SMALLDERS PROJECT

SMART **M**ODELS FOR **A**GRIFOOD **L**OCAL VA**L**UE CHAIN BASED ON **D**IGITAL TECHNOLOGIES FOR **E**NABLING COVID-19 **R**ESILIENCE AND **S**USTAINABILITY

D4.1

State of the art on Agri-food Business Models: a systematic review of the literature

The PRIMA programme is an Art.185 initiative supported and funded under Horizon 2020, the European Union's Framework Programme for Research and Innovation.

Project Information

Acronym: SMALLDERS

Title: **S**mart **M**odels for **A**grifood **L**ocal Va**L**ue Chain Based on **D**igital Technologies for **E**nabling Covid-19 **R**esilience and **S**ustainability

Coordinator: The University of Calabria (Italy)

Programme: PRIMA. Thematic area Agro-food value chain. Topic 2.3.1

Start: 2022-05-01

Duration: 36 months

Web: https://mel.cgiar.org/projects/smallders

Consortium:

University of Calabria, Italy (UNICAL)

University of Parma, Italy (UNIPR)

University of Extremadura, Spain (UEX)

IMT Mines Ales, France (LSR)

Faculty of Science of Tunis, Tunisia (LAPER)

DELIVERABLE

Number: D4.1

Title: State of the art on Agri-food business models: a systematic review of the literature

Lead participant: University of Extremadura (UEX)

Work package: WP4

Dissemination level: Public (PU)

Type: Report (R)

Due date: 2023-04-30

Submission date: 2023-04-30

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Reviewer(s): UNICAL

Document revision

Version	Date	Editor	Overview
First release	20 Feb 2023	Sergio Rubio	First release of the document
Second release	11 April 2023	Vittorio Solina	Review
Third release	25 April 2023	Sergio Rubio and F.J Miranda	Final version

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Executive summary

The agri-food sector is under strong competitive pressures that threaten its competitiveness: high input costs, especially energy costs; new consumer purchasing and consumption habits, which require digitalization; and environmental concerns in this sector are some of the factors behind these tensions. To improve the competitiveness of the members of the agri-food supply chain, it seems necessary to propose innovations in their business models.

In this deliverable, a systematic review of the literature was carried out to identify what, when, who, where and how research has been done on new business models in the agri-food sector. Based on the analysis of 36 key articles published in Web of Science journals, three typologies of new business models have been identified: Sustainable Business Models, Agri-food Business Models 4.0, and Cooperative Business Models. Following the content analysis of these articles and the interpretation of their results, we propose several lines of future research and recommendations for researchers who wish to delve deeper into this research topic, whether from the perspective of agricultural economic policy, innovation theory, business organization, consumer behavior, commercial distribution policy or even the field of technological development and the creation of computer applications.

1. Introduction

The term "business model" was coined in academic literature by Bellman et al. (1957), although it is a concept that has become increasingly relevant, and Osterwalder (2004) defines it as: "...a conceptual tool that contains a set of elements and their relationships and allows expressing a company's logic of earning money. It is a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams".

New business models arise from changes that are generated in environmental conditions and allow reconfiguring business capabilities to adapt to changes (Teece, 2010). Thus, business models are seen as a vehicle for innovation and a means to commercialize innovations, drive open innovation, collaborative entrepreneurship and intellectual property (Evans et al., 2017). A growing interest in research on business model innovation and its effects on business competitiveness has been observed in recent years (Tell et al., 2016). However, as some papers point out (e.g., Ulvendblad et al., 2014; Tell et al., 2016), academia has not paid the necessary attention to the particular case of business models in the agri-food sector, despite the importance of this sector, so this study aims to shed light on the new business models in the agri-food sector through a systematic review of the academic literature, and thereby identify the main challenges facing the sector in the environment of great uncertainty that exists.

The importance of the agri-food sector is explained not only by its function as a supplier of food products to the public and its contribution to economic growth and employment, but also by its role in the conservation of the environment and natural and landscaped areas, as well as its importance as the backbone of the area and its contribution to the maintenance and development of the rural environment. However, it is also responsible for a large part of global greenhouse gas emissions: agriculture alone accounts for one third of all greenhouse gas emissions (IPCC, 2020), before considering the contribution made by the processes in the supply chain before it reaches the consumer, such as food processing, transportation and retailing, and any post-consumer processes

relating to the generation of food waste and its treatment. As a result, we cannot talk about agriculture without including other sectors of industry and related services, so that when we talk about the agri-food sector we are referring to a cross-cutting model of the entire agriculture and food sector, which describes everything that happens from production on the farm until it is consumed in our homes.

According to Eurostat (2020), agriculture-related industry and services accounted for 9,476,600 jobs in 2019, and in 2020 the agriculture sector accounted for 1.3% of the European Union's GDP. Moreover, the EU food and beverage industry employs 4.5 million people and generates a turnover of €1.1 billion and €222,000 million in added value (FoodDrinkEurope, 2021), making it one of the largest manufacturing industries in the EU. In half of the 27 EU Member States, the food and beverage industry is the largest employer in the manufacturing sector.

