

Article

Agri-Food E-Marketplaces as New Business Models for Smallholders: A Case Analysis in Spain

José Manuel García-Gallego ¹, Antonio Chamorro-Mera ¹, Víctor Valero-Amaro ¹, Marta Martínez-Jiménez ¹, Pilar Romero ², María Teresa Miranda ² and Sergio Rubio ^{1,*}

¹ Departamento de Dirección de Empresas y Sociología, Escuela de Ingenierías Industriales, Universidad de Extremadura, Av. Elvas s/n, 06006 Badajoz, Spain; garciagallego@unex.es (J.M.G.-G.); chamorro@unex.es (A.C.-M.); vvalero@unex.es (V.V.-A.); martamj@unex.es (M.M.-J.)

² Departamento de Ingeniería Mecánica, Energética y de los Materiales, Escuela de Ingenierías Industriales, Universidad de Extremadura, Av. Elvas s/n, 06006 Badajoz, Spain; pmunoz@unex.es (P.R.); tmiranda@unex.es (M.T.M.)

* Correspondence: srubio@unex.es

Abstract

This paper presents the SMALLDERS project, a European initiative aimed at transforming smallholders' business models through an innovative technological platform. The platform functions as an e-marketplace that connects small farmers directly with consumers while simultaneously promoting environmental sustainability and collaboration across the agri-food value chain. The study evaluates the platform's commercial viability and acceptance through a mixed-methods approach, incorporating qualitative and quantitative data. Research methods include focus group sessions, interviews with key stakeholders—such as transport companies, large distributors, and public administrations—and a consumer survey assessing intentions and attitudes toward the e-marketplace. Results indicate limited overall consumer readiness to adopt the platform; however, 48.6% of respondents expressed willingness to use it provided competitive prices and personal benefits are assured. Smallholders regard e-commerce as a promising opportunity, yet they face significant barriers, including limited resources, low digital literacy, and logistical constraints. Stakeholders generally view the platform positively, emphasizing that its success depends on achieving a critical mass of business volume. To foster adoption, SMALLDERS proposes three business models for smallholders: sustainable, cooperative, and technological. The platform includes a user-friendly feature to assist smallholders in transitioning among these models, complemented by training and support services designed to encourage more resilient and innovative agricultural practices.

Keywords: agri-food value chain; sustainability; resilience; technology; e-commerce



Academic Editor: Steliana Rodino

Received: 15 July 2025

Revised: 20 August 2025

Accepted: 21 August 2025

Published: 24 August 2025

Citation: García-Gallego, J.M.; Chamorro-Mera, A.; Valero-Amaro, V.; Martínez-Jiménez, M.; Romero, P.; Miranda, M.T.; Rubio, S. Agri-Food E-Marketplaces as New Business Models for Smallholders: A Case Analysis in Spain. *Agriculture* **2025**, *15*, 1806. <https://doi.org/10.3390/agriculture15171806>

Copyright: © 2025 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Smallholders are the most vulnerable link in the agri-food supply chain. In addition to the threats they have been facing for several decades [1], there are now new ones arising from (1) recent international trade agreements that make competition more aggressive; (2) investment requirements to comply with the fight against climate change and environmental criteria set by EU legislation and green policies, despite their important contribution to sustainable development goals [2]; (3) the increase in production costs (especially energy costs) which are not passed on in the prices charged; (4) the greater sensitivity to consumer prices due to the inflationary crisis experienced after COVID-19;

or (5) the process of depopulation and aging of the rural world which makes it difficult to access labor and generational change on farms.

Despite their critical role in food security, smallholders often receive a tiny fraction of the final price of food [3]. Their weak bargaining power against large industries and retail chains prevents them from obtaining fair prices for their products [4]. These barriers reduce their capacity for resilience and adaptation, which compromises their long-term sustainability. The protests of farmers and livestock producers that took place in many EU countries during 2024 clearly reflect the need for a profound transformation of the European agri-food system.

To address these challenges, the project ‘Smart Models for Agrifood Local vaLue chain based on Digital technologies for Enabling COVID-19 Resilience and Sustainability’ (SMALLDERS) was launched in 2022 in the framework of the PRIMA (Partnership for Research and Innovation in the Mediterranean Area) initiative with the support of the European Union. Involving research institutions from Italy, France, Tunisia, and Spain, SMALLDERS aims to design and implement a technological platform that acts as a meeting point for multiple actors in the agri-food value chain. The platform supports operational efficiency, facilitates resilience-building strategies, enables direct market interactions between smallholders and consumers, and fosters cooperation with other key stakeholders such as transport companies, large distributors, exporters, cooperatives, and public administrations. The platform has been designed to allow the simulation of the decision-making process along the value chain and to provide a set of KPIs to assess the technical, economic, and environmental performance of smallholder farms (Figure 1).

