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Innovation as the Backbone of Sustainable Development Goals

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Abstract: This paper focuses on the achievement of one of the Sustainable Development Goals (SDG) through the use of Information and Communication Technologies (ICT) in Social Economy enterprises. Specifically, this research studies which are the conditioning factors for the active use of ICT (technological innovation) in the second-degree of olive oil cooperativism in Spain. The reason for the importance of this sector is that it currently leads world oil production. Moreover, second-degree cooperativism overcomes one of the problems frequently pointed out by the literature on the olive sector, namely the lack of concentration and integration of supply. In order to achieve the objective established in this research study, the fuzzy set Qualitative Comparative Analysis (fsQCA) methodological technique has been used. The results obtained indicate that the degree of technological innovation is favored by the intensity of cooperative integration, diversification within the company, orientation towards the final market (packaged sales), ICT training of employees, the commercial importance of the foreign sector and the supply of ecological products.

Keywords: agricultural cooperatives; second grade cooperative; organic olive oil; technological innovation; sustainable development goals (SDG); fuzzy set Qualitative Comparative Analysis (fsQCA)

1. Introduction

Through the Millennium Development Goals, the efforts of the different countries of the world were grouped together and channelled into a movement against poverty, which, until then, was the most successful in history [1]. The Millennium Development Goals gave way to the Sustainable Development Goals (hereinafter SDG). In September 2015, the Heads of State and Government of more than 150 countries, meeting as an Assembly at the United Nations, approved Agenda 2030 on the Sustainable Development Goals, which included 169 goals grouped into 17 objectives aimed at eradicating poverty and achieving sustainable development in its social, economic and environmental dimensions [2]. In this case, not only was the participation of all governments requested but it was also essential to have the help of citizens and businesses [3].

Reports linking the business sector to SDG [4–9] have been compiled [3]. In one of PWC's reports [4], Director Malcolm Preston argued that ratification of SDG presents an opportunity and will change consumer demand and the way business is done, calling for corporate responsibility and commitment to SDG [3].

The importance of the Social Economy (henceforth SE) in achieving SDGs has been studied in the current scientific literature [10] and has been recognized by the United Nations and the International

Labour Organization. In this sense, the United Nations Inter-Agency Working Group on the Social and Solidarity Economy noted the importance of the Social and Solidarity Economy, indicating that it could play a key role in the achievement of Agenda 2030, and has carried out several studies that show the link between this type of entity and SDGs [11,12].

In this paper, we focus our analysis on one family of the Social Economy: agricultural cooperativism. Specifically, we will analyze the Spanish olive cooperative movement for several reasons: (a) Spain is the world's leading producer of olive oil and more than 70% of its output is produced by cooperatives [13,14]. According to the data provided by the International Olive Oil Council [15,16] for the 2018-19 campaign, Spain has produced more than 51% of the world's olive oil and the new plantations predict a constant increase; (b) There are 11,316,000 hectares in the world that are exclusively dedicated to the cultivation of 1.500 million olive trees (72% are mountain and hill trees), located mainly in the Mediterranean basin (79%), which gives them an enormous environmental value (at the same time that they serve to reduce erosion, they constitute a CO₂ sink) which leads them to be considered by many researchers as public goods [3]; (c) Annually, an increase in the world's olive grove surface area is observed, which represents 1% per year (between 34 and 45 million seedlings, which means 154,000 new hectares). The importance of olive groves is spreading worldwide, since 56 countries already cultivate olive groves and 169 consume them [17] and these figures are increasing year by year [3]; (d) On the other hand, the production of olive oil in relation to the total of oils and fats produced in the world represents only 2%. However, consumption has been growing by between 2 and 3.9% annually, which is why companies are interested in this product with their turnover increasing in recent years, ranging from 9000 to 13,600 million euros per year and employing over 30 million people [17]. All of these reasons make it a strategic sector worldwide and for Spain, in particular. Agenda 2030 expressly states that "We are embarking together on the road to sustainable development, collectively tackling the task of achieving global development ... We will work to build dynamic, sustainable, innovative and people-centred economies ... " [18] (p. 6). The economic development of a region can be understood as the process of growth in which both economic and social actors exchange goods, services and knowledge, make investment decisions and enter into agreements and contracts, thereby bringing about structural change [19,20]. Taking into account the above definition, the United Nations has considered that generating development in all territories and doing so in an economically, socially and environmentally sustainable manner, will achieve the objective, but by using partnerships, using investment/financing of projects by governments, businesses and citizens, and focusing on technological innovations. In fact, the last of the SDGs, number 17: "Strengthening the means of implementation and revitalizing the Global Partnership for Sustainable Development", is a set of tools that participants should use to obtain the rest of the SDGs and where the United Nations especially expresses the need to "increase the use of enabling technologies, particularly information and communications technology" [18] (p. 30). ICTs, therefore, constitute a cross-cutting tool in the pursuit of sustainable development.