For a long time, governments and major intergovernmental bodies have been striving to ensure the availability of food, with the aim of providing year-round access to the products that form the basis of our diet. However, for some time now, new factors have led to the whole agricultural system being called into question. These new trends in the sector can be summarised as the following three:

- Consumers are becoming increasingly demanding when it comes to food and the issues such as health, nutritional properties, provenance, sustainability and animal welfare are becoming critical.
- Climate change will alter the way we farm as a result of the influence of factors such as rainfall, temperatures and soil quality. As a result, new strategies such as precision agriculture, irrigation optimisation and crop diversification, among others, are being established.
- New technologies applied to agriculture will completely determine the way business is done in the sector: the digitisation of the sector, the use of agricultural drones and robots, satellite monitoring of crops and the development of new genetic improvement techniques will contribute to

reducing the digital divide between urban and rural areas, boosting business development and new business models.

In fact, recently, Wojtynia et al. (2021) point out that one of the most controversial aspects among the main stakeholders in the agri-food sector is precisely the types of business models that will prevail in the coming years. Similarly, Tell et al. (2016) conclude that the theory on new business models in the agri-food sector is not sufficiently developed, so there is an important opportunity for new studies to contribute to defining a more solid theoretical framework for understanding innovation in business models within this sector. That is why the aim of this work is to identify the way in which research on the new business models in agri-food has developed internationally, with a view to identifying the main lines of work followed and determining a future research agenda in this field. The following section will describe the methodology of research and then the results will be presented and discussed.

2. Methodology

As we have mentioned above, existing studies on new business models in the agri-food sector are scarce, so it is important to review the articles published to date in order to establish a research agenda based on this review. With this objective in mind, we have selected the systematic review as our methodology, as it allows us to expand existing knowledge by researching the articles available, of both a theoretical and empirical nature (Webster & Watson, 2002).

Throughout the systematic review, the PRISMA method was applied to guide the data collection process. The advantages of PRISMA include the ability to define clear research questions, classify inclusion and exclusion criteria and evaluate large literature databases within a specific time frame (Page et al., 2021).

To perform our literature review, we focused on publications in the highest impact journals using the Web of Science Core Collection (WoS) database. WoS is an online citation indexing database originally produced by the Institute for Scientific Information, but now maintained by Clarivate Analytics, and it includes over 30,000 journals. It is one of the most reputable scientific citation search engines and is often used as a research tool by academic libraries as it provides comprehensive citation data (Li et al., 2018).

Table 1 indicates the eligibility criteria in this study: (a) journal articles, as they contain more mature and comprehensive reports (González-Albo & Bordons, 2011); (b) English language publications, to facilitate the literature search and analysis; (c) relating to the areas of Business Economics and Agriculture; and (d) articles that focus on innovation in business models in the agri-food sector.

Table 1. Inclusion and exclusion criteria

Criterion	**Eligibility**	**Exclusion**
Document type	Journal articles including case studies	Conference reports and book chapters
Language	English	Non-English
Subject area	Business economics. Agriculture.	Other
Focus of study	Business model in agri-food sector	Other

The systematic review process was conducted during August 2022 and consisted of four stages: identification, screening, eligibility and analysis. The first stage was to identify the keywords to be used in the search process. Specifically, we combined "new business model" OR "business model innovation" AND "agri-food". The AND and OR operators were used to make the research more complete.

In the screening stage, a total of 285 records were obtained with these search strings. A total of 51 articles were excluded during the screening and a further 198 articles were eliminated in the eligibility phase because they only tangentially dealt with the business model concept or the agri-food sector. Upon completion of this systematic review, only 36 studies focusing on the research topic were retained. As the development of a review protocol is vital for a rigorous systematic review (Xiao and Watson, 2019), Figure 1 represents the PRISMA flow chart used in this study.

