

## Article

# Modelling Critical Innovation Factors in Rural Agrifood Industries: A Case Study in Cuenca, Spain

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**Abstract:** The agrifood industry contributes to sustaining the population and the economic growth in rural areas of Spain. Innovation in the agrifood sector has therefore become a necessity as a means of improving the competitiveness of companies and the territory, thus promoting sustainable rural development in areas currently characterised by social issues such as depopulation. Meeting this need requires the generation of specific knowledge on innovation in the rural agrifood industry to strategically steer the business management of innovation. This study aims to contribute to further improving the competitiveness of the agrifood industry through the interrelation of critical innovation factors in small and medium-sized agrifood enterprises, thus shedding light on the innovation environment of differentiated local products in depopulated rural regions. The qualitative Interpretive Structural Modelling (ISM) methodology was used with the participation of entrepreneurs and experts from the sector. The ISM was applied to a case study in *Alcarria Conquense*, a Spanish region that embodies the current problems of many rural territories. The results show four factors (cooperation, managerial skills, absorptive capacity, and market orientation) are binding variables with a high power of influence and dependence, and a fifth factor, funding, is the most dependent on the others. The work contributes to the literature by revealing the needs and opportunities for a potential strategic planning of rural development that can positively influence the problems of the region through innovation management in this industry.

**Keywords:** competitiveness; ISM; rural development; planning



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## 1. Introduction

The agrifood industry has economic, social, and environmental implications, providing the rural population with a livelihood, and contributing to the economic growth of the local territory. Due to the essential nature of this industry, constant innovation is required, because innovation has become a vital requirement to improve business competitiveness and regional development [1–5]. Undertaking innovation activities can reduce production costs, render processes more flexible, add quality, and even lead to new products that better fit consumer demands [6,7]. In turn, territorial competitiveness serves to gauge a territory's particular development potential, and aids in the planning and design of its programmes and strategies. For a company, innovation relies on elements that are internal and external to its organisation [8–10]. According to Fumero and Ullastres (2017), the innovation of a company is the result of the attitudes, actions, and behaviours of a set of people with different capabilities who make up the company, and is mainly determined by the relationships established between these people and the environment [11].

Innovation has often been praised for its strategic potential and included as a tool in a number of national and international policies, for example, regulation (EU) No 1151/2012 of the European Parliament and of the Council on quality schemes for agricultural products and foodstuffs [12]; the Europe 2020 Growth Strategy [13]; and the action plan for the

implementation of the 2030 agenda, developed as an SDG-oriented update of Spain's national sustainable development plan, which was drawn up in 2007.

In the action plan for achieving the targets set out in the Sustainable Development Goals (SDGs) in Spain [14], innovation is mentioned as a strategy in industry (SDG 9), sustainable agriculture (SDG 12), and economics (SDG 8), which are all structural aspects of agribusiness. These goals will be pursued by implementing policies such as: The 2017–2020 State Plan for Scientific and Technical Research and Innovation (drawn up by the Ministry of Economy, Industry and Competitiveness); those of the Spanish Development Finance Company (Compañía Española de Financiación del Desarrollo – COFIDES) as an economic growth driver; and the Agenda for the Strengthening of the Industrial Sector in Spain.

Although there is a support network structured by the 2030 Agenda, in the context of Spanish rural areas, the promotion of innovations linked to the agrifood sector to identify answers to the issues and specific circumstances of these territories is undertaken by producers, producer organisations, Local Action Groups (LAGs), and research centres [15]. The 2018 data from the Spanish Ministry of Agriculture and Fisheries, Food and Environment (Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente, MAPAMA) show that the agrifood industry in Castile-La Mancha (CLM) generated a business volume of more than EUR 8785 million and accounted for 3.15% of the employment in the region [16]. This is evidence of the strategic nature of the sector, resulting in added value and quality, and generating benefits for companies and an emotional connection with consumers [17], largely as a result of having more than 40 agrifood quality measures in CLM, including Protected Designations of Origin (PDO) and Protected Geographical Indications (PGI). According to the 2014–2020 Rural Development Programme (RDP) of the Government of Castile-La Mancha (2017), the region's agrifood industry is vulnerable and susceptible to economic, commercial, and market threats, as is atomised and mostly made up of small and medium-sized enterprises [18].

Consequently, there is a need to generate valid knowledge through a participatory approach to the study of innovation in the agrifood industry. This would provide a strategic direction for the business management of innovation and thus contribute to achieving the global objectives of a more sustainable production and industrial system.

For the purposes of this research, due to its orientation towards the study of organisations and agribusiness management, innovation is construed as a process of significant changes in the product, process, marketing, technology, or organisation of a company [19,20] occurring collectively and interactively among a variety of actors: companies, universities, research centres, government agencies, and financial institutions [21]. The different factors influencing this process merit identification.

This study, therefore, aimed to contribute to improving the competitiveness of the agrifood industry of the Spanish comarca *La Alcarria Conquense*, which is located in the Province of Cuenca, by (a) identifying critical business innovation factors in the agrifood industry; (b) interpretative modelling of the innovation structure; and (c) participatory analysis of the model developed with agrifood companies. As a result, the study contributes to a clearer vision of the innovation processes in the rural agrifood sector and sets the basis for conscious decision making in planning future strategies to foster innovation.

## 2. Case Study

The La Alcarria Conquense region lies in the northwest corner of the province of Cuenca (Figure 1), within the Autonomous Community of Castile-La Mancha. The region has a total of 67 population centres grouped in 43 municipalities and distributed over an area of 2500.07 km<sup>2</sup> [22].