The objective of this paper is to analyze, within the group of second-degree olive oil cooperative societies, which already constitute a business alliance, which business activities influence the improvement of the use of ICTs so that they, in turn, contribute to the achievement of SDG. To achieve this objective, the fuzzy set Qualitative Comparative Analysis (fsQCA) methodology has been used. To this end, this paper has been structured following a classic research sequence. Thus, once the problems and research objectives have been established, a review of the specialized literature in this field is carried out, which gives rise to a series of research proposals. Subsequently, the methodology followed and the population under study are commented on. The article continues with the presentation of the results achieved, and ends with the main conclusions reached in the study.

2. Theoretical Framework

It is no coincidence that the United Nations has chosen technologies, and, in particular, information and communication technologies (ICTs), to establish them as cross-cutting tools for achieving the SDGs.

The scientific literature points to innovation and investment in R&D as the main drivers of economic growth and job creation in a given country or region [21–23].

Porter [24,25] already indicated what competitiveness was. Specifically, it stated that “competitive advantage derives from the way in which companies organize and carry out discrete activities. In order to gain a competitive advantage over its rivals, a firm must offer a service at a comparable value to the competitor, but carry out the activities more efficiently than its competitors (lower cost) or carry out the activities in a particular way that creates greater value for the buyer and allows for an extra charge (differentiation).” Clearly, the correct use of ICT constitutes differentiation [26]. Schumpeter [27] already predicted that technological change would be decisive, assuming that companies that were not able to adapt to innovations would not survive in the market.

ICTs have, therefore, become established as necessary for achieving development, so much so that the European Union indicates that the development of ICT is vital for Europe’s competitiveness in today’s increasingly digitalized world economy. During the 2014–2020 funding period, the European Regional Development Fund (ERDF) set aside more than 20 billion euros for investments in ICTs and the European Commission established the Digital Europe 2021–2027 program, which aims to support the digital transformation of Europe’s economy and society, and thus bring its benefits to European citizens and businesses [28].

If we focus on the proposals that we defend in this paper, we must indicate that within the prosperity axis where some of the SDGs are included, economic growth is a priority concept and is mainly included in SDGs 8 and 9 (decent work and economic growth and industry, innovation and infrastructure). Specifically, target 8.2 indicates that higher levels of economic productivity should be achieved through diversification, technological upgrading and innovation. This target is related to target 9.4, which calls for modernizing infrastructure and converting industries to being sustainable, using resources more efficiently and promoting the adoption of technologies by 2030. These SDGs will be reflected in proposals 1, 2, 3 and 4.

Development strategies refer to the decisions that business management takes regarding the future development of the field of activity, both in terms of its quantitative aspects (growth strategy) and its qualitative aspects (increasing the number of products or services or what we call diversification strategy) [29].

