring compliance with data protection law is inadequate.

Few of the websites analysed include quality certifications on their websites, although fruit cooperatives have the most. On the other hand, almost 82% report having other certifications, which differ greatly from one another: awards of different kinds (international, national, regional or local) or simply acknowledgements.

Last but not least, with regard to the availability of a mobile version (FA 3), of the total number of websites analysed, 97.1% have links to one (FA 3.1). This item also showed significant growth compared to 2018 (Table 5), which represents a very positive development, since mobile terminals have become an essential point of sale for

Table 5 Web Content Analysis (ecommerce and additional functions variables). Source: Authors' own work

E-commerce variable											
1. Online payment services											
CE.1- Online payment	32.6%	72.9%	- 0.404***	7.7%	13.0%	23.5%	48.5%	- 0.260*	23.6%	51.9%	- 0.292***
EC.2- Secure online transaction	32.6%	72.9%	- 0.404***	7.7%	13.0%	23.5%	48.5%	- 0.260*	23.6%	51.9%	- 0.292***
EC.3- Interaction with the server	41.3%	50.0%		7.7%	13.0%	17.6%	42.4%	- 0.271*	25.5%	39.4%	- 0.149*
Variable additional functions											
Information security											
FA 1.1- Privacy Policy or Legal Notice	65.2%	91.7%	- 0.323**	57.7%	73.9%	58.8%	75.8%		61.3%	82.7%	- 0.238***
FA 1.2- Data protection law	2.2%	2.1%		7.7%	8.7%	0.0%	0.0%		2.8%	2.9%	
2. Certifications											
FA 2.1- Quality certifications ISO 9000/9001	0.0%	0.0%		19.2%	17.4%	5.9%	6.1%		6.6%	5.8%	
FA 2.2- Food safety registration	0.0%	0.0%		0.0%	0.0%	0.0%	0.0%		0.0%	0.0%	
FA 2.3- Environmental certifications (ISO 14000)	0.0%	0.0%		7.7%	8.7%	0.0%	3.0%		1.9%	2.9%	
FA 2.4- Other certifications	73.9%	79.2%		73.1%	87.0%	64.7%	81.8%		70.8%	81.7%	- 0.129 ⁰
3. Mobile version											
FA 3.1- Link to mobile version of the website	58.7%	97.9%	- 0.479***	50.0%	91.3%	67.6%	100.0%	- 0.437***	59.4%	97.1%	- 0.456***
FA 3.2- Availability of cooperative PPPs	0.0%	0.0%		3.8%	4.3%	2.9%	0.0%		1.9%	1.0%	

Phi coefficient in absolute value, *p* value:⁰*p* < 0.1; **p* < 0.05; ***p* < 0.01; ****p* < 0.001

e-commerce (Nel and Boshoff 2020), having emerged as the new online environment since the proliferation of smartphones. On the other hand, very few cooperatives claim to have a mobile application (FA 3.2), and this figure is in fact even lower than in 2018.

Results for the eMICA model

The information contained in this section is an indicator of the maturity of the agri-food cooperatives analysed with regard to their commercial direction on the Internet. If we analyse the results as a whole, they show that there is still room for improvement in the adoption of e-commerce by this type of entity, despite the progress observed in recent years.

The fact that only 13.5% of the websites have reached Phase 3 (5.7% in 2018) and that the vast majority are at Phase 1 (more than 70% have not passed the first level of Phase 2, compared to 75% four years ago), indicates the low degree of functional maturity achieved by these cooperatives in the development of their websites. Nevertheless, there is a certain shift from a static, purely informative perspective to a dynamic website with increasing levels of interactivity. It should also be noted that although the results show that a quarter of the websites have average interactivity (Table 6), this number is largely represented by the cooperatives with information download or subscription options, but with a lower representation of Web 2.0 tools, as we have seen in the web content analysis.

Phase 3 includes 13.5% of the websites evaluated and, in addition to offering secure purchasing processes and payment gateways, most of them provide communication mechanisms that favour interactivity with the user. If we analyse this by activity, we see that wine cooperatives have the highest degree of interaction and maturity (24.2% are in Phase 3).

Without taking into account the level at which each cooperative finds itself, we can see that more than half provide for the entire purchasing process to be carried out online (51.9%), compared to 23.6% in 2018. This figure differs considerably depending on the orientation of each cooperative: 72.9% of oil cooperatives, 13.0% of fruit cooperatives and 48.5% of wine cooperatives. These results are double those of the previous study (Table 6). Even so, this means that half of the cooperatives analysed do not facilitate e-commerce. Despite the noted improvement, this may translate into a loss of potential customers.