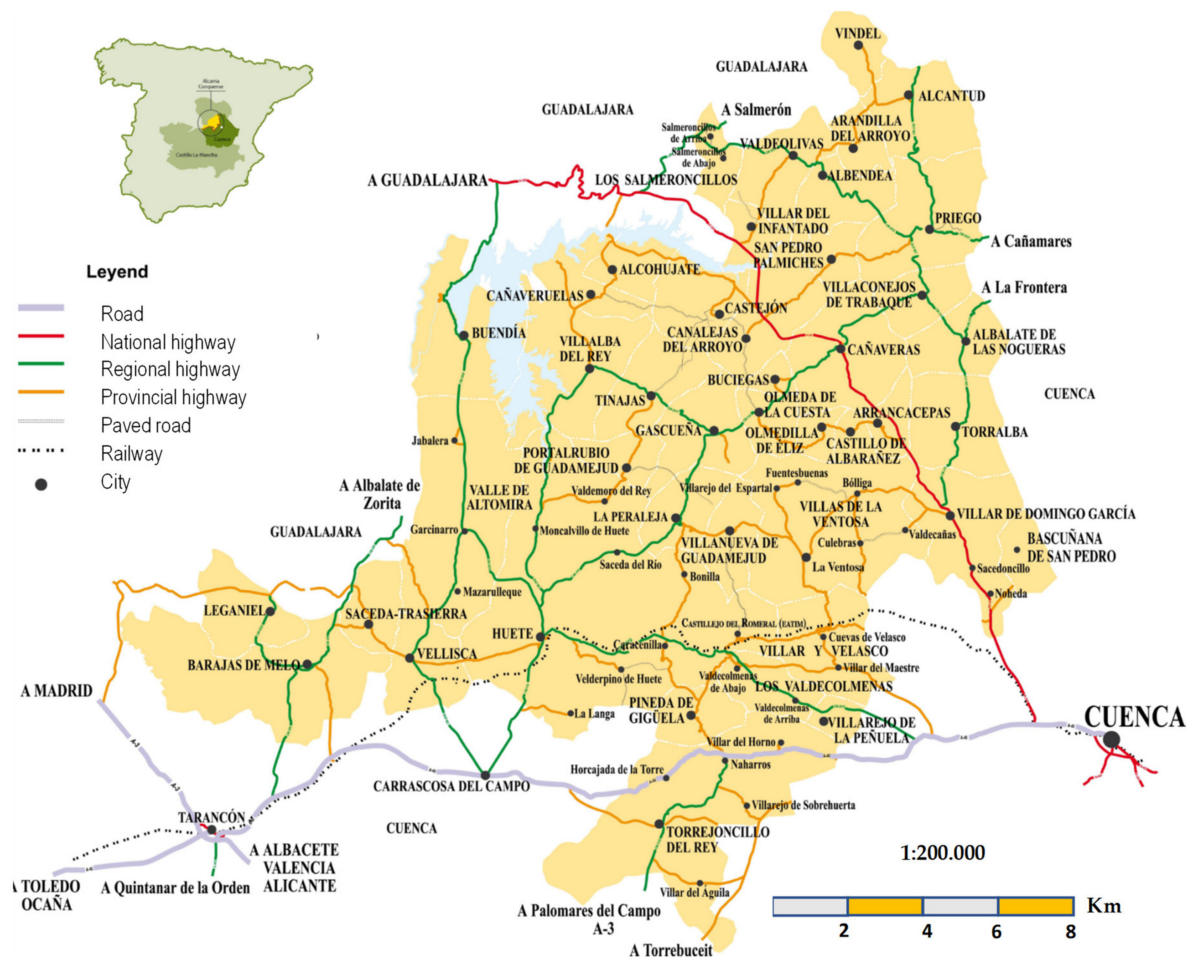


Figure 1. Location of the La Alcarria Conquense region in Spain [22].

The region's 2020 population was 8804 inhabitants, with a density of 3.52 inhabitants per km<sup>2</sup>. This figure highlights a high degree of depopulation compared to the values of 93 inhabitants per km<sup>2</sup> in Spain or 104 inhabitants per km<sup>2</sup> in the European Union [23]. The population is mostly concentrated in four municipalities of over 500 inhabitants, only one of which is larger than 1000 inhabitants, accounting for 46.1% of the population. The remainder of the population is distributed among 39 municipalities, 19 of which have less than 100 inhabitants. The region shed 3567 inhabitants in the 2001–2020 period, partly due to natural demographic shifts and partly due to emigration. Some of the consequences of the significant depopulation include: (a) ageing population—34.3% of the total population over 65 years of age; (b) masculinisation—53.4% of the population is male; (c) lack of generational replacement—only 13% of the population is under 16 years of age; and (d) a negative natural year-on-year population growth rate of  $-6.5\%$  [22].

This progressive depopulation has led to the inaction of the local population, triggered by the lack of three factors, namely, initiative, training, and local job opportunities [24]. In the past, individuals with a greater capacity for entrepreneurship have sought new job opportunities outside the region, further compounded by the local education system's failure to foster a sense of belonging or regional identity. The extensive farming activities prevalent in the territory do not demand seasonal labour. As a result, the labour demand in the area is insufficient and inadequate incentives exist for the population to remain.

The work by the CEDER Alcarria Conquense Local Action Group under the LEADER approach, within the framework of the Rural Development Programmes implemented in the region, has been a decisive factor benefiting the agrifood sector and the territory [25], providing investments of over EUR 5.9 million in the region's main agro-industrial sectors.

Under this programme, the agro-industrial sector received financial support for establishing small businesses, or investing in infrastructure and specialised equipment, including training initiatives and support for marketing and promoting products through activities such as local and regional fairs and events.

The industrial sector has a modest manufacturing presence, mainly related to wood, pottery, wickerwork, and forging. In contrast, the agrifood industry has significantly more relevance in the territory, primarily linked to processing oil, cheese, honey, lamb, and wine. In the La Alcarria Conquense, there are a total of 51 companies in the agrifood industry (see Table 1) and its importance in the region is determined by the following aspects: (a) its contribution to population fixation, through the generation of direct employment (this industry represents 11.98% of jobs at the local level) [22]; (b) the increase in the added value of agricultural and livestock products, especially in a region where the main economic activity is rainfed agriculture (sunflower, cereal, and olive groves); (c) the growing interconnection of the agrifood industry with the development of the rural tourism sector through the creation of agro-industrial-related activity (e.g., an oil museum, honey museum, and wine and cheese tasting room); and (d) the external promotion of the region's image, mainly related to those products included in the quality schemes, such as Protected Designation of Origin (PDO) and Protected Geographical Indication (PGI), including La Alcarria oil, La Alcarria honey, Calzadilla Vino de Pago wine, and Manchego cheese.

**Table 1.** List of agrifood companies in the La Alcarria Conquense region [26].

Agrifood Business Activity Type	Total	Percentage (%)	Quality Brand Owners
Vegetable oils and fats	5	9.8	5
Non-alcoholic beverages	1	2.0	
Meat and meat products	11	21.6	
Cereals, flours and derivatives	6	11.8	
Extracts, sauces, spices and condiments	1	2.0	
Forestry, aromatic and medicinal plants	1	2.0	
Dried fruits, nuts and derivatives	1	2.0	
Hay, fodder and animal feed/nutrition	1	2.0	
Milk and dairy products	3	5.9	2
Honeys and waxes	4	7.8	6
Grape musts, wines and wine derivatives	4	7.8	1
Bread, pastries, cakes, baked goods and confectionery	13	25.5	
<b>Overall total</b>	<b>51</b>	<b>100</b>	<b>14</b>

### 3. Materials and Methods

The methodology used in this research is characterised by having two main phases: in the first, the critical factors of agrifood innovation were identified and modelled with the help of a bibliographic analysis, consultations with experts, and the Interpretive Structural Modelling (ISM) method; in the second phase, the preliminary results obtained from the model were applied to the companies in the territory identified as having the highest representation of the innovation processes in the study area. From this participatory analysis of the model, it was possible to define the main needs and opportunities in the area for improving innovation and generating strategic plan guidelines.