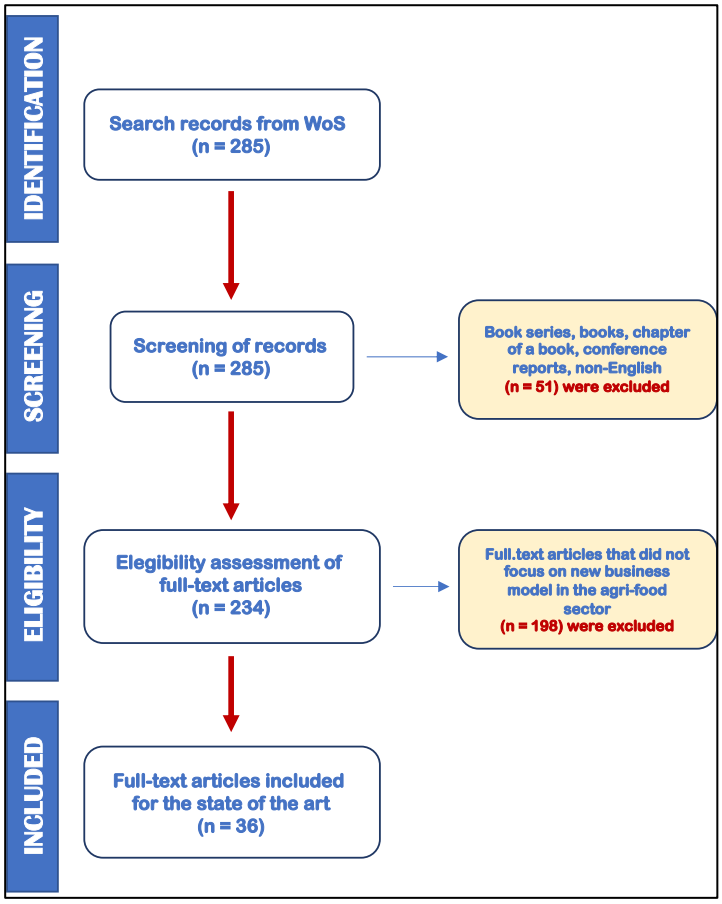

Figure 1. Study flowchart

In the fourth stage, a descriptive analysis was used to summarise the 36 selected articles and a content analysis was used to address the research questions. The content analysis codes the data from each primary study under general topics before analysing the occurrences of each topic (Dixon-Woods et al., 2005). The abstracts were first analysed and then the full text to extract the data needed to address the research questions. These data were then manually coded into different topics according to the different types of new business models. All the authors compared the results of the analysis and jointly drafted the different sections of this study.

3. Results

Despite the first article focusing specifically on new business models in the agri-food sector was published in 2004 (Fritz et al., 2004), it is only in recent years (2020 onwards) that the number of publications has increased significantly, which reinforces the importance of this research topic in the coming years (Figure 2). The 36 articles analysed in this review have been published in a total of 23 academic journals, the top four by number of articles published being: Sustainability (9), British Food Journal (3), International Food and Agribusiness Management Review (3) and Journal of Cleaner Production (2).

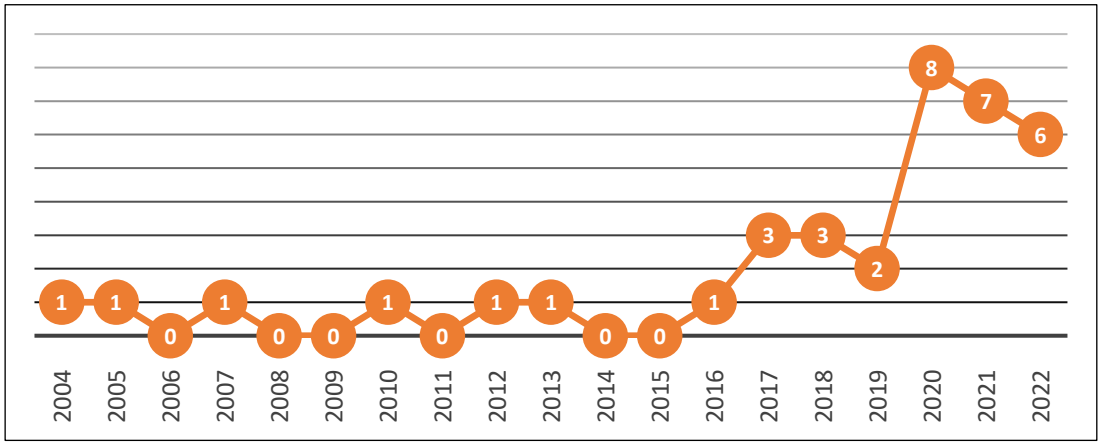

Figure 2. Evolution of the number of publications

Note: the year 2022 is analysed up to the month of August.

With regard to the main researchers in the discipline, Figure 3 shows the ranking of authors by number of articles. The most prolific authors, with 5 publications, are Professors Per-Ola Ulvenblad and Pia Ulvenblad (Halmstad University, Sweden). They are followed by Professors Henrik Barth and Maya Hoveskog (Halmstad University, Sweden) with 4 records, and Professor Mechthild Donner (University of Montpellier, France) with 3 articles. These leading authors in the field have joint authorship in several publications.

By number of citations, the most cited paper up to August 2022 is "A conceptual framework for supply chain collaboration: empirical evidence from the agri-food industry" (Matopoulos et al., 2007) with 272 citations. With over 50 citations each, this is followed by "Artificial Intelligence in the Agri-Food System: Rethinking Sustainable Business Models in the COVID-19 Scenario" (Di Vaio et al., 2020) and

"E-commerce in agri-food sector: A systematic literature review" (Zeng et al., 2017). Figure 4 shows the distribution of articles by geographical area (taking into account the authors' institution of origin, not their nationality). We can see that most of the studies come from European countries, with Italy and, to a lesser extent, the United Kingdom being the countries with the highest number of articles on business models in the agri-food sector, specifically, 44.4%.