Overall, the most significant changes between 2018 and 2022 (Table 6) have occurred in Phase 2, Levels 2 (sitemap and privacy policy) and 3 (blogs and forums, access to social media profiles, commenting and mobile web version) and Phase 3 (complete purchase and secure transaction). It is quite possible that these changes are due to the mobility restrictions and lockdowns that occurred during the pandemic, which forced organizations to rapidly transition to e-commerce as a matter of survival. This implies that, within eMICA, various elements of Phase 2, Level 3 and Phase 3 have developed faster than other elements of Phase 2, Levels 1 and 2. This would imply a shift from a mainly informative website, as indicated by Granollers et al. (2013), to a website with content more focused on online commerce.

Table 6 Extended Model of Internet Commerce Adoption (eMICA). Source: Authors' own work

	Oil 2018	Oil 2022	Phi coefficient	Fruit 2018	Fruit 2022	Phi coefficient	Wine 2018	Wine 2022	Phi coefficient	Total 2018	Total 2022	Phi coefficient
Phase 1: Promotion (Information)												
Level 1: Basic Information	93.5%	97.9%		96.2%	100.0%		97.1%	100.0%		95.3%	99.0%	
Contact details	95.7%	97.9%		96.2%	100.0%		97.1%	100.0%		96.2%	99.0%	
Date and Time of update	0.0%	0.0%		0.0%	0.0%		0.0%	0.0%		0.0%	0.0%	
Information on the location of the cooperative	93.5%	97.9%		96.2%	100.0%		97.1%	100.0%		95.3%	99.0%	
Information on the activities carried out	89.1%	91.7%		92.3%	95.7%		85.3%	93.9%		88.7%	93.3%	
Level 2: Information rich	84.8%	87.5%		92.3%	95.7%		91.2%	100.0%	− 0.213 ^Φ	88.7%	93.3%	
E-mail and/or Contact form	100.0%	100.0%		92.3%	100.0%		94.1%	100.0%		96.2%	100.0%	− 0.138*
Product information (quality and variety)	100.0%	100.0%		96.2%	100.0%		88.2%	93.9%		95.3%	98.1%	
Events or fairs	47.8%	45.8%		23.1%	26.1%		64.7%	66.7%		47.2%	48.1%	
Website available in more than one language	78.3%	77.1%		84.6%	87.0%		73.5%	87.9%		78.3%	82.7%	
Quality certifications	73.9%	72.9%		73.1%	82.6%		70.6%	75.8%		72.6%	76.0%	
News dissemination	52.2%	58.3%		38.5%	43.5%		64.7%	69.7%		52.8%	58.7%	
Promotions and incentives via the Internet	19.6%	20.8%		11.5%	13.0%		14.7%	15.2%		16.0%	17.3%	
Phase 2: Provision (Dynamic information)												
Level 1: Low level of inter-activity	17.4%	22.9%		26.9%	26.1%		32.4%	39.4%		24.5%	28.8%	
Prices and basic product information	97.8%	97.9%		96.2%	100.0%		88.2%	93.9%		94.3%	97.1%	
Links to further product information	17.4%	16.7%		15.4%	13.0%		0.0%	0.0%		11.3%	10.6%	

Table 6 (continued)