#### 3.1. Identification of Critical Agrifood Innovation Factors

The selection of the critical factors analysed in the business fabric, as a fundamental part of the research, required a review of scientific articles and literature on innovation and business management in small and medium-sized enterprises (see Table 2). The databases used were Scopus, Web of Science, and Google Scholar. A total of 21 articles dated until August 2018 were identified, using the following keywords: innovation factors, critical innovation factors, and agrifood industry innovation. All the papers were reviewed, and

those more closely related to the case study context were selected. These are listed in Table 2 in relation to the critical factors.

**Table 2.** List of critical innovation factors.

No.	Critical Factor	Reference
1	Funding	[27–29]
2	Cooperation	[19,20,30,31]
3	Absorptive capacity	[19,28,32–34]
4	Managerial skills	[11,27–29]
5	Market orientation	[11,27,28,34]

The factors found to be critical for the entrepreneurial innovation process in the agrifood industry were financing, cooperation, absorptive capacity, managerial skills, and market orientation.

Financing is one of the most important aspects of a company's ability to innovate. The structure of financing encompasses elements such as own and third-party financing, venture capital, borrowing requirements, and obtaining credit [29]. The availability of financial resources is a strength for innovation capacity in small and medium-sized enterprises [28,35]. The amount of and access to resources [36,37], and sources of funding, influence the selection of innovations that are implemented with the aim of improving competitiveness [27].

The nature of innovation processes in small and medium-sized enterprises also emphasises the importance of cooperation with other agents in the environment, precluding isolation [19,38–41] by establishing simple transactions and, potentially, alliances [31]. An innovative company needs links between the different actors in the innovation system: public laboratories, universities, ministries, regulatory authorities, competitors, suppliers, and customers [20]. This results in collaboration between the participants involved, each of whom is distinguished by their own knowledge and resources [30,41–43].

Absorptive capacity is a concept that creates a link between the ability to acquire and transfer knowledge internally, and the access, identification, and assimilation of externally generated information and knowledge [19,32,44]. This enables the successful introduction and assimilation of innovations that are efficiently adapted to the specific case of each company [34], and thus becomes a resilience tool [45]. Knowledge management determines the ability to innovate within small and medium-sized enterprises due to advantages such as simple organisational structures, fewer employees, and minimal bureaucratic involvement, highlighting the absorptive capacity of internal knowledge sharing and learning processes [33]. This learning capacity is collaborative and based on experience and cognitive processes involving the acquisition, exchange, and use of knowledge through actions. These actions include effective idea generation through practices such as experimentation, continuous improvement, teamwork, group problem solving, observing others, and participatory decision making [28].

The fourth factor corresponds to managerial skills. Innovation activities in small enterprises depend on internal organisational variables [46], mainly linked to the figure of the entrepreneur or manager and his or her behaviour [29], because he or she is the main driver of change processes through leadership [27]. The role of the entrepreneur and his or her managerial skills play a vital role in the business, which must be able to plan for the future and build competitive advantages based on innovation without neglecting the present. Furthermore, the business must be reactive to opportunities and take risks in continuous improvement, incorporating innovation management into the organisational culture in a continuous and inherent manner, while being increasingly committed to local, national, and global agendas to ensure long-term sustainability [11,47]. The entrepreneur is the facilitator and promoter of entrepreneurial activity, and his/her management style is a predictive characteristic for the future adoption of innovations in an environment of trust, collaboration, collective understanding, mutual learning, and self-improvement [11,28].

Engaging business practices with market orientation also facilitates a higher level of innovation [28]. The market comprises not only of customers and users, but also suppliers and competitors whose relationships with each other are a source of innovation [19]. Effective means of contacting customers and understanding their needs are the key to avoiding failure. Market and consumer habit studies are necessary as pilot plans for the success of innovations [11,34].

### 3.2. Modelling Critical Innovation Factors

Interpretive Structural Modelling (ISM) uses mathematical foundations to decompose a complex system into subsystems by interpretively establishing a multitier structural model. The model is interpretive because it incorporates the judgements and opinions of experts, but also structural because it is based on the relationships extracted from the set of variables studied, and establishes hierarchies based on the combinations between these relationships [48–50].

Originally developed to analyse socio-economic systems, this model has found a prominent position in social science research [51,52]. The approach is capable of identifying and relating different elements or factors that make up a system. Through an interactive learning process based on literature reviews, expert consultations, group work techniques, and direct relationship matrix approaches, the model imposes order and direction on the complexity of relationships between the elements studied around a theme or problem [48,50,53,54], producing an output diagram to view the final structure of the model. The process involves a series of phases (see Figure 2), concluding with the generation of a graphical representation by means of the Interpretive Structural Modelling technique of the relationships between the factors.

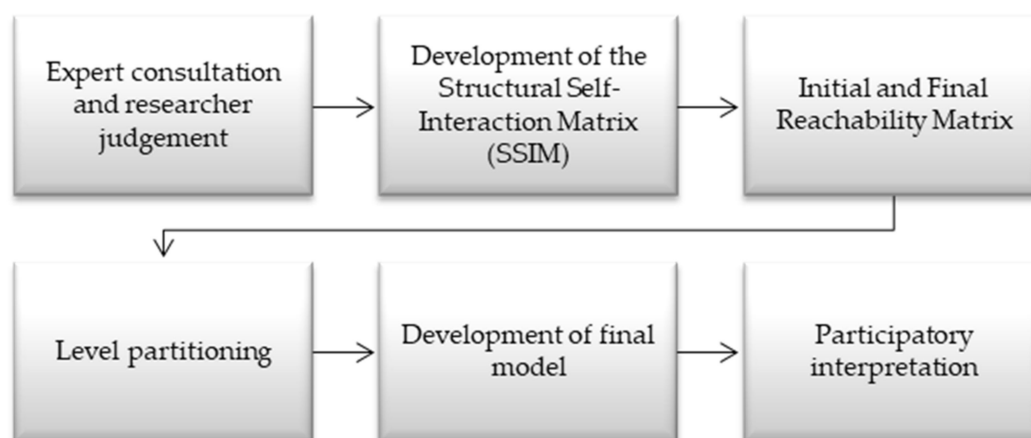


Figure 2. ISM implementation flowchart.

#### 3.2.1. Expert Consultation

Expert consultations were conducted using the Delphi method, seeking to achieve a consensus based on discussion among experts through an interactive process. Specifically, the panel in the research sought to integrate the analysis and structuring of the five factors that are considered key to the implementation of innovation in the business sphere (see Table 3), according to the current situation of the production of local products linked to a given rural territory.