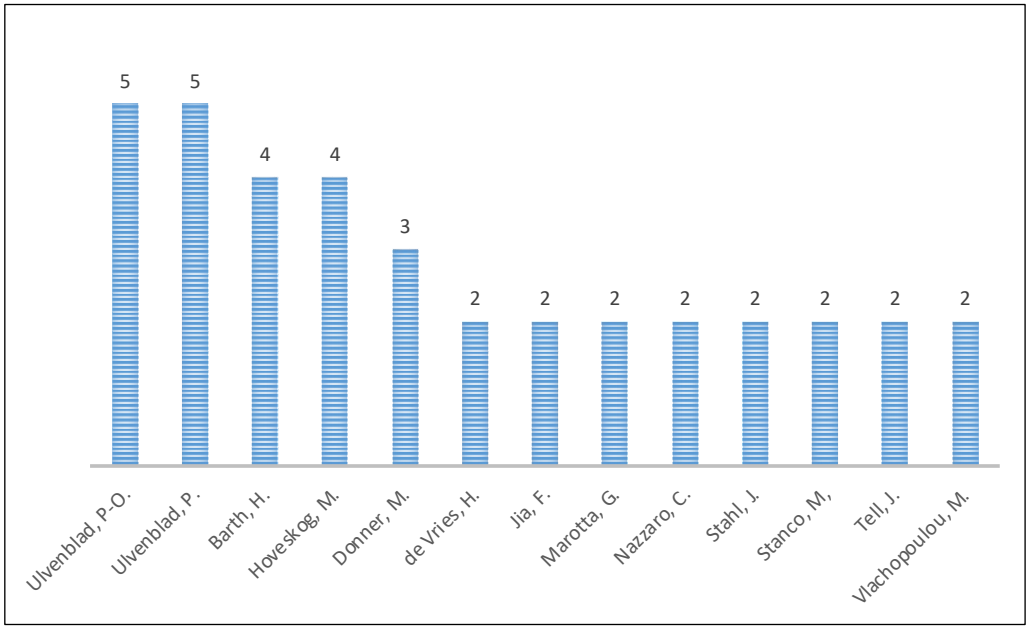

Figure 3. Ranking of authors by number of articles published

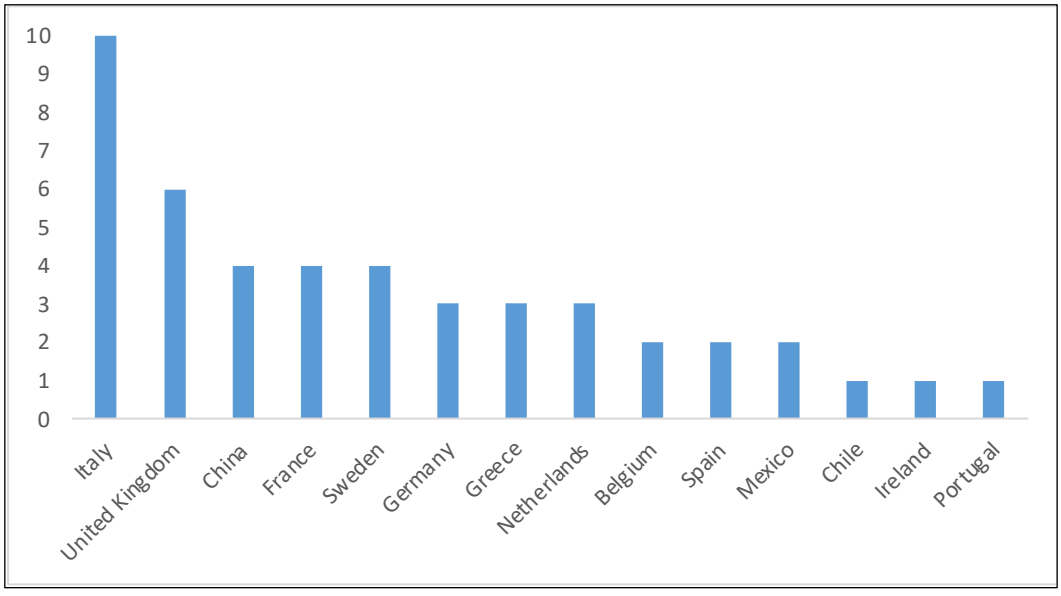

Figure 4. Country of origin of the authors (2001-2022).

Regarding the methodologies used in these articles, it should be noted that the majority use case analysis as their main methodology (63.9%), using qualitative analysis techniques such as content analysis. However, we will discuss the content of these studies in more detail in the following section.

4. Discussion

Based on the analysis of the selected articles, three types of business models have been identified, which we have tried to summarise in Figure 5: Sustainable Business Models (SBM), Agri-food Business Models 4.0 and Cooperative Business Models (CBM). These types are described in the following sections.