	Oil 2018	Oil 2022	Phi coefficient	Fruit 2018	Fruit 2022	Phi coefficient	Wine 2018	Wine 2022	Phi coefficient	Total 2018	Total 2022	Phi coefficient
Possible recipes and cooking tips	17.4%	18.8%		7.7%	8.7%		29.4%	30.3%		18.9%	20.2%	
Information on visits	10.9%	10.4%		7.7%	8.7%		44.1%	54.5%		20.8%	24.0%	
Training	19.6%	18.8%		61.5%	65.2%		29.4%	27.3%		33.0%	31.7%	
On-line product surveys	0.0%	0.0%		0.0%	0.0%		0.0%	3.0%		0.0%	1.0%	
Promotions	19.6%	22.9%		11.5%	13.0%		14.7%	15.2%		16.0%	18.3%	
Share page	6.5%	10.4%		3.8%	4.3%		2.9%	3.0%		4.7%	6.7%	
Download the cooperative's annual report	4.3%	4.2%		7.7%	8.7%		2.9%	3.0%		4.7%	4.8%	
Level 2: Medium level of interactivity	10.9%	18.8%		23.1%	26.1%		26.5%	36.4%		18.9%	26.0%	
Site map	32.6%	81.3%	− 0.492***	19.2%	69.6%	− 0.508***	35.3%	81.8%	− 0.472***	30.2%	78.8%	− 0.488***
Web cam	0.0%	0.0%		0.0%	0.0%		0.0%	0.0%		0.0%	0.0%	
Download brochures and/or photos	39.1%	35.4%		69.2%	78.3%		76.5%	72.7%		58.5%	56.7%	
Sending news by email	17.4%	16.7%		15.4%	17.4%		32.4%	36.4%		21.7%	23.1%	
Privacy policy or legal notice	65.2%	91.7%	− 0.323**	57.7%	78.3%		58.8%	75.8%		61.3%	83.7%	− 0.250***
FAQs	0.0%	0.0%		0.0%	0.0%		0.0%	0.0%		0.0%	0.0%	
Search by words	39.1%	47.9%		38.5%	47.8%		26.5%	30.3%		34.9%	42.3%	
Online product catalogue	30.4%	41.7%		42.3%	43.5%		70.6%	81.8%		46.2%	54.8%	
Level 3: High level of interactivity	4.3%	16.7%	− 0.200 ⁰	23.1%	26.1%		11.8%	33.3%	− 0.259*	11.3%	24.0%	− 0.167*
Exclusive web area for consultation by Clients / Partners	60.9%	64.6%		65.4%	73.9%		38.2%	57.6%		54.7%	64.4%	
Multimedia applications	73.9%	68.8%		88.5%	95.7%		76.5%	75.8%		78.3%	76.9%	
Blogs, forums and/or chats	2.2%	14.6%	− 0.222*	3.8%	13.0%		0.0%	9.1%	− 0.220 ⁰	1.9%	12.5%	− 0.206**
Email newsletters (newsletter)	13.0%	16.7%		19.2%	21.7%		23.5%	36.4%		17.9%	24.0%	

Table 6 (continued)

	Oil 2018	Oil 2022	Phi coefficient	Fruit 2018	Fruit 2022	Phi coefficient	Wine 2018	Wine 2022	Phi coefficient	Total 2018	Total 2022	Phi coefficient
Access to the cooperative's social media profiles	63.0%	70.8%		46.2%	56.5%		61.8%	84.8%	− 0.260*	58.5%	72.1%	− 0.143*
Ability to collect comments online	10.9%	43.8%	− 0.367***	7.7%	43.5%	− 0.415**	11.8%	66.7%	− 0.563***	10.4%	51.0%	− 0.441***
Option for customers to vote on quality	15.2%	14.6%		3.8%	4.3%		8.8%	9.1%		10.4%	10.6%	
Assessment of satisfaction with the products on offer	0.0%	0.0%		0.0%	0.0%		0.0%	3.0%		0.0%	1.0%	
Virtual Tour of the cooperative and its entire process	0.0%	0.0%		0.0%	0.0%		5.9%	3.0%		1.9%	1.0%	
Mobile web version	58.7%	95.8%	− 0.446***	50.0%	91.3%	− 0.447**	67.6%	100.0%	− 0.437***	59.4%	96.2%	− 0.440***
Mobile app download	0.0%	0.0%		3.8%	4.3%		2.9%	0.0%		1.9%	1.0%	
Phase 3: Process (Functional Maturity)	4.3%	10.4%		3.8%	4.3%		8.8%	24.2%	− 0.208 ⁰	5.7%	13.5%	− 0.133 ⁰
Complete purchasing process	32.6%	72.9%	− 0.404***	7.7%	13.0%		23.5%	48.5%	− 0.260*	23.6%	51.9%	− 0.292***
Secure online transaction	32.6%	72.9%	− 0.404***	7.7%	13.0%		23.5%	48.5%	− 0.260*	23.6%	51.9%	− 0.292***
Interaction with the server: database query	41.3%	50.0%		7.7%	13.0%		17.6%	42.4%	− 0.271*	25.5%	39.4%	− 0.149*

Phi coefficient in absolute value. *p* value: ⁰*p* < 0.1; **p* < 0.05; ***p* < 0.01; ****p* < 0.001