**Table 3.** General information about the experts consulted.

ID	Workplace	Position	Training	Years of Experience	Area Experience
E1	Administration of the Community Board of Castilla-La Mancha	Technical	Agricultural engineer	>10	Agroindustry Rural development Innovation
E2	Castilla-La Mancha university	Research professor	Bachelor of Humanities	>35	Agroindustry Rural development Innovation
E3	CEDER Alcarria Conquense Association	Manager	Law degree	>25	Agroindustry Rural Development
E4	Huete Futuro Foundation	President	Degree in History	>35	Rural development innovation
E5	Cuenca Provincial Council	Technical	Agricultural engineer	>35	Agroindustry Innovation
E6	Administration of the Community Board of Castilla-La Mancha	Technical	Degree in Law	>10	Business incentive Innovation
E7	Polytechnic University of Madrid	Research professor	Agricultural engineer	>20	Rural development Innovation

Expert consultations took the form of a questionnaire via face-to-face interviews and electronic digital media. There were seven experts, all of whom are involved in innovation, rural development, agronomy, industry, history, planning, and communication. Additionally, they also have knowledge of and a relationship with the territory under study, carrying out their professional activity in different areas of public administration, the academic sector, and associations linked to the territory. There was also strong representation from the regional government, namely the Agricultural Research Service, the Regional Institute for Agrifood and Forestry Research and Development, and the Provincial Directorate of Economy, Business and Employment of the CLM Regional Government. The expert panel comprises members of associations and foundations linked to the region (CEDER and Huete Futuro), the academic sector (UCLM), and a private actor dedicated to social innovation design services.

The experts were selected considering the following criteria: a) good knowledge of the study territory, and of the network of agro-industrial companies located in it and the characteristics of the business community; b) knowledge of the innovation processes carried out in the agrifood industry of the territory in the last 10 years; and c) participation in the implementation or monitoring of an innovation process in the companies of the territory.

### 3.2.2. Structural Self-Interaction Matrix

The Structural Self-Interaction Matrix (SSIM) serves to systematise the relationship between specific variables defining a problem or several problems, detected through expert consultation.

The group of experts was asked to establish the relationships between pairs of selected critical innovation factors. Four symbols are used to indicate the direction of the relationship between each pair of factors (i, j):

V: Factor i leads to factor j, but factor j does not lead to factor i

A: Factor j leads to factor i, but factor i does not lead to factor j

X: Factors i and j lead to each other

O: Factors i and j are unrelated

The questionnaire responses were used to generate the information to complete the Structural Self-Interaction Matrix (see Table 4), with questions structured as follows:

1. How does each pair of critical innovation factors relate to each other? Select the letter that best describes the relationship between each pair of factors “i” and “j” (V, A, X or O)\*. Then indicate and comment on relevant aspects that justify the selection (optional).
2. How important are each of the relationships between pairs of factors for implementing each innovation type? Please rate each innovation type according to the following scale: 1 = Not Important (NI), 2 = Somewhat Important (SI), 3 = Very Important (VI)

**Table 4.** Structural Self-Interaction Matrix with critical factors.

Factor	5	4	3	2
1. Funding	O	A	O	A
2. Cooperation	X	A	X	
3. Absorptive capacity	X	X		
4. Managerial skills	X			
5. Market orientation				

When establishing the definitive relationships between the pairs of factors, the initial criterion considered was the number of mentions by the experts. The symbol that accumulates several mentions greater than 3 was selected. When this condition was not met, the selection was subject to the judgement of the researcher, who was informed by the research context and supported by a set of comments made by the consulted experts to justify the answers to the questionnaire.

### 3.2.3. Initial and Final Reachability Matrix

The structural matrix was converted into a binary matrix consisting of zeros and ones, referred to as the initial reachability matrix (see Table 5), by substituting the above symbols according to the following rules: (a) If the previous input was V, the input (i, j) was 1 and the input (j, i) was 0; (b) If the previous input was A, the input (i, j) was 0 and the input (j, i) was 1; (c) If the previous input was X, the inputs (i, j) and (j, i) were both 1; and, (d) If the previous input was O, the inputs (i, j) and (j, i) were both 0. In turn, the final reachability matrix (see Table 6) was obtained by applying the concept of transitivity in the context of factor relationships, which suggests that if factor A is related to B and B is also related to C, then it is mandatory that A and C are related. The first corresponds to the total of factors that everyone can help to achieve, including themselves. The second refers to the total number of factors that can contribute to its scope.

**Table 5.** Initial reachability matrix among critical factors.

Factor	1	2	3	4	5
1. Funding	1	0	0	0	0
2. Cooperation	1	1	1	0	1
3. Absorptive capacity	0	1	1	1	1
4. Managerial skills	1	1	1	1	1
5. Market orientation	0	1	1	1	1

**Table 6.** Final reachability matrix among critical factors.

Factor	1	2	3	4	5	PI1
1. Funding	1	0	0	0	0	1
2. Cooperation	1	1	1	12	1	5
3. Absorptive capacity	0	1	1	1	1	4
4. Managerial skills	1	1	1	1	1	5
5. Market orientation	0	1	1	1	1	4
Dependency power	3	4	4	4	4	19

### 3.2.4. Level Partitioning

Tier ranking was undertaken by assessing the groups of influence and dependency factors for each. Depending on the intersection of elements between each set, the factors were separated into hierarchical levels, and the factors with overlapping sets of influence and intersection were placed at the top (Tier 1). The comparison of the similarity between these two sets was applied for each factor, continuing the hierarchical division (see Table 7).



**Table 7.** Level partitioning of the critical factor.

Factor	Influence Set	Dependency Set	Intersection	Tier
1. Funding	1	1, 2, 4	1	1
2. Cooperation	1, 2, 3, 4, 5	2, 3, 4, 5	2, 3, 4, 5	2
3. Absorptive capacity	2, 3, 4, 5	2, 3, 4, 5	2, 3, 4, 5	1
4. Managerial skills	1, 2, 3, 4, 5	2, 3, 4, 5	2, 3, 4, 5	2
5. Market orientation	2, 3, 4, 5	2, 3, 4, 5	2, 3, 4, 5	1

### 3.2.5. Development of the Final Model

The factors were organised visually according to the levels identified above, and the links were shown according to the relationships revealed in the reachability matrix. The links between factors caused by transitivity were then removed, yielding the final diagram, which was in turn transformed into the structural modelling of critical innovation factors based on ISM, replacing nodes with the corresponding factor name. Factors were then able to be classified as linking, dependent, independent, or autonomous variables.

### 3.3. Participatory Analysis of the Model

Entrepreneurs of the territory were interviewed in relation to the products that are currently subject to the PDO quality regime: honey, sheep's cheese, olive oil, and wine. The decision to focus on these agro-industries was based on the local production differentiated through quality certification, which has fostered innovation in the region in recent decades via new industry equipment, infrastructure, and marketing. More recently, and despite a certain degree of disdain of some entrepreneurs towards these quality assurance systems, they have become more influential in exploiting market innovations. Using the quality schemes as a criterion allowed us to avoid the confusion with agrifood industries that were not related to agricultural productions but more related to food processing, such as bakeries and butchers.