Other projects with similar objectives can be found at the European level, notably “Smart Solutions in Short Food Supply Chains” (SMARTCHAIN) and “Short Supply Chain Knowledge and Innovation Network” (SKIN). Both initiatives are focused on the so-called short food supply chains (SFSC) and employ technological environments to support collaboration among supply chain actors. However, they do not tackle key elements addressed by the SMALLDERS platform, such as the development of novel business models for small farmers and systems aimed at improving the efficiency of agri-food operations.

In addition, the SMALLDERS platform implies a double change in the business model of participating smallholders. On the one hand, the platform makes it possible to assess the environmental impacts linked to their farms, to advise them on environmental sustainability measures that they can adopt based on an initial assessment, and, finally, to provide public information to potential customers and other stakeholders on their environmental commitment. All this by applying the potential of digitalization in the agricultural sector, following in certain aspects the three archetypes of smallholder participation engendered by digital technology established by Kruk et al. (2021) [5]: “the tutorial”, “the dashboard”, and “the platform”.

Secondly, the SMALLDERS platform modifies the traditional business model of a smallholder, as one of its main functionalities is its use as a direct sales channel for them. In other words, the platform has a commercial aspect as an e-marketplace or collective e-commerce space. An e-marketplace is a technological platform, managed by an independent body or by a stakeholder, that brings together multiple buyers and sellers around a website, through which they can buy and sell directly to each other, as well as obtain other value-added services [6]. Although they were originally born in the field of Business to Business (B2B) relations, they have now also developed in the Consumer to Consumer (C2C) and Business to Consumer (B2C) markets, managed by large technology companies. However, the differentiating feature of the SMALLDERS platform lies in the fact that the suppliers are exclusively small agricultural producers, so that the electronic marketplace becomes a process of disintermediation of the agri-food system.