The business growth strategy was already included by Ansoff [30] when he identified it with the strategy of increasing the size of the organization, but aimed at strengthening the same activity that the organization had been developing. Growth is interpreted as a sign of health, vitality and strength, and, in addition, in dynamic and competitive environments companies must grow, if only to maintain their competitive position [29]. The relationship between the size of the organization and its propensity to innovate is a widely studied issue. Thus, size is one of the main factors affecting the innovative attitude of firms [31], with large firms being more prone to technological innovation [32]. Among the factors that make it difficult for small companies to innovate are: lack of financial resources; lack of personnel; lack of time and lack of technological knowledge [33]. This is supported by several studies that establish a direct relationship between firm size and firm innovation [34]. This relationship has also been studied frequently in the cooperative sector, with many authors noting that business integration is one of the determining factors in the strengthening of enterprises [33,35–46]. According to these arguments, it is possible to put forth the following proposition in our research study:

Proposition 1. *The degree of business integration, measured by the number of member cooperatives, favors innovation in the organization.*

Within the diversification strategy, we find diversification related and not related to the initial business. The abundant scientific literature indicates three trends [47]: One group of researchers indicate that the greater the degree of diversification, the better the results. In this sense, it is argued that the diversified firm has much greater flexibility, since it can attract external funds for growth [48,49];

it can also exchange capital among its businesses [50]; it can employ a series of mechanisms to create and exploit the advantages of market power [51] and be better positioned to optimize the allocation of these resources, because it has superior access to information [52,53]. Therefore, diversification may generate efficiencies that are not available to the single business enterprise [54]. Another group of studies argues that diversified firms are better than single-business firms, but it is not clear whether related diversification is better or worse than unrelated diversification. In this sense, the activities that are necessary to exploit the relationship involve costs that partially mitigate the benefits of such a strategy [55], and given the transaction costs, related diversification strategies cannot be achieved without internal trade-offs, which lead to inefficiencies [56]. In the end, synergy initiatives often do not meet management's expectations [57], which mitigates the main advantage of related diversification over unrelated alternatives [47]. A third group of papers argues that related diversification is superior to expansion strategies and also to unrelated diversification. In this area, diversification strategies are better since they enjoy economies of scope [58]. On the other hand, firms that diversify in a related way are involved in multiple industries with firms [59] that can take advantage of a common pool of corporate resources and this gives them competitive advantages [47]. Therefore, in general, there seems to be agreement that higher levels of profitability can be achieved with diversification strategies than with expansion strategies, following the logic of the exploitation of surplus resources [29].

Companies covering new businesses need to adapt to the technologies used by suppliers and customers and this knowledge can be applied to other business areas by improving interrelationships, communication and management. Diversification creates requirements for internal coordination associated with the exchange of resources across multiple business units [60]. The review carried out of ICTs and business innovation processes [61] shows that the generation of new products and services involves the incorporation of new knowledge and ICTs. The literature shows [62] that firms that follow related diversification strategies find more benefits from adopting ICTs [63] than those that adopt strategies not related to financial synergies [64]. However, ICTs also have the potential to reduce transaction costs if unrelated strategies are used [65]. Therefore, the proposition we advocate is the following:

Proposition 2. *Related and unrelated diversification favors the use of ICT in the organization.*

At present, in the olive oil sector, a major problem persists in the marketing of its products to the final consumer, i.e., the sector has a significant deficit in its market orientation. ICTs and technological innovation, in general, offer the sector an important channel for solving this structural problem [66]. This results in the need for market orientation for commercial success [67]. When marketing their products, market-oriented organizations should increase their innovation process, allowing efficient commercial traffic [68]. Commercial efforts aimed at the end market will result in a greater innovative effort, for example, through the design of higher quality websites [69]. As discussed above, there is scientific literature indicating that related diversification finds more benefits from ICT adoption [63]. Based on the previous literature, we can make the following proposal:

Proposition 3. *Orientation to the final market, measured by the percentage of sales that are packaged (related diversification), favors innovation in the organization.*