The Castile-La Mancha Agrifood Industries Registry for 2017 includes 14 industries in the region linked to these four products and with a quality certification, such as PDOs and PGIs. However, the number of companies included in the study was lowered to nine when ruling out those that were not suitable for the research aim, considering as central criteria the positive relation to agrifood production when the study was carried out and the fact that they had undertaken innovation within the previous 5 years. Table 8 shows the study's technical data sheet, which ultimately involved the on-site interview of eight entrepreneurs, which encompassed 64% of the quality brand owners in the agrifood industry companies, including all of those relating to milk and dairy products.

Table 9 provides an overview of the companies selected for the study.

During a total of eight visits to the territory between May and August 2018, fieldwork was carried out through personal interviews and direct observation of the business fabric of the agribusiness linked to differentiated local products. The questionnaire was designed based on considerations and guidelines from the third edition of the Oslo Manual, and business innovation questionnaires used in industry surveys and studies [20,55,56].

The interview included the application of a questionnaire with questions to establish: (a) the innovation trajectory from the basic characteristics of the company and entrepreneur, and the main innovations implemented that the entrepreneurs were able to identify; and (b) the relevant internal aspects of the factors selected as being critical to innovation at the company level. The variables considered during the interview development and in the forward analysis are detailed in Table 10.

**Table 8.** Case study fact sheet.

Initial Population	
Study units	Quality brands owners in the agrifood industry companies
Initial population	14
Vegetable oils and fats	5
Milk and dairy products	2
Honeys and waxes	6
Grape musts, wines and wine derivatives	1
Scope	Region: Alcarria Conquense
Time	May 2018–August 2018
Definitive population	
Company selection	By convenience and expert criteria
Companies removed from the study	5
	No innovation activities since more than 5 years (4)
	Not related with food production (1)
	Unwilling to cooperate (1)
<b>Definitive population</b>	<b>9</b>
<b>Covered Quality Brands Owners in the Agrifood industry companies</b>	<b>64%</b>
Vegetable oils and fats	80% (4)
Milk and dairy products	100% (2)
Honeys and waxes	33% (2)
Grape musts, wines and wine derivatives	100% (1)
<b>Interview type</b>	<b>Semi-structured personnel</b>
<b>Conducted interviews</b>	<b>8<sup>1</sup></b>

<sup>1</sup> The total number of interviews was eight because one entrepreneur is CEO of two of these case studies companies.

**Table 9.** Description of the studied companies.

Id	Production	Company Information				Employees	Market <sup>1</sup>	Entrepreneur Information	
		D.O.	Localisation	Year of Foundation	Gender <sup>2</sup>			Educational Background	
C1	Olive oil	Aceite de La Alcarria	Villalba Del Rey	1976	2	N	M	Basic	
C2	Olive oil	Aceite de La Alcarria	Villalba Del Rey	1990	2	N	F	Basic	
C3	Olive oil	Aceite de La Alcarria	Valdeolivas	1982	6	I	M	High	
C4	Olive oil	Aceite de La Alcarria	Vellisca	2015	5	I	F	High	
C5	Cheese	Queso Manchego	Huete	1984	5	I	M	High	
C6	Cheese	Queso Manchego	Huete	1980	11	I	M	High	
C7	Honey	Miel de La Alcarria	Huete	2010	1	N	F	Basic	
C8	Honey	Miel de La Alcarria	Valdeolivas	1982	1	N	F	Basic	
C9	Wine	Vinos Pagos Calzadilla	Huete	1981	4	I	M	High	

<sup>1</sup> "N" means that the company is commercialising their products in a national market, and "I" means that they export their products into an international market. <sup>2</sup> "M" stands for male and "F" stands for female.

The questionnaires used in the interviews also included, for each of the critical factors analysed, a section on needs and opportunities so that the interviewee, based on his or her own innovation history, could identify both aspects. The information gathered was then grouped, ordered, and classified by each factor, and subsequently analysed in relation to (i) the problem to be addressed; (ii) dependent factors; and (iii) influencing factors.

We conducted formal conversations, such as that with the local action group management, and also informal conversations with local figures linked to rural development and the private business sector, during field visits and participation in cultural events, which facilitated the acquisition of a sense of the territory and the context of the research.

**Table 10.** Variables considered in developing the questionnaire.

Type of Innovation	Innovation Trajectory	Variable Used
Product		Type of product innovation Product innovation novelty Product innovation developer
Process		Process innovation type Process innovation novelty Process innovation developer
Organisational		Type of organisational innovation Organisational innovation effects
Market		Type of marketing innovation Marketing innovation effects
Critical factor	Critical Factors	Variable Used
Financing		Mechanism used to finance innovation activities Knowledge of public financing lines Perception of public financing lines
Cooperation		Planning and allocation of own financial resources for innovation Key actors in the development of innovations Key information sources to support innovation activities Network in innovation and contribution to society Relationship and dynamics with other organisations linked to rural development, agrifood industry, PDO, among others Innovation culture
Absorption capacity		Availability of ICT infrastructures for the dissemination of knowledge and innovations Training plans for internalisation of innovation and specialised knowledge Evaluation and learning of innovation Diversity of training and technical and professional specialisation of human resources Materialisation of the innovation strategy
Managerial skills		Relationship between strategy and innovative culture Assumption of risks in the implementation of innovation processes
Market orientation		Marketing integration in the development of innovations Relationship between market demand and innovation Use of ICTs for innovations in business relationships

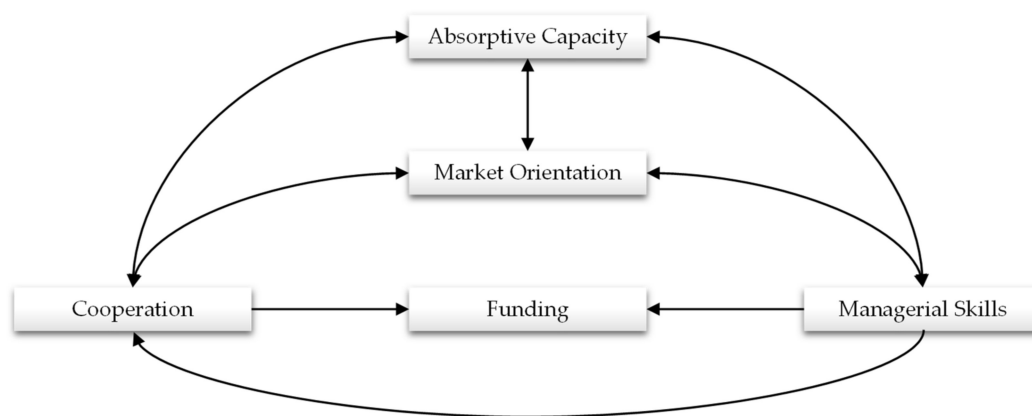
## 4. Results and Discussion

### 4.1. Critical Innovation Factors Model

The outcome of the modelling process with the experts is reflected in Table 4, Table 5, Table 6 and Table 7 and Figure 3, following the steps outlined in the methodology. This also provided the framework for further analysis.