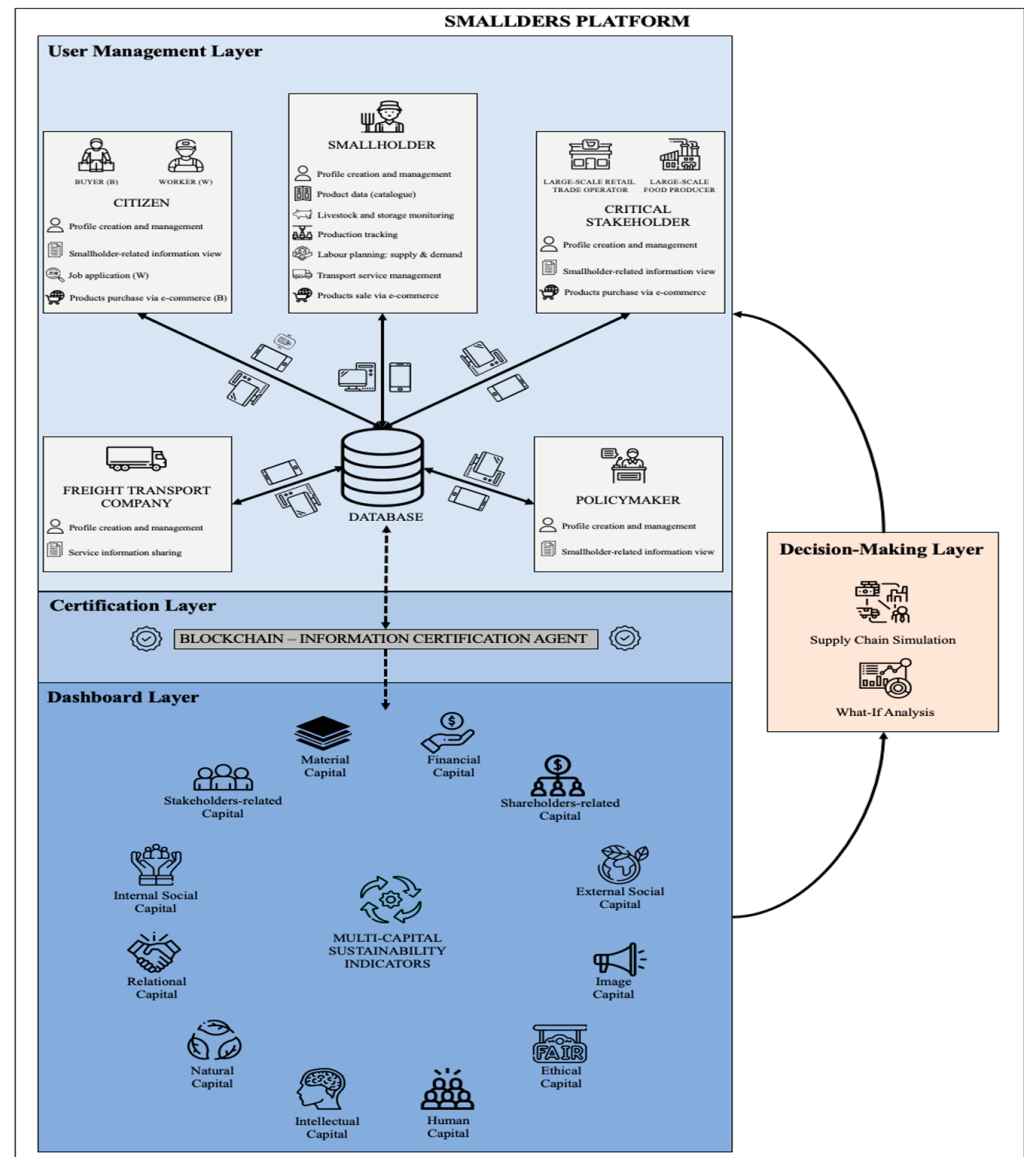


Figure 1. SMALLDERS Platform Architecture.

This article describes the work carried out during the development of the platform that was necessary to understand its potential attractiveness among the different actors involved: consumers, small-scale farmers, and stakeholders. These studies have made it possible to assess the commercial viability of the platform, as well as to compile a series of recommendations regarding the technical requirements of the platform's functionalities. This general aim is specified in the following specific objectives (SO):

- To analyze consumers' attitude and intention to participate in a smallholder e-marketplace (SO1).
- To identify opportunities and barriers for smallholders to join such a platform (SO2).
- To identify opportunities and barriers for other agri-food stakeholders to engage with the platform (SO3).

The following sections describe the main activities developed in the SMALLDERS project associated with the development of new business models for smallholders, as well as their relationship with consumers and other actors in the agri-food value chain, such as transport companies, large distributors, exporters, cooperatives, and public administrations. The following section describes a classification of agri-food business

models that serves as a starting point for their implementation in the platform. Then, a description of the methodologies used during the elaboration of the different activities is provided. The main results are then presented for each of the multiple users of the platform: consumers, smallholders, and stakeholders. Finally, a set of conclusions and recommendations on the development of the project and its results is discussed.

2. New Agri-Food Business Models

The project started with a literature review study [7] which identified three main categories of innovative business models in the agri-food sector: Sustainable Business Models, Technology Based Business Models and Cooperative Business Models.

Sustainable Business Models (SBM), also called ‘Green Business Models’, do not focus solely on economic profit but integrate social and environmental values as competitive elements. Following Mehrabi et al. (2022) [8] and the literature review by Herzig & Zander (2025) [9], some prominent examples of these models are Community Supported Agriculture, Alternative Agri-Food Networks, Solidarity Purchasing Groups and Short Food Supply Chains, Crowdfarming, Participatory Guarantee Systems, Bio-districts, or Circular Models, which integrate the circular economy paradigm at different levels of the agri-food supply chain [10,11].

Secondly, there exist Technology Based Models (TBM). Digitalization has driven the so-called Agriculture 4.0 [5,12], with models that leverage technologies such as Artificial Intelligence [13,14], the Internet of Things [14,15], Blockchain [14,16], Big Data [14,16] or e-commerce [17]. Among these models, e-marketplaces stand out, i.e., digital platforms that directly connect producers and consumers [18], also referred to by some authors as virtual farmers’ markets [3].

Research on specialized e-marketplaces for smallholders is very scarce and recent. For example, Leduc et al. (2021) [19] focus on the technological aspects, describing the blockchain operation of an e-marketplace with farmers. Wang et al. (2022) [20] analyze the topic from the farmers’ perspective. They explore whether smallholders are willing to adopt online markets as selling/purchasing channels and whether different types of farmers with different channel preferences exist.

Several studies focus on the consumers (actual or potential) of an e-marketplace platform for food. For example, Stephens and Barbier (2021) [21] interview French consumers to obtain their opinion and assessment of their participation in the e-marketplace. Parth et al. (2021) [22] conducted qualitative research through interviews aimed at exploring how a socio-digital platform can foster consumer responsibility in food consumption to encourage sustained responsible consumption. Yu and Zhang (2022) [23] explore the influencing factors from the levels of the platform, product, and consumer that affect consumer attitudes and purchase intentions towards agricultural products via public-interest livestreaming. Liu et al. (2023) [24] focus on how fresh food e-commerce platforms can reduce consumer conversion to other forms of purchase and increase consumer repurchase.