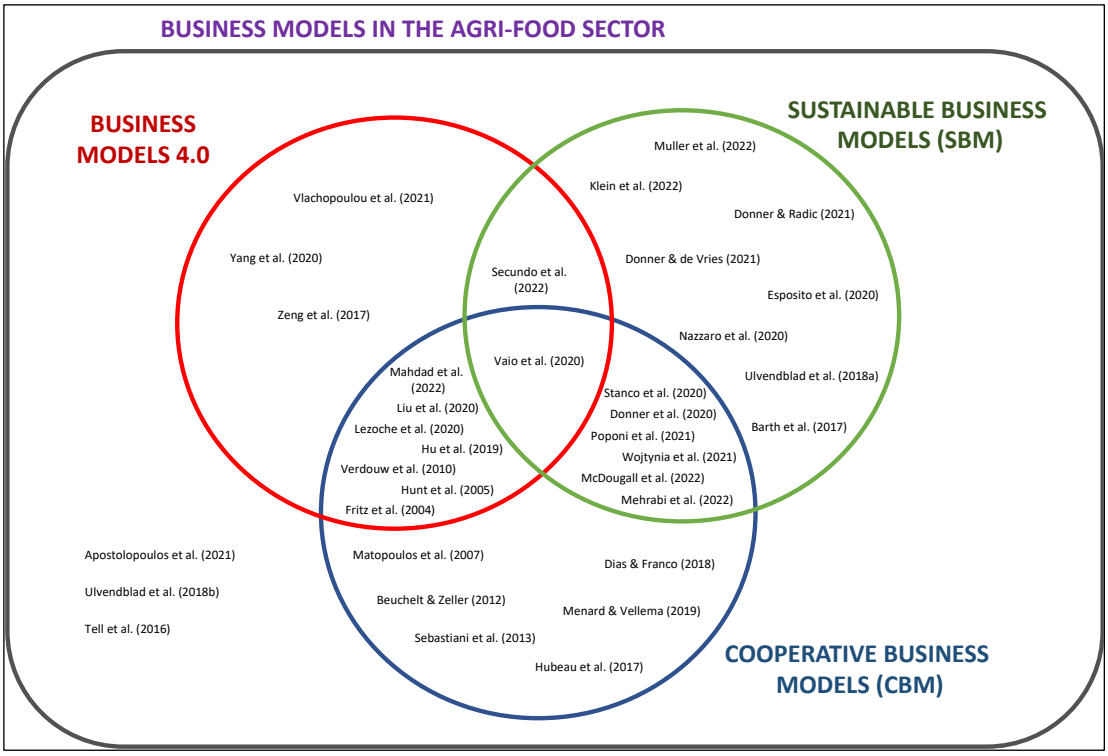

Figure 5. Type of business models in the agri-food sector

4.1 Sustainable Business Models (SBM)

Unlike the classic business models, SBMs (also known as Green Business Models, GBMs) are not limited to maximising economic value, but instead are oriented towards creating benefits for a wide range of stakeholders, always taking into account environmental and social values. Barth et al. (2017), in their literature review, demonstrate the growing interest in this type of business model in the literature. According to Bocken et al. (2014), eight SBM archetypes can be identified, depending on their objective:

1) Maximise efficiency in the use of materials and energy.

2) Create value from waste.

3) Use renewable and natural processes.

4) Provide functionality and not ownership.

5) Adopt a stewardship role.

6) Commit to sufficiency.

7) Re-use for society/the environment.

8) Develop scalable solutions.

The papers of Ulvenblad et al. (2018a), Ulvenblad et al. (2018b) and Barth et al. (2021) validate the above archetypes for the Agri-food sector, using interviews and case studies of companies from the sector in Sweden.

Donner et al. (2020) focus on the study of value creation processes from agro-industrial waste, through an analysis of international cases in which they propose six business models to make use of waste in the sector: biogas plant, upcycling entrepreneurship, environmental biorefinery, agricultural cooperative, agropark and support structure. They differ in their way of value creation and organisational form, but strongly depend on partnerships and their capacity to respond to changing external conditions. Other papers on SBM are those of Muller et al. (2022), who identify strategies that lead to green innovation in family companies; Nazzaro et al. (2020), on how to incorporate corporate social responsibility into the sector's business models; and Secundo et al. (2022), who study the relationship between the digitisation of companies in the sector and the ease of achieving the UN Sustainable Development Goals.

Among these papers, it is worth highlighting that of Mehrabi et al. (2022), who present a list of new SBMs in the agri-food sector that, while not exhaustive, perfectly illustrates the new trends in this field. Based on this classification, the following is a list of innovative SBMs:

a) **Community Supported Agriculture (CSA):** model in which consumers are part of the food production process and share the costs and risks associated with this process with producers. More specifically, and

following Woods et al. (2017), these models are characterised by the following:

- Members share the risks and benefits of food production with the farmer.
- Members buy a share of the farm's production before each growing season.
- In return, they receive regular deliveries of the farm's produce throughout the season.
- The farmer receives working capital in advance, gains financial security, obtains better crop prices and benefits from the direct marketing scheme.

b) **Alternative Agri-Food Networks (AAFNs)**, which prioritise local markets and seek to support the local economy by encouraging a circular economy. AAFNs comprise a diverse set of new markets that function differently from the traditional food market. These markets are the result of initiatives that began with non-governmental organisations seeking to help underdeveloped, developing or economically dependent countries, as well as small farmers in the developed world (Bingen et al., 2011), and consumer demands for a new value in eating, such as in the "slow food" movement (Pietrykowski, 2004).

c) **Solidarity Purchasing Group (SPG):** groups of consumers who coordinate to jointly buy food directly from sustainable producers, selected according to ethical and solidarity-based principles: fair prices for producers, preference for local produce, sustainability in production (i.e., organic) and the transportation of goods (i.e., preference for social cooperatives as service providers).

d) **Short Food Supply Chain (SFSC):** The EU regulation on support for rural development (1305/2013) defines a "short supply chain" as one involving a limited number of economic operators, committed to co-operation, local economic development and close geographical and social

relations between producers, processors and consumers. In these chains, systems such as "on-farm selling", "pick-your-own", and e-commerce-based business models such as "box schemes" or "prepaid baskets" are used (Doernberg et al. 2022).

e) **Participatory Harvesting Schemes:** involves the participation of consumers in the harvesting process, such as the "self-harvested gardens", that might be implemented in community gardens (Turner, 2011).