Figure 3 shows the four factors assessed in the context of the case study with significant influencing power and dependence (absorptive capacity, market orientation, managerial skills, and cooperation), corresponding to linkage variables. Funding, by comparison, is the only dependent variable, and is mainly influenced by managerial skills and cooperation.

In rural territories with a small population, such as that of the case study, access to sources of financing for companies is vital for their development, given that their size, access to markets, and absorption capacity define their immediate future. Having managers with managerial skills and the capacity for cooperation is a determining factor for access to finance and, potentially, the continuity of the company.



**Figure 3.** ISM-based modelling of critical business innovation factors in the La Alcarria Conquense agrifood industry.

The role developed by the CEDER Alcarria Conquense Local Action Group in the territory was highlighted within the framework of the Rural Development Programs with a LEADER approach, through the measures to support the agrifood industry with the financing of new investments, acquisition of managerial skills of those responsible, and support for cooperation projects. As an example of cooperation work, the acquisition of the La Alcarria Oil Designation of Origin (2009) was highlighted, which affects 42 municipalities, and brings together more than 2000 farmers and five processing companies.

Building on the framework provided by the modelling, we were able to structure the analysis of the participatory process according to the characterisation of the factors.

#### 4.2. Critical Factor Management

##### 4.2.1. La Alcarria Conquense's Innovative Track Record

A share of 100% of the interviewed entrepreneurs claimed to have at least once tried process, organisational, and/or market innovations. With regard to product innovations, 25% of respondents said that they had implemented innovations that were new to their market, whereas 75% indicated that these were exclusively new to the company. The development of this type of innovation occurred in equal proportions, 50% by the company alone and 50% by adopting or modifying goods originally developed by other companies or institutions.

Regarding the identified process innovations, 100% of companies implemented new or improved production methods; 62.5% implemented some new or improved logistics, delivery, or distribution method; and 37.5% implemented a new or improved process support activity. A single interviewee indicated having developed a highly disruptive innovation that was new to their market. The development of this type of innovation indicates that 62.5% of the companies had experience implementing it on their own and 50% by adopting or modifying processes originally developed by other companies or institutions.

Of the total number of mentions of types of implemented organisational innovations, 46.1% referred to new methods of organising external relations with other companies or public institutions, 38.5% to new business practices for organising processes, and 15.4% to new methods of organising responsibilities and decision making. In terms of the effects sought with these innovations, of a total of 13 mentions, 46% were highlighted as referring to the improvement of product quality and 23% to the reduction of response times to the needs of the client and/or supplier.

Market innovations also achieved 19 mentions in the range of implemented initiatives. It was also notable that 37% of mentions alluded to new methods for distribution channels, and 26% to both significant changes in product design, packing, and packaging, and new promotional media or techniques. Regarding the effects of these innovations, 100% of companies implemented them to increase or maintain market share, 75% to introduce products to geographically new markets, and 62.5% to introduce products to new market segments.

The data are summarized and divided by companies in Table 11.

**Table 11.** Innovation track records of the studied companies (elaborated from data obtained during the case study interviews).

Innovation Type	Profile of the Studied Companies	Related Company
Product	Innovations for their market	C4, C9 (22.2%)
	Innovations for the company	C4, C2, C3, C7, C5, C6, C9 (77.8%)
Process	New or improved logistics method	C4, C7, C8, C5, C6, C9 (64.7%)
	New or improved process support activity	C2, C3, C9 (33.3%)
Organisation	New organisational methods	C1, C2, C7, C8, C5, C6, C9 (46.7%)
	New business practices	C4, C2, C3, C8, C5, C6 (66.7%)
	New methods of organisational accountability and decision-making	C4, C8 (22.2%)
Market	New distribution channels	C4, C2, C3, C7, C8, C5, C6, C9 (88.9%)
	Product design, packing and packaging	C4, C3, C7, C5, C6, C9 (66.7%)
	Other actions	C1, C2, C8, C9, C7, C5, C6 (88.9%)

#### 4.2.2. Participatory Analysis of the Model

Funding was the first factor to be analysed. The funding mechanisms for innovation activities show that all companies had at some point received public subsidies. In addition, 44.4% opted to access credit from public and/or private entities (C4, C2, C7, C5, C6), and only 33.3% used other methods, such as the use of own self-financing resources and awards (C4, C3, C7). Only half of the companies studied were successful in accessing public funding, leaving the others with a feeling of distrust towards the service, mainly due to the failure to secure funding, or the low relevance of public funding in the comprehensive results of the investments.

In addition, only C2 planned to allocate their own resources to implement innovation. In six companies (C7, C8, C1, C4, C3, C5, C6), decisions regarding the innovation process were made on the basis of current economic capacities and the search for sources of funding, without a strategic planning process. Partly because of this, funding is perceived by most entrepreneurs as a facilitating factor for innovation, recognising the need for access to sources of information and knowledge of funding alternatives. This is in line with findings from other studies that acknowledge funding as a key element for successful innovation in small and medium-sized enterprises, including in rural areas [35]. However, although to a lesser extent, some companies (C1, C3, C8) recognise funding as an obstacle and a bottleneck to the development of innovations. The latter develop their innovative ideas with their own funds and can enjoy greater flexibility and autonomy, which can lead them to perceive external funding as a constraint.

In relation to the critical cooperation factor, the key actors with whom firms had interacted in the development of innovations can be categorised as customers, suppliers, and competitors. Customers stand out as one of the main sources of information used by companies in innovation activities (C4, C2, C7, C5, C6), in addition to participation in trade fairs, conferences, and exhibitions (C4, C2, C7, C9). Secondly, companies mentioned suppliers (C4, C2, C3), competitors (C4, C5, C6, C9), and associations at professional and industry levels (C3, C8) as key actors for the process with which they have cooperated. Such actors in the production chain, in addition to the interaction with the end user, are recognised as interactions that can improve products through the exchange of feedback [4,57,58]. Similarly, cooperating with companies in the same sector leads to an exchange of specific and more technical information that can foster innovation [4,59]. Important actors, such as laboratories, consultants, research and development institutes, universities and higher education institutions, or other organisations such as industry associations and chambers, were exclusively involved in the process for 23.3% of the companies (C4, C2, C3). These actors are essential, especially in rural areas, because they help connect rural enterprises with the knowledge of more industrialised areas, thereby providing more accessible and understandable [43,60] information sources that can be considered valuable, such as journals, technical publications, and patent databases, which were barely accessed by 22.2% of

the enterprises (C4, C3). This finding demonstrates the difficulty of accessing information by innovators and the consequent need for intermediation.