Table 7 Average items of the groups generated. Source: Authors' own work

Variable	Total	Group 1	Group 2	Group 3	F for Snedecor
<i>WCA</i>					
WCA-I.1	5.914	6.659	5.286	5.543	28.001***
WCA-I.2	3.067	3.732	2.393	2.829	18.080***
WCA-I.3	0.885	1.342	0.214	0.886	13.102***
WCA-I.4	0.885	1.561	0.607	0.314	35.212***
WCA-C.1	2.789	3.244	3.107	2.000	19.387***
WCA-C.2	1.798	2.488	1.893	0.914	23.863***
WCA-C.3	0.827	1.000	0.821	0.629	10.718***
WCA-EC	1.433	1.707	2.679	0.114	54.158***
WCA-FA1	0.856	1.049	0.857	0.629	10.861***
WCA-FA2	0.904	1.098	0.750	0.800	5.324**
WCA-FA3	0.981	1.000	1.000	0.943	
<i>eMICA</i>					
eMICA F1. N1	2.914	2.976	2.714	3.000	8.899***
eMICA F1. N2	4.808	6.000	4.286	3.829	62.256***
eMICA F2. N1	2.144	2.829	1.750	1.657	22.706***
eMICA F2. N2	3.394	4.244	3.000	2.714	27.310***
eMICA F2. N3	4.106	5.073	4.214	2.886	35.535***
eMICA F3. N1	1.433	1.683	2.714	0.114	56.294***

p Value: ^o $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 8 Cross-tabulation of groups and types of cooperatives. Source: Authors' own work

	Group 1		Group 2		Group 3		TOTAL	
Oil	16	39.0%	21	75.0%	11	31.4%	48	46.2%
Fruit	8	19.5%	1	3.6%	14	40.0%	23	22.1%
Wine	17	41.5%	6	21.4%	10	28.6%	33	31.7%
TOTAL	41	100.0%	28	100.0%	35	100.0%	104	100.0%

χ^2 test = 18.956 ($p = 0.001$)

Results of the cluster analysis

To achieve a greater level of detail in the analysis of the 2022 sample, a top-down cluster analysis was performed using the Howard-Harris algorithm. Specifically, the DYANE 4.0 program (Santesmases 2009) was used to obtain this segmentation. The number of items fulfilled in each of the subsections of the WCA and eMICA were taken as analysis variables, these values being standardized for use in the cluster analysis. Solutions with two, four and five clusters were discarded, as they generated clusters of almost negligible size. The segmentation solution with three clusters provided the greatest increase in the variance explained, while avoiding the generation of excessively small clusters. Once the three groups were generated, an ANOVA (Table 7) and cross-tabulations with the categorical variables were performed (province, county, and type of cooperative), giving a significant χ^2 only for type of cooperative (Table 8).

On the basis of the ANOVA (Table 7) and the only significant cross-tabulation (Table 8), it is possible to identify the main circumstances existing among the Catalan agri-food cooperatives with an online presence in 2022:

- Group 1 (39.4%): these are the cooperatives with the highest level of completion in all sections of the WCA and eMICA, except in those referring to e-commerce (WCA-CE and eMICA 3.1.). This is the group with the most wine cooperatives, although it has a balanced presence of the three types.
- Group 2 (26.9%): these are the cooperatives with average values for their online presence, except for the sections referring to online commerce (WCA-CE and eMICA 3.1.), where they clearly stand out above the other two groups. Most of them are olive oil cooperatives; there is only one fruit cooperative.
- Group 3 (33.7%): these are the cooperatives with the lowest level of online presence and that only have average values in the sections referring to the most static and basic information, with online commerce elements being almost non-existent. The fruit cooperatives have the highest weight.

Bearing in mind that the sample analysed comprises FCAC cooperatives with an available website, four groups were obtained: Group 1 (25.9%) with a greater online presence; Group 2 (17.7%) with an average level of online presence, but with developed online commerce; Group 3 (22.2%) with a lower and more basic online presence; and a fourth group with no website or online presence at the time of the study (34.2%).