f) **Crowdfarming:** This business model was created in 2017 and consists of an online platform in which farmers earn income through two channels: one, a more classic one, in which they can sell their harvests directly to end consumers, and another, a more innovative one, in which consumers can sponsor a tree (nowadays, they can also sponsor beehives, livestock, etc.)(Mehrabi et al., 2022). This adoption means that the customer will receive a photograph of the tree, information on its development and a certain quantity of its fruit. (i.e. CrowdFarming.com).

g) **Business models based on Participatory Guarantee Systems (PGS):** PGS are quality guarantee systems that operate locally, certifying producers, based on consumer participation. They are certification systems managed by the local group, which is responsible for organising and making visits to the farms to support the farmer and propose improvements to move towards greater levels of sustainability, both in production and marketing (see Chiffoleau et al., 2019). Certification ceases to be a control mechanism, but rather a support mechanism for farmers. In Europe, moreover, where the weight of consumption is greater than that of production, PGS are particularly adapted to short marketing channels. In this way, in addition to shortening the chain and thus allowing fairer prices for both parties, it also relieves farmers of some of the responsibility for all the decisions (planning of production, certification, distribution and marketing), as they can be made (and taken) jointly by both parties.

h) **Bio-districts:** These are geographical areas in which farmers, citizens, tour operators, associations and authorities establish an agreement for the

sustainable management of local resources, based on organic principles and practices, in order to achieve the economic and socio-cultural potential of the territory. They all act according to the principles and methods of organic and agro-ecological production. Each bio-district is defined by a lifestyle, diet, human relations and a characteristic nature (Poponi et al., 2021).

i) **Sustainable Collective Innovation model:** Companies in the agri-food sector are introducing sustainable innovations at different stages of the value chain in order to reposition themselves in the market and meet the growing demands of society. In order to be effective, these innovation processes require a collective approach based on integration strategies (that is, vertical and horizontal) and coherent and synergistic behaviour by all economic operators involved in the value chain. A successful example of this type of model is studied in the paper of Stanco et al. (2020).

In recent years, some authors have identified a new type of business model under the name of "circular business models". Thus, Esposito et al. (2020) review the literature on circular business models in the agri-food sector, and McDougall et al. (2022) differentiate three levels on which to develop new business models based on the circular economy: a) internal circular operation and pollution prevention; b) supply chain circular operation; c) societal circular operation. For their part, Klein et al. (2022) analyse four cases of the application of circular business models in the potato sector, while Donner and Radic (2021) do the same with forty-one cases of circular business models in the olive oil sector. Finally, Donner and de Vries (2021) analyse eight cases of European companies and propose a theoretical model on innovations in circular business models in the sector, connecting them with biotechnological innovations, in which an emerging area of co-creation is identified that is currently acquiring significant importance.

4.2 Agri-food Business Models 4.0

The digitisation and technological evolution processes in the agri-food sector have culminated in the concept known as Agriculture 4.0 (Latino et al., 2022) in which, despite the abundant existing literature, one of the least explored aspects is the analysis of the associated business models. For their part, Apostolopoulos et al. (2021) conclude that the COVID-19 pandemic has provided a definitive boost for the development of new business models based on new digital technologies.

Several of the papers analysed identify the new technologies that are having the greatest impact on business models in the agri-food sector. These include artificial intelligence (Vaio et al., 2020; Lezoche et al., 2020), Internet of Things (Mahdad et al., 2022; Lezoche et al., 2020), Blockchain (Liu et al., 2020; Lezoche et al., 2020) and Big Data (Liu et al., 2020; Lezoche et al., 2020). For their part, Hunt et al. (2005) use their case study analysis to analyse how e-business models known as "extended product and enterprise" are used to support agri-food supply chain activities.

Based on the taxonomy of digital business models proposed by Rappa (2000), Vlachopoulou et al. (2021) propose a classification of the main business models that can be applied in the agri-food sector:

a) **The "e-Marketplace" model**: it connects farmers, partners and consumers through a technological platform that enables the exchange of information, factors and products between the parties involved (Fritz et al., 2004; Canavari et al., 2010; Strzebicki, 2015). One of the most popular types of business model for e-marketplaces is to charge a fee for each transaction. When a customer pays a supplier, the marketplace facilitates the payment and charges either a percentage or a flat fee. Yang et al. (2020) analyse a successful application of this model in the Chinese market.

b) **The "Subscription" model:** it uses a fee that is charged regularly and typically offers free membership with time or access restrictions and a paid membership option, which allows for the combining of a trial or a free level

of service and another that is premium (Vlachopoulou et al., 2021). One example is farm machinery leasing initiatives that are helping farmers to reduce costs by connecting unused equipment to farms in need of machinery. In this way, a combine harvester that costs hundreds of thousands of euros, but sits idle for most of the year, can be leased to farms in different regions and be operational all year round.

c) **The Data-Driven (DD) model**: it refers to organisations that use data as a key resource for running their business (Vlachopoulou et al., 2021). In 2018, the consultancy McKinsey conducted a study on innovation in food processing, exploring the factors that drive innovation in this business model. It concluded that the increasing availability of data leads companies to leverage advanced analytics to generate insights and learn how to run their businesses more efficiently (Santhanam et al., 2018). Spijker (2014) distinguishes five subcategories of Data-Driven models:

- *Sale of basic data*: software is created to help farmers collect data, which are linked in some cases to other open data, and information is then generated for the decision-maker. Basically, the buyer pays for the software or data, either through a subscription or by paying for the software package or dataset up front.