The questions concerning the critical factor of cooperation included questions on networking and contribution to society; 55.6% of companies said they are aware of the possibilities of networking and working groups, but their involvement was low due to resource constraints (C2, C3, C5, C6, C9). Only 22.2% recognised the importance of cooperation and networking with organisations and public administrations to direct efforts to contribute to society through their own activity (C4, C7). Another 22.2% saw innovation as a solo venture with no strategic importance and no contribution to society (C1, C8). As the model shows, cooperation is dependent on managerial capacities, which may affect the process of stakeholder identification and involvement, in addition to the awareness of the need for and importance of cooperation.

With regard to absorptive capacity, 77.8% of companies had a limited entrepreneurial culture of innovation (C1, C2, C7, C5, C6, C3, C8), because, despite being innovative at specific times and in specific aspects, they currently have little inclination towards continuous processes of this type and face problems in practice when trying to do so.

There are particular constraints in developing innovations in small and medium-sized enterprises, especially in rural areas, which may be the reason for the limited absorptive capacity in general. Smaller companies usually face limits in financial and technological resources [38], and the low density of companies and agglomerations that characterise rural areas, especially in Spain, means that entrepreneurs feel less competitive pressure and are less motivated to innovate [9]. In addition to the lack of entrepreneurial culture, this may also be due to the family character of most companies. Other aspects that emerge from the reduced company culture are that few companies budget for training plans for key workers, and the application of evaluation processes is limited, with most companies sporadically applying informal evaluation mechanisms. One of the salient features of the analysed industry is the diversity of training and technical specialisation in diverse areas, including, but not restricted to, physical-chemistry, logistics and exports, tasting and oil mills, product traceability, marketing, and food technology.

In relation to the critical factor related to managerial skills, it should be noted that innovation strategies rarely materialise through processes led by key groups or individuals. However, two companies were also identified that claim to have an integrated, participatory, and continuously engaged approach that enables this to materialise (C4, C9). The relationship between strategy and corporate culture indicates that innovation shapes the mission, vision, and corporate values assumed by all employees in 33.3% of the companies (C4, C7, C9).

Continuing with this factor, participation and motivation in innovation planning, the majority of entrepreneurs use mechanisms to collect ideas and suggestions and evaluate actions (C4, C7, C8, C5, C6, C9), whereas the others indicated that they do not have mechanisms to contribute ideas or suggestions for improvement (C1, C2, C3). Utilising a company's internal knowledge requires a communicative environment [46], which is why the advantageous characteristics of small and medium-sized companies, such as simple organisational structures, low number of employees, and little bureaucratic involvement [33], help the process.

In relation to risk taking, 44.4% of companies internalised innovation and the risks involved, and evaluated risks before making decisions (C4, C5, C6, C9); C2 and C8 assumed the need to innovate and contemplated it in future plans; C1 and C3 conceived innovation as a risky bet, and innovation was not contemplated in business objectives; and only C7 admitted risk was an inherent factor in innovation and error as a process of growth and improvement.

Finally, the analysis of the critical factor of market orientation showed little integration of marketing in the development of innovations, because 55.6% of the interviewees affirmed that innovations were mostly based on technical and quality specifications (C1, C2, C7, C5, C6), in addition to the 33.3% who, despite contemplating the need to be market oriented,

faced daunting limitations in this area, mainly in terms of knowledge and specialised human resources (C4, C3, C8). The difficulty of attracting or maintaining qualified human resources in small enterprises in rural areas is a recognised constraint to the innovation process in rural areas [39]. Only C9 incorporated market demands into its management from the outset of innovation development. Of the total number of companies, 44.4% prioritised their own initiatives, disregarding market demands (C2, C5, C6, C8). Within this same factor, the support and use of technology displayed a more positive picture. In relations, marketing, and sales, 44.4% of the companies used ICTs (Information and Communication Technologies) intensively in their commercial relations (C4, C2, C5, C6), and another 33.7% claimed to use the web and to have an incipient development of computer tools to improve commercial relations (C3, C7, C9).

A summary of the main opportunities and needs of the agrifood sector in the region was drawn from the knowledge gained from the participatory analysis of the critical factors. The modelling of the factors also made it possible to structure a correlation of dependence between the proposed actions and to take a first step towards the structuring of a planning process aimed at agro-industrial innovation in the region (Table 12).

**Table 12.** Opportunities and needs for potential strategic rural development planning.

Factor	Opportunities (O) and Needs (N)	Issue	Dependent Factors	Influencing Factors
Funding	Approach to key actors for the channelling of public funds, grants and subsidies specifically targeted at innovation and quality schemes (O). Generating business commitments in the planning and allocation of own resources for innovation, and monitoring and assessment of funding alternatives (N).	Sensitivity to the environment and internal vulnerability of the sector	Cooperation and managerial skills	None
Cooperation	Diversifying sources of information and actors in the environment as collaboration for developing innovations (O). Increased involvement of the entrepreneur in networking with organisations and public administrations to direct efforts aimed at contributing to society through own innovative activity (N). Generating experience and knowledge sharing between management and staff of the different companies and actors (O).	Atomisation of the industry, weak business fabric	Managerial skills, absorptive capacity and market orientation	Funding, absorptive capacity, and market orientation
Absorptive Capacity	Expertise, capacity building, and training in key areas and human resources, and mechanisms to assess the implementation of innovative initiatives (N). Handling external information appropriate to their environment and trends in business innovation management (O). Commitment of management and entrepreneurs in the sector to take on the role of strategic innovation (N). Intensive and innovative use of communication technologies to manage business relations nationally and internationally (O).	Atomisation of industry, weak business fabric, and population fixation	Cooperation, managerial skills, and market orientation	Cooperation, managerial skills, and orientation
Managerial Skills	Strengthening marketing management and encouraging more market research to reduce risks in the implementation of innovations and internationalisation processes (N).	Weak business fabric, vulnerability due to company size and human resource constraints	Absorptive capacity and market orientation	Funding, cooperation, absorptive capacity, and market orientation
Market Orientation		Market threats, population fixation, unemployment, and technical specialisation	Cooperation, absorptive capacity, and managerial skills	Cooperation, absorptive capacity, and managerial skills

Although 62% of the interviewees possess completed higher education, the need to improve managerial skills was expressed, because these have an impact on the interrelation of critical factors. The fact that they have a knowledge base acquired through their higher

education makes it easier for them to identify the managerial skills that their business activities require. In this regard, most of the interviewees are the second generation to manage the company. The digitalisation of production processes and the opening of the local market to a global market (62% of the companies export) are aspects that require new managerial skills that were not part of the acquired experience transmitted by the previous generation.