We are currently immersed in an increasingly competitive global market in which companies must operate. In this context, technological innovations are becoming indispensable tools for acting in the international market. For example, a high-quality website available in different languages is a low-cost way of internationalizing the company [70] and accessing a larger number of potential clients [71]. Websites also allow small companies to access exports more effectively [72]. This relationship also exists in the opposite direction, i.e., technological knowledge and access to commercial innovations can be increased both through internal development and through the firm's relations with other organizations abroad [73,74]. Based on this argument, the following proposition can be made:

Proposition 4. *The degree of internationalization, measured through the percentage of exports, favors innovation in the organization.*

Human capital plays a decisive role in the knowledge economy [75], even more so in highly competitive environments such as the current olive oil market. Human resource training is a determining factor in innovation [76], and ongoing staff training is necessary in order to acquire useful and up-to-date knowledge of the environment in which the company operates [77], such as the acquisition of technological knowledge [78].

Thus, in order to obtain an innovative attitude in the company, it is essential to have managers who are highly trained and up-to-date with the needs of the market [79]. This will encourage the training of workers in the organization and, therefore, innovation within it [80]. The SDGs argue that quality training is essential to increasing the skills needed in people to achieve greater entrepreneurship (SDG 4), and the olive sector is not oblivious to this. Based on these theoretical arguments, we propose the following proposal:

Proposition 5. *The training of employees in ICT favors innovation in the organization.*

The organic production sector is currently in continuous growth. However, there are important barriers to the increase in demand for this type of product like consumer misinformation, the lack of points of sale and the high differential between organic products and their conventional counterparts, with these problems being even more pronounced in the olive oil sector [81]. This is leading consumers to increasingly use digital media as an alternative purchasing channel [80]. In addition, consumers of organic products tend to be more active on the Internet, partly because of their greater need for information [82], so these consumers will make greater use of websites that provide them with rich information and are well designed [83]. This situation will lead companies to make a strong commitment to innovation, especially commercial innovation. SDG 12, 13 and 15 are reflected in this proposal, since the defense of the planet is a work axis that the United Nations defends as essential and in which technological innovation must play a crucial role [3]. Based on the above argument, we can make the following proposal:

Proposition 6. *The commitment to ecological production favors innovation in the organization.*

3. Methods

3.1. Population

The organizations analyzed in this study account for a total of 449 companies (444 cooperatives: 1 SAT (Agricultural Processing Company); 3 SA (Public Limited Company); 1 cooperative group), most of them first-degree cooperatives, integrating more than 165,000 individual members, with a turnover of more than 2 billion euros and employing more than 2500 people. The degree of cooperative integration in the olive sector accounts for 50.16% of existing cooperatives and 25% of all oil mills [46]. These organizations are made up of around 35 second-degree co-operative societies dedicated to the marketing of olive oil and in which constitute our target population. In Spain, the second-degree cooperative societies are the largest olive oil marketers, accounting for 26% of total Spanish production [46]. In order to collect the data, the collaboration of Agrifood Cooperatives of Spain was requested first, since they are the confederation that includes most of the Spanish agricultural cooperatives. This confederation carries out an annual structured survey in which, in addition to first-degree cooperatives, second-degree cooperatives also participate. This survey was carried out in 2018 and collects data on cooperatives corresponding to 2017. On the other hand, in the year 2018, a structured telephone survey was carried out, aimed at the organizational heads of each of the 35 entities

(total population), which completed the information collected in the Agrifood Cooperatives of Spain database. Data was obtained from 27 of them, representing a response rate of 77.14%.

3.2. Methods

The methodological technique that has been used in this study has employed the Qualitative Comparative Analysis (QCA) technique, using the fuzzy set approach (fsQCA) in order to establish technological and organizational variables that together are associated with a higher level of efficiency. The QCA technique, based on Boolean algebra, uses a verbal, conceptual and mathematical language that configures it as a qualitative and quantitative approach, combining the main advantages of both [84]. In this way, by applying QCA, it is possible to systematically analyze a set of cases in order to determine causal patterns in the form of need and sufficiency relationships between a set of conditions and a given outcome [85]. The advantage of this method over a regression technique is that it establishes relationships between subsets of variables in order to explain relationships. In addition, this technique makes it possible to work with medium-size samples not large enough to apply traditional quantitative methods [86,87].