And finally, Cooperative Business Models (CBMs) are characterized by adopting collaborative environments of competing in the market that are completely different from traditional approaches [25,26]. Among them, they distinguish the following: (1) Sharing models, in which firms have similar capabilities to achieve scale or network outcomes; (2) Specialization models, in which firms combine their complementary capabilities to offer products that they could not offer individually; and (3) Allocation models, in which firms have overlapping capabilities, whereby the most efficient firm in performing each of the activities is selected, thus improving the efficiency of the alliance.

The SMALLDERS platform combines the three types of business models: it is a technology-based model, it is a cooperative model among peers, and it is a model based on environmental sustainability. It is a technology-based model because it acts as an e-marketplace for small producers to sell their production directly. Compared to the option of creating their own online shop, participating in an e-marketplace as a collective shop benefits small farmers because it does not require technical knowledge, the associated costs are lower, and, above all, it facilitates access to a larger population of potential buyers. It is a cooperative model because it allows commercial collaboration between small producers, as well as with other agents in the supply chain and even with job seekers. Finally, it is a sustainable model because in its e-marketplace function, it provides information on certain environmental impacts and ecological characteristics of the product and the producer.

3. Objectives and Methods

As mentioned above, this research has a threefold focus: on consumers, smallholders, and stakeholders. The first specific objective (SO1) is to analyze consumers' attitudes toward an e-marketplace composed of smallholders and their intention to purchase fresh food through it. It is important to note that the success of an e-marketplace for small-scale producers depends on consumer acceptance. Therefore, an analysis of its commercial viability was conducted to investigate purchasing and consumption habits of fresh food consumers in Spain. Given that this research was conducted exclusively within a specific geographical area, caution should be observed when extrapolating these findings to other regional or national contexts. In addition, considering the scarcity of studies on the subject [21,22,27], identifying both the opportunities perceived by potential consumers and the barriers they face in accessing purchases through this type of direct sales channel is highly relevant. The research was developed in two phases: qualitative and quantitative.

The qualitative phase was designed using a focus group methodology. This is a technique in which a group of individuals is brought together to discuss a specific topic with the aim of extracting personal experiences, beliefs, perceptions, and attitudes through moderated interaction [28].

In this case, a total of 6 discussion sessions were organized involving 41 participants. The sample was selected using the snowball sampling method, whereby initial participants were invited to take part and subsequently encouraged to recruit additional participants from among their acquaintances. This approach is widely recognized in contemporary methodological literature as particularly effective for accessing specific or hard-to-reach populations (Ting et al., 2025) [29]. The inclusion criterion involved being the primary decision-maker responsible for purchasing fruits and vegetables in the household. By leveraging social networks, the method facilitated access to a targeted segment of the population that might otherwise be difficult to identify through conventional sampling techniques. Each session, with an average duration of approximately 2.5 h, involved between five and twelve consumers. The sessions took place between July and October 2023 (Figure 2). Around 73% of the participants reported consuming fruit and vegetables daily, 68% were women, 61% were over 40 years old, and 61% lived in households with three or four people. The script used in the sessions was structured in 5 blocks of questions: usual establishments for buying fresh food, importance of origin and sustainability in food purchasing, direct purchasing from smallholders, and the Internet as a purchasing channel and online platform for smallholders.



Figure 2. A focus group session.

All focus group sessions were audio-recorded and subsequently transcribed verbatim to ensure the accuracy and completeness of the qualitative data. The transcripts were then subjected to a detailed and systematic analysis aimed at identifying key themes, patterns, and divergences in participants’ responses. This analytical process was conducted collaboratively by three members of the research team, enabling triangulation of perspectives and thereby enhancing the reliability and validity of the findings. This enabled the identification of the main opportunities and threats facing e-marketplaces as commercial business models for smallholders.