The result of the cross-tabulation between the cluster analysis and the type of cooperative (Table 8) led us to perform an ANOVA to analyse whether there were differences between the type of cooperative and online presence (Table 9). This analysis shows that wine cooperatives have the highest number of items, especially in terms of information (WCA-I1, WCA-I2 and WCA-I4), but also in terms of communication. Olive oil cooperatives only stand out in the sections relating to e-commerce (WCA-CE and eMICA

Table 9 Average items of the types of cooperatives. *Source:* Authors' own work

Variable	Total	Oil	Fruit	Wine	F for Snedecor
<i>WCA</i>					
WCA-I.1	5.914	5.771	5.696	6.273	3.136*
WCA-I.2	3.067	2.875	3.087	3.333	
WCA-I.3	0.885	0.625	0.913	1.242	3.970*
WCA-I.4	0.885	0.792	0.478	1.303	7.351***
WCA-C.1	2.789	2.771	2.652	2.909	
WCA-C.2	1.798	1.729	1.478	2.121	
WCA-C.3	0.827	0.771	0.870	0.879	
WCA-EC	1.433	1.958	0.391	1.394	11.413***
WCA-FA1	0.856	0.938	0.826	0.758	
WCA-FA2	0.904	0.792	1.130	0.909	3.571*
WCA-FA3	0.981	0.979	0.957	1.000	
<i>eMICA</i>					
eMICA F1. N1	2.914	2.875	2.957	2.939	
eMICA F1. N2	4.808	4.750	4.522	5.091	
eMICA F2. N1	2.144	2.000	2.217	2.303	
eMICA F2. N2	3.394	3.146	3.348	3.788	3.046 ⁰
eMICA F2. N3	4.106	3.896	4.044	4.455	
eMICA F3. N1	1.433	1.958	0.391	1.394	11.413***

p Value: ⁰ $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

3.1.). In general, it is the fruit cooperatives that make the least intensive use of the Internet, although they have improved substantially compared with previous studies (Cristobal-Fransi et al., 2020; Granollers et al. 2013; Montegut et al. 2013). This result is similar to that obtained in a previous study by Cristobal-Fransi et al. (2020), but with a higher overall development of e-commerce.

Discussion

The analysis shows that a significant proportion of cooperatives have a basic and relatively static Internet presence, not to mention the fourth group of cooperatives, which had no website at the time of the study. Although improvements have been observed in this respect in recent years, especially with regard to online commerce (Mastronardi et al. 2020), there is still work to be done. Oil cooperatives are the most involved in online commerce, while wine cooperatives have more comprehensive content, and fruit cooperatives have the least online presence and more static and basic websites. These results are in line with research applied to other sectors, which indicate that in many cases websites are static showcases of products and services that do not exploit the full potential of the Internet and e-commerce (Bernal et al. 2018; Daries et al. 2020; Granollers et al. 2013).

This study has found that cooperatives in Catalonia have improved their online presence in recent years, especially in aspects related to online commerce. This improvement can be explained by the need for greater market orientation due, among other reasons, to the health crisis resulting from Covid-19. This crisis has forced many sectors, including the cooperative sector, to strengthen their online presence in order to be able to reach their customers under better conditions, customers whose mobility limitations restricted their ability to obtain the agri-food products offered by these entities.

However, the results also reveal that not all cooperatives have a website (34.2%). Moreover, a simple online presence is not enough, and these organizations need to go beyond a traditional presence and favour online interaction and collaboration, connectivity and the possibility for users to generate and share content and knowledge. The health crisis has made it necessary to accelerate this process of evolution (Mastronardi et al. 2020), which involves moving from merely informative websites to fully operational online commerce platforms (Granollers et al. 2013).

Despite the positive evolution of recent years, the websites of agricultural cooperatives in Catalonia still show a low level of interactivity. This element requires improvement, as it facilitates cooperatives' communication with the surroundings and therefore enhances their role in territorial development. However, only 13.5% of the websites analysed allow for the entire purchasing process to take place over the Internet, even if this has more than doubled since 2018 (Cristobal-Fransi et al. 2020). This percentage needs to improve and will likely depend on the role organizations award to online presence, their understanding of the benefits of adopting new technologies as they become available, and their level of innovation. There will also be a need to increase interactivity through the implementation of consumer reviews and feedback, blog development, social media presence, although this will, of course, depend on budgetary constraints. In recent years, some aspects of interactivity have also been developed as tools to support

online commerce in the context of a pandemic and restrictions, but there is still much room for improvement.

The websites of the agricultural cooperatives that were analysed show significant deficiencies in the interactivity of their online presence, as they do not include most of the items required at this level. Slightly less than a quarter of the cooperatives have a high level of interactivity. This means that they have not completed the eMICA process in its entirety, despite offering the full purchasing process. Many of the cooperatives, even if they pass Phase 3 related to e-commerce, do not comply with Phase 2 of the eMICA process related to dynamic information. It is possible that the emergency situation generated by the pandemic triggered a hasty deployment of e-commerce without them fully consolidating the interactivity elements needed to support e-commerce.