- Product innovation: In the product innovation category, existing products (often machinery) become much more data-intensive. Data that is generated from sales and usage of one product (or service) is used to create a second product or an addition to the original, which leads to an innovative value proposition. "Innovative" can refer to a simple added feature or to a novel type of solution. However, the latter usually results in the most sustainable type of value propositions, since they tend to become stand alone products which are less dependent on the original product.

- Product exchange. Data is exchanged between, for example, farmers and food manufacturers to increase the service component of the transaction. Examples show that processors of agricultural products can make computer programs available to

support the farmer's management and, at the same time, improve the production or marketing process of the food business.

- Integration of the value chain: Activities in an existing chain are organised through ICT, making decision-making more efficient at another point in the chain. An example is prescriptive farming, where some of the decision-making is moved from the farm (based on local knowledge) to software at another level in the value chain, or the model proposed by Verdouw et al. (2010) for the fruit sector.

- Creation of value networks: Through platforms that link different groups of customers and support their interaction. There is often an element of co-creation, whereby data from one group triggers activities of the other group and vice versa. These platforms sometimes have strong network effects: it is attractive for users to join a platform which other customers have already joined. European examples are 365Farmnet, AgFuse and Akkerweb.

d) **The "Everything-as-a-service" business model:** Also called XaaS Business Model, it uses X as a placeholder for any kind of product, meaning that you do not sell the product itself but charge for the usage or the output of the product (Singh et al., 2020), such as pay-per-use or a monthly flat fee, like Uber or Netflix, respectively. In financial terms, the customer exchanges capital expenses for operational expenses. Although XaaS can be seen as a standard leasing or renting model, that is not the case. Today, anything as service business models are based on the supplier taking on the responsibility for the data analysis and maintenance of the service and using information via the Internet of Things (IoT) to provide real-time upgrades and improvements.

In their review of the literature on e-commerce in the agri-food sector, Zeng et al. (2017) identify different electronic business models depending on who assumes the responsibility of connecting the producer and consumer.

Specifically, they identify five models: government driven mode, service provider driven mode, rural entrepreneur driven mode, smallholder driven mode and cooperative driven mode.

Finally, it is worth highlighting the paper of Hu et al. (2019), who perform a simulation exercise to analyse the effectiveness of different e-commerce-based business models applied in Chinese agricultural cooperatives based on the PYO (Pick your own) model.

4.3 Cooperative Business Models (CBM)

Although many of the business models discussed in the previous two sections share characteristics with those included in this category of CBM, this includes articles that describe other kind of business models that cannot be considered either sustainable or technology-based.

The current environment is pushing companies to create new ways of organising themselves and relating to their surroundings. This leads to the creation of collaborative ways of competing in the marketplace that are completely different from traditional approaches. Within this type of model, De Man and Luvison (2019) identify three variants:

1) Sharing model: Companies have similar capabilities in order to achieve scale or network effects.

2) Specialisation model: Companies combine their complementary capabilities to offer products that they could not offer individually.

3) Allocation model: Companies have overlapping capabilities, so the company that is most efficient in performing each of the activities is selected, thus improving the efficiency of the alliance.

The literature reviewed includes several analyses of successful cases of CBM models in countries such as Portugal (Dias and Franco, 2018), Belgium (Hubeau et al., 2017), Italy (Sebastiani et al., 2013), Greece (Matopoulos et al., 2007) and Nicaragua (Beuchelt & Zeller, 2012). A special case of CBM would be the so-

called *Inclusive Business Models* (IBM), which according to FAO (2015) are characterised by:

a) providing a living wage to vulnerable groups, such as small-scale farmers, women and young people working for a company or supplying a buyer, while allowing the buyer to remain competitive;

b) using flexible trading arrangements that make it easier for small-scale farmers or companies to supply a buyer, for example, by paying cash on delivery, accepting small shipments and providing reliable and regular orders;

c) supporting farmers and small businesses to establish a stronger bargaining position, through the development of skills, collective bargaining and access to market information and financial services;

d) harnessing the knowledge and experience of older market operators, including traders and processors, and promoting collaboration, transparent pricing mechanisms and risk sharing;

e) being scalable, so that more people can benefit and/or the business model can be replicated in other value chains;

f) allowing a variety of business models to exist so that the rest of the sector can benefit from the upgrading of skills and technologies and avoid over-dependence on a single buyer.

On these IBMs, Ménard and Vellema (2019) analyse 10 cases on the problems associated with business models in Africa.

5. Conclusions and future lines of research

As pointed out in the introduction, despite the growing interest in research on innovations in business models (Tell et al., 2016), the academic literature has not paid the necessary attention to the particular case of business models in the agri-food sector (Ulvenblad et al., 2014; Tell et al., 2016). This is despite the fact that the agri-food sector plays a key role in economic growth, environmental conservation and rural development. However, as discussed in this deliverable, this sector is responsible for a large part of greenhouse gas emissions, water pollution, as well as deforestation and loss of soil fertility. This fact, together with the structural changes in the sector in terms of consumer behaviour, the technological and environmental environment, and even the international geopolitical situation, have led to the need for further understanding of and theory on the development of new business models that allow the sector to adapt to these changes.