The fuzzy set development (fsQCA) is one of the most widely used variants of QCA, as it solves one of the main drawbacks and criticisms of the initial approach called csQCA, which is its strictly dichotomous approach [88]. The fsQCA variant will offer, as a result, one or more antecedent combinations sufficient to obtain a specific result, such as: $X1^* \sim X2^* X3$ sufficient for a result (Y). Using the symbolism of this technique ($X1^* \sim X2^* X3 \rightarrow Y$). Being: X1, X2 and X3 background; Y, the result; * the union and \sim the absence or negation, in this case, the opposite value to X2 (1- X2).

As indicated above, the QCA technique was developed for small sample environments or populations [84], so it is not a drawback for this research, in which the study universe is small. For the correct execution of this technique, the phases recommended in the literature for the calibration of variables, the analysis of need and the analysis of sufficiency are followed. For this reason, the corresponding calibration of variables was carried out first. Then, a necessity analysis of the efficiency scores on the different causal conditions was performed to verify that none of the values obtained exceeded the recommended threshold of 0.9, established by [89], which was corroborated.

The dependent variable is the degree of technological innovation. This variable has been created by considering the different ICTs used by the company in its business performance. Thus, a count has been made of the number of technologies used by the company, considering the following: intranet, website, presence in social networks, e-shop, presence in electronic markets and app. For their part, the causal variables used were: diversification (related and unrelated); staff training in ICT; percentage of turnover that is sold in packaging; percentage of exports; consideration of ecological product; and business integration. All these variables are listed in Table 1.

Table 1. Variables used in the fsQCA (fuzzy set Qualitative Comparative Analysis).

Outcome	Description	
Innovation	Counting of ICTs used by the organization	Categorical variable ¹
Condition	Description	
Diversification	The company has multiple sections/divisions	Dichotomous variable ²
ICT training	ICT training for staff	Categorical variable ³
Marketing	Percentage of product sold in packaging	Continuous variable ⁴
Internationalization	Percentage of exports to total turnover	Continuous variable ⁴
Ecological	Includes organic products in the company's offer	Dichotomous variable ²
Integration	Number of companies it comprises	Continuous variable ⁴

Source: Compiled by the authors. ¹ Count of ICTs used by the company, considering the following technologies: intranet, website, presence in social networks, e-shop, presence in electronic markets and app. Calibrated as per Ragin and Rihoux [87]. ² Dichotomous variable (1: yes; 0: no). ³ Categorical variable with four levels (0.01: no knowledge; 0.33: user level; 0.67: intermediate level; 0.99: advanced level). Calibrated as per Ragin and Rihoux [87]. ⁴ Continuous variables were calibrated using fsQCA 3.0 software.

4. Results

In a first approach to the data of this study, Table 2 shows the average values of the variables that have been considered in the analysis.

Table 2. Descriptive statistics for the variables used in this study.

Variables	Statistics on the Organizations Analyzed
Innovation	29.63% make use of intranet. 88.89% have a website. 40.74% have a virtual store. 62.96% use virtual social networks. 11.11% is in the electronics markets. 7.41% have apps.
Diversification	51.85% have more than one section. 48.15% have only one section.
ICT training	37.04% are very highly educated. 22.22% are highly educated. 18.52% have an average education. 11.11% have a low level of training. 11.11% have no training at all.
Marketing	The average of packaged sales is 32.67%. 18.51% of companies sell only packaging.
Internationalization	The average percentage of exports is 32.04%. 14.81% of companies do not export.
Ecological	29.62% include organic products in their offer.
Integration	On average, the societies make up about 20 organizations. In total, the sample includes 449 organizations.

Source: Compiled by the authors.

Firstly, all the variables, both causal and outcome, were calibrated so that their measurements in fuzzy sets show values ranging from 0 to 1. Subsequently, an analysis of the need for the innovation variable was performed on the different causal variables to verify that none of the values obtained for consistency exceed the recommended limit of 0.9 and that coverage is not too low [89].