Different circumstances are found within the general aforementioned low online presence, ranging from very complete websites, especially among wine cooperatives, to the absence of a website in one third of FCAC cooperatives. Between these two extremes, we find intermediate situations, such as cooperatives with a very basic online presence, as is the case of fruit cooperatives, and others with a fairly basic online presence, but with a firmly established online trade. In general, fruit cooperatives lag furthest behind in terms of online presence, and especially in the development of online commerce. These results are in line with those of previous research (Bernal et al. 2018; Cristobal-Fransi et al. 2019; Montegut et al. 2013).

Finally, we can answer the two research questions raised:

RQ1 Has the level of online presence of agri-food cooperatives improved in recent years?

The main conclusion is that the online presence of these cooperatives improved during the period analysed, especially in relation to e-commerce (possibly due to the effect of the pandemic). However, with the exception of e-commerce, these changes are not significant, and levels of online presence differ greatly within the sector, as indicated by the cluster analysis. This was found to be partly related to the type of cooperative.

RQ2 Is the combined approach formed by WCA and eMICA useful for measuring the development of agri-food cooperative websites?

The results of this research confirm the usefulness of a combined eMICA and WCA approach to measure the development of agri-food cooperative websites.

Conclusions

Social economy enterprises must develop with a focus on innovation and the adoption of ICTs. Online presence is decisive and must be used in all of its dimensions, not only as an element of promotion and communication, but also for sales and e-commerce.

In terms of theoretical implications, the findings of this study add to the literature on technology adoption by the agri-food sector by focusing on Internet presence. The study proposes a model to explain the level of e-commerce maturity of agricultural cooperatives by relating this to the items contained on their websites. Based on the results,

this study makes several specific theoretical contributions. Firstly, the results highlight that the optimal development of a website improves the positioning, image, and use of e-commerce in the agricultural sector. Secondly, from a methodological point of view, the results of the study provide further confirmation of the usefulness of the combined approach in order to measure the development of commercial websites in the agribusiness sector. The proposed method consists of the extended model of Internet Commerce Adoption (eMICA) and the Web Content Analysis (WCA) model, based on the dimensions of Information, Communication, e-Commerce and Additional Functions. Finally, this study adds to the literature on social economy e-commerce adoption by studying its application in agri-food cooperatives, leading to the conclusion that agricultural cooperatives have much room for improvement in the area of online presence. This improvement would not only bring benefits to the organization, but also helps the territorial, social and tourism development of the region where the cooperative is located.

In terms of management implications, it is recommended that cooperative managers invest efforts in developing their online presence in order to improve the opinions of their consumers, as an effective online presence will have a positive impact on the organization's image. When designing the corporate website for an agricultural cooperative, a series of guidelines must be followed and a set of fundamental elements must be included around the four dimensions proposed: Information, Communication, e-Commerce and Additional Functions. An optimum presence on the Internet will promote better results, both in terms of number of visits and number of sales made.

Abbreviations

ANOVA	Analysis of variance
COVID	Coronavirus disease
eMICA	Extended Model of Internet Commerce Adoption
EU	European Union
FCAC	Federación de Cooperativas Agrarias de Cataluña (Federation of Agrarian Cooperatives of Catalonia)
GDP	Gross domestic product
ICTs	Information and communication technologies
MAPAMA	Ministerio de Agricultura, Pesca y Alimentación (Ministry of Agriculture, Fisheries and Food)
MICA	Model of Internet Commerce Adoption
OSCAE	Observatorio Socioeconómico del Cooperativismo Agroalimentario Español (Socioeconomic Observatory of Spanish Agri-Food Cooperativism)
USA	United States of America
WCA	Web content analysis

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Author contributions

ECF has promoted the study. All authors conceived of and planned the study. ECF and ND acquired the data and performed statistical analysis. JRC has performed statistical and econometric analysis. ECF and ND drafted the manuscript. MRR and JRC critically reviewed it for important intellectual content. All authors read and approved the final manuscript.

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Availability of data and materials

The data sets used and analysed during the current study are available from corresponding author on reasonable request.

Declarations

Competing interests

The authors declare they have no competing interests.

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