The need to increase cooperation at sectoral (vertical) and territorial (horizontal) levels is another factor affecting the identified opportunities and needs. The lack of a culture of collaboration, mistrust, personal and sectoral individualism, and the negative effects of failed experiences of cooperation, all of which are deeply rooted in the depopulated rural areas of Spain, are the main obstacles to the development of cooperation in the case study. The development of cooperative, sectoral, and/or territorial projects would significantly help to address one of the problems identified, namely, the atomisation of industry. For instance, all the olive oil producers involved in this study agreed that the successful case of sector and territorial cooperation involved securing the PDO for La Alcarria Olive Oil, integrating all olive oil producers and almost the entire olive oil processing industry.

Most of the interviewees highlighted the work carried out in the region by the Local Action Group CEDER Alcarria Conquense through the rural development programmes under the LEADER approach, to promote training aimed at improving the managerial skills of the business fabric and to increase the level of specialisation of the human resources of the territory. In the same manner, respondents also valued the inter-territorial cooperation projects promoted by CEDER Alcarria Conquense with other Local Action Groups, in which companies from the agrifood sector are increasingly integrated, favouring the exchange of experiences, interaction between companies, and the promotion of the spirit of cooperation.

#### 4.2.3. Strategic Plan

One should not underestimate the collaboration framework at the EU level, mediated by the European Innovation Partnership (EIP), which makes available mechanisms and initiatives for joint programming, in coordination with Member States and knowledge communities [61]. In light of the recently presented findings, and given the opportunity presented by the completion of European 2020 Strategy, the methodology developed in this work aimed to generate a discussion that will allow the incorporation of evaluative aspects into the findings of innovation in the rural sphere, and to direct the planning of the agrifood industry.

Initiatives in organic production and energy saving, concern for product presentation and preservation, and market diversification, are promoting the competitive position of companies in the region. Fumero and Ullastres (2017) argue that added value and differentiation are required in response to competitive pressure, and management and the ability to adapt to the environment are key elements in achieving these goals [11]. Talent, intelligence, and knowledge requirements are challenges that the La Alcarria Conquense agro-industry faces as it seeks to boost companies that are lagging behind due to a lack of specialisation, a shortage of skilled labour and personnel, and the need for generational change in the family businesses that characterise the region. Learning capacity is ensured by effective idea generation and by implementing practices such as experimentation, continuous improvement, teamwork, observation of others, and group decision making [28]. The alignment of the private sector of the rural agrifood industry with sustainable development and the achievement of the SDGs needs to be given greater prominence. Alarcón and Sánchez (2014) found the complexity of innovation processes in the studied sector is well known and incorporates social, economic, and environmental elements, focusing particularly on improvements in sustainability, bioeconomy, health, biotechnology, and climate change [7].

A large variety of people and organisations are involved in social development practice, including community development practitioners, social planning organisations, and ministries [62]. The studied territory has an important history in the organisation of rural



development. Moreover, the agrifood industry in this territory has a long history that should guide new joint efforts in the search for the common good and human development as a competitive advantage. The ISM model and the measurement carried out in the private sector show that the region has considerable development agents and assets at the community level (LAGs and foundations). These organisations have been working to promote rural development with a territorial approach since the beginning of LEADER, in addition to new and old innovative enterprises led by women.

The differentiated local production has historically encouraged innovations, mainly in processes, by means of equipment and infrastructure in the industry, and in sales promotion. More recently, and despite a level of disdain of some entrepreneurs regarding quality assurance systems, these quality measures have become more influential in exploiting market innovations. Criteria such as internationalisation and re-industrialisation are shown to have an influence on companies that best manage innovation to remain competitive [11]. The use and application of ICTs requires more training of the workforce, to enable ICTs to affect marketing, organisational structure, and relations with other companies and public research institutions. The Internet is the leading facilitator of business in other countries [20].

## 5. Conclusions

This research helped to identify funding, cooperation, absorptive capacity, managerial skills, and market orientation as critical factors affecting innovation processes in the agrifood industry. The factors of absorptive capacity, market orientation, managerial skills, and cooperation were identified as having a strong influence and dependence on innovation processes, and the funding factor was found to be conditioned by managerial skills and cooperation.

The atomisation of industry is an obstacle to innovation processes, and managerial skills and cooperation were identified as critical factors that need to be reinforced to combat the lack of a culture of collaboration, mistrust, and personal and sectoral individualism. These factors are also necessary to counter the negative effects of failed cooperation experiences, aspects that are deeply rooted in the depopulated rural environment and which have a negative impact on the initiative of the business fabric. For this reason, the role of the Local Action Group in the framework of the implementation of the European Union's rural development policy is of vital importance in rural territories with a small population, through its planning and execution of the territorial development strategy. Using such an approach, the priorities of financial support for investments can be established, with special relevance to the agro-food industry.

The main bias of this research is the exploration of the private sector from a single reality, i.e., that of the entrepreneur, who plays the role of owner and manager in most cases, with the exception of companies working under the cooperative model. Notwithstanding this, the efforts applied to validate the method and reduce bias incorporated a diversity of criteria from other actors during the research process via expert consultation and direct observation.

This work focused on the study of five main factors. However, the model can be applied to a greater number of relationships and elements, and thus undertake a broader exploration and possible evaluation of business management and its contributions to innovation and development. Incorporating a validation of results with the actors involved in the data collection would also be of interest. This would provide valuable feedback to guide concrete strategies and actions in the current policy framework for innovation in the rural agrifood industry.

The structuralist approach of the case study with the ISM model helped to impose order and direction on the relationships between five critical innovation factors in small and medium-sized enterprises, which were representative of the studied business fabric. According to the results of this research, managerial skills and cooperation were identified as the main links to funding, and enable the influence of absorptive capacity

and market orientation to be channelled as the drivers of knowledge, talent, intelligence, and communication.

This study contributes to providing more detailed information relating to innovation processes in the rural agrifood sector, especially in the Spanish context, where rural areas face many social and environmental challenges. Knowledge of how the critical factors of innovation in a concrete area are related and how they interact should be used for conscious decision making and planning of future strategies to foster innovation.

This study showed that support for strengthening the cooperative and associative fabric in under-populated rural territories favours innovation processes in the agri-food industry. In addition, this support can counteract the lack of collaboration culture, mistrust, personal individualism, and the negative effects of unsuccessful cooperation experiences.

The current study contributes to improving the competitiveness of agri-food companies in under-populated rural territories by identifying, and relating with greater clarity and precision, the critical factors that affect innovation processes and the way these processes are perceived by businesses. Moreover, this study establishes future lines of intervention in the planning process of the territorial development strategy for the 2021–2027 European Rural Development Fund programming period.

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