Finally, the results of the fuzzy set analysis for companies with a high degree of innovation are presented in Table 3, which shows the intermediate solution. As used in the literature, the black circles (●) denote the presence of a condition, while the crossed-out circles (⊗) indicate its absence (there is no such result in the model). The solution table includes theoretical consistency values of sets for each configuration, as well as the general solution, with a value above the threshold recommended in the literature (>0.75). The causal configurations have been ordered from highest to lowest gross coverage.

Table 3. Results of the fsQCA analysis.

Causal Configuration	1	2	3	4	5
Diversification		•	•	•	
ICT training	•	•	•		•
Marketing	•		•		
Internationalization	•	•			
Ecological				•	•
Integration		•	•		•
Raw coverage	0.401542	0.327961	0.225648	0.210231	0.177996
Unique coverage	0.201822	0.073581	0.051156	0.096006	0.031535
Consistency	0.913876	0.945455	0.904494	0.750000	0.920290
Model coverage	0.747723				
Model consistency	0.837520				

Source: Compiled by the authors.

The results indicate a global model coverage of 0.74, suggesting that a substantial proportion of the outcome is covered by the six variables considered, with an overall consistency of 0.83. The first configuration alone explains 40.15 percent of the organizations with the greatest innovation. This combination of variables is made up of the variables of employee ICT training, packaged sales and percentage of exports. The second configuration shows that 32.79 percent of the organizations that present a greater degree of innovation are those that diversify, with employees trained in ICT, packaged sales and a greater degree of integration. In calculation, all the variables considered are present in the model with a positive tendency towards innovation. In this way, the proposals described above are fulfilled.

5. Conclusions

The existing literature directly links economic development to innovation and investment in R&D&I. The SDGs developed by the United Nations and signed by most countries seek to generate that development which is needed to improve the well-being and prosperity of the world's population. This paper has focused specifically on one of the tools that appears in SDG 17, the use of ICTs as a cross-cutting tool for achieving the SDG. In addition, the SDG highlights the need for partnerships in order to achieve the SDG more quickly. In this sense, this paper has also focused on analyzing the second-degree cooperativism of the Spanish olive sector, due to its enormous importance worldwide.

In this context, the main objective we set ourselves was to determine which are the structural, organizational and commercial factors that favor technological innovation in the second-degree olive cooperatives in Spain. The results obtained in this study allow us to verify, through the use of the fuzzy set Qualitative Comparative Analysis (fsQCA) technique, that the immersion of companies in ICTs is favored by the following factors: the intensity of cooperative integration, measured by the number of first degree cooperatives or other entities that make up the second-degree cooperative; diversification in the company, measured by the sections/divisions that make up the cooperative; orientation towards the final market (percentage of product that is sold in packaging); ICT training of employees; the export nature of the cooperative, according to the percentage that foreign trade represents for the sales of the cooperative and the supply of ecological products.

In short, the SDGs that have been analyzed here through the different proposals that have been corroborated (SDG 4, 8, 9, 12, 13 and 15) show that the implementation of these SDGs contributes to improving innovation. At the same time, innovation promotes economic development and the prosperity of territories and nations, which in turn leads to an improvement in the SDGs.

The conclusion we draw is that far from considering SDGs as a burden for companies and institutions, they should be analyzed and integrated into organizations as an opportunity, since this link through this closed circle will undoubtedly improve not only the competitive position of

the company but will also help to alleviate some of the major problems of humanity. This link with the SDGs, which must be shown to consumers, must be the hallmark of the companies that responsible consumers will undoubtedly seek and reward.

This line of research, focused on the cooperative movement in the olive sector, could be extended in future research that focuses on other sectors of the Social Economy, with the aim of contrasting whether the factors marked here, as determining the technological innovation of the company, can be established in a general way in any sector of activity. In this respect, it would be very interesting to see whether the differentiating factors of the olive oil sector determine that these are key factors for its progress in technological innovation.

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