For all these reasons, this document analyses, summarises and organises the existing literature on new business models in the agri-food sector with the aim, firstly, of providing researchers in this field with detailed information on the research carried out to date and, secondly, of identifying those research gaps that can be filled in future research and that may serve to complement or extend the results obtained to date.

The systematic literature review has identified three main forms of business models in the agri-food sector: Sustainable Business Models (SBM), Agri-food Business Models 4.0 and Cooperative Business Models (CBM). SBMs focus on creating benefits for a wide range of stakeholders, taking environmental and social factors into account. Agri-food Business Models 4.0 focus on the processes of digitisation and technological innovation in the sector. Finally, CBMs focus on new forms of competition based on co-operation that break away from traditional models. The three types of new business models are complementary and can sometimes be adopted together. The identification of these types of business models and the variants included in each of them is a valid starting point for new researchers in this field.

Moreover, the systematic literature review carried out allows us to conclude that new business models in the agri-food sector are a topic of recent research interest. Researchers' interest in it has been growing in recent years, with a notable increase in the number of articles devoted to this topic since 2017, which suggests that it will be an important field of research in the future. Among the most cited papers are recent articles focusing on digitisation and technological innovation, so this is likely to be one of the most researched sub-topics in the coming years.

From the literature review, some research gaps were identified that should be further explored in the future. Firstly, the results obtained show that most of the studies have been carried out using qualitative research methodologies. Furthermore, within the scope of our review, the relationship between digitisation and technological innovation in agri-food business models and the level of implementation of sustainable objectives in these business models has not been researched thoroughly. The only paper found on this topic is that of Secundo et al. (2022), who study the relationship between the digitisation of companies in the sector and the ability to achieve the UN Sustainable Development Goals. In the same sense, and despite the fact that the crisis caused by the COVID-19 pandemic has boosted innovation in agri-food business models, we have detected a lack of papers focused on solving problems arising from the shortage of raw materials or labour, possible energy crises or external dependence on local markets when it comes to meeting demand. The recent war that began in Ukraine in 2022 has demonstrated the limitations of international markets, mainly the European market, when it comes to dealing with problems arising from this type of crisis.

In view of the above, the following are recommended as future lines of research:

- There is a need to develop more systematic approaches that include both innovation and sustainability. The degree of maturity of research on business models in the agri-food sector, especially focusing on the sustainability aspect, is in its early stages. As several papers do not even consider sustainability aspects, we argue that awareness of the value of integrated approaches needs to be developed in order to present

sustainable innovations as a competitive advantage for the future, such as those derived from business models based on the circular economy.

- From a research point of view, it is also interesting to deepen the understanding of the owner-manager's "value intention" in relation to business model innovation in the agro-industrial sector. However, in order to further develop this field, more empirical research is needed that builds on the theories and frameworks developed in this area. Only then will our understanding of the underlying mechanisms increase, which will eventually lead to the development of a solid theoretical base.

- An in-depth analysis of the processes involved in the transition from a traditional business model to the new business models identified is also recommended for future research. As most research has used a qualitative approach, it is recommended to use a quantitative methodology to study the limiting factors that prevent companies from implementing these new models and their effects on their social and environmental performance.

- Finally, it is recommended to thoroughly study business models based on maximising efficiency in the use of materials and energy, creating value from waste or using renewable and natural processes, among other aspects. In other words, it is recommended to create a solid theoretical base for the implementation of sustainable business models in the agri-food sector. These models will allow for the pursuit of responsible objectives on a socially or environmentally responsible level and for a wide range of stakeholders (multi-capital sustainability), while at the same time increasing levels of resilience to mitigate the negative consequences of possible future crises like those caused by pandemics or wars.

If we focus on the unit of analysis and study, future research can be classified into the following lines of work:

1) To investigate the attitude and capacity of small farmers and ranchers to implement some of these new business models, or to participate and collaborate in new business models driven by other agents of the agri-

food value chain. For example, their willingness to participate in the disintermediation process by participating as sellers in an e-marketplace.

2) To investigate the predisposition of industrial companies in the agri-food sector to implement collaborative models with small farmers and ranchers, in a context of seeking mutual benefit and, therefore, ceding part of their bargaining power.

3) In a similar way, to investigate the predisposition of the distribution link (wholesalers and retailers) to implement collaborative business models.

4) To study the willingness of consumers to participate in sustainable business models or to support small producers who implement them with their purchases, such as Community Supported Agriculture, Solidarity Purchasing Groups or those based on Crowdfarming. More studies are needed to evaluate the structure of consumer preferences for food from these new business models, the profile of the individuals who make up the segment with the greatest preference for these foods, the willingness to pay for them, the level of knowledge and credibility of food labeling systems that certify the origin of sustainable business models, etc.

It is relevant to point out that these lines of future research should be carried out in different geographical contexts, not only in the European context, which is the most analyzed so far. The reason is that the implementation and acceptance of these new business models by the different agents of the agri-food sector (including consumers) will surely be influenced by the characteristics of the agricultural system of each country or region, as well as by its culture and economic context.

The limitations of this study are those typical of any literature review and derived from the methodology employed. The establishment of criteria of time, language, type of publication or database chosen means that this review may have left behind relevant studies in this field of research, and it is therefore recommended that new reviews be carried out with different criteria in the coming years to complete the results obtained in this work.

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