Based on the learning obtained from this qualitative analysis, an online survey was conducted on the intentions and attitudes towards the purchase of fresh food through a specific e-marketplace for smallholders (Table 1). The sampling method employed mirrored that used for the focus groups, employing a snowball sampling approach initiated through messaging applications and social media platforms. Initial respondents were invited to participate and then encouraged to share the survey link with their social and professional networks. This strategy also aligns with recent recommendations for survey-based research targeting hard-to-access populations, as it leverages social connections to enhance participation rates and efficiency [29]. As with the focus groups, eligibility was restricted to individuals serving as the primary decision-makers for purchasing fruits and vegetables in their households, ensuring that the collected data were directly aligned with the study’s objectives. The final sample consisted of 393 Spanish consumers, whose main profile was that of a woman (59%) aged between 45 and 55 (36%), living in a household with three or four people (56%) and a daily consumption of fruit and vegetables (69%). The variable ‘purchase intention’ was measured through 10 items to be rated on a five-point probability scale (not at all likely–very likely). Attitude towards the e-marketplace platform was assessed by two variables, one relating to beliefs about the products purchased through this sales channel (5 items) and the other relating to beliefs about the socio-economic benefits of buying directly from small-scale farmers (4 items). In both cases, a five-point Likert scale was used.

Table 1. Technical details of the survey.

Target population	Spanish consumers, responsible for food purchases at home
Type of survey	Online, non-probabilistic convenience sampling
Sample size	393
Fieldwork	October–December 2024

The second specific objective (SO2) is to identify the opportunities and barriers that smallholders face in moving from their traditional business model to an innovative business model of participating in a platform such as SMALLDERS. To this end, it was decided to focus the study on Extremadura, a region in southwestern Spain characterized by the significant weight of the agricultural sector in its GDP (7.7%). The study was also limited to the fruit sector due to its high presence in this territory and its level of organization, which facilitated access to information and actors in the sector.

The work methodology used in this stage was in-depth interviews. According to Knott et al. (2002) [30], “in-depth interviews are a versatile form of qualitative data collection used by researchers across the social sciences. They allow individuals to explain, in their own words, how they understand and interpret the world around them”. The interviews were designed to obtain detailed information on two key issues:

1. The description and characterization of the business models currently implemented.
2. The identification of barriers and needs perceived by producers in relation to their business model.

Considering the large number of existing smallholders and the grouping of many of them in certain organizations, it was decided to conduct interviews with (1) the CEO of the main association of fruit producers in the region; (2) the manager of an agricultural cooperative specialized in the cultivation of a specific fruit; and (3) two small farmers, one of them a member of a cooperative and the other one an independent farmer.

Finally, the third specific objective (SO3) was to identify the opportunities and barriers posed by stakeholders to participate in an e-marketplace with the functionalities of the SMALLDERS platform and which of them might influence its final technical design. By stakeholders, we have considered other agents involved in the activity of smallholders. As representatives of them, in this phase of the research, personal interviews were conducted with two managers of freight transport companies, a large fruit producer and exporter manager, and a representative of public administration responsible for regional policy on agri-food issues.

It is important to highlight that public administrations play a key role in the agri-food supply chain through policies and regulations that should promote fair competition, transparency, and price stability by contributing to the development of more efficient price structures. Regarding the SMALLDERS platform, public authorities have a place to interact with other actors in the agri-food supply chain, especially farmers. Thus, based on the information that small producers have decided to share, policymakers can be aware of their needs and difficulties, market trends, the use of innovative technologies, and interactions with other actors in the supply chain, among other aspects. Sharing of information with the government can be even more relevant during crises (e.g., pandemics) to gain a better understanding of the social and economic situation of smallholders during these periods and to take prompt corrective measures, such as providing economic incentives or facilitating access to credit.

The SMALLDERS platform includes a specific module for use by policymakers, with the following functionalities: (1) access to information provided by smallholders, (2) direct channel of communication with smallholders, and (3) publication of relevant and useful information for smallholders.

The script of the interviews contained several semi-structured questions to allow for open-ended answers from the interviewees so that they could express themselves fluently about the aspects to be investigated. The interviews began with a presentation of the SMALLDERS project and an explanation of the functionalities of the future platform. In the case of the interviews with companies, the script was structured through a series of questions related to the following:

- Basic characteristics of the company interviewed: age, size, employees, clients, etc.
- Operational activity of the company: business model used and use of digital platforms.
- Level of knowledge and familiarity with the use of e-marketplace platforms in the agri-food sector.
- Specific functionalities of the SMALLDERS platform, with the aim of knowing how useful the interviewee considered each of them to be for its subsequent implementation.

4. Results of the Consumer Research

After analyzing the conversations held by consumers in the focus group sessions, the following opportunities for e-marketplaces as direct sales channels for smallholders were identified:

- Consumers awareness of the importance of protecting agriculture to maintain our quality of life, as well as the low price farmers currently receive.
- Increased use of the Internet as a shopping channel since the COVID-19 pandemic.
- Growing preference for local products and for knowing their origin.
- Perception that buying directly from smallholders would generate benefits for them by providing them with a higher margin on the selling price.
- Positive perception of the online platform for smallholders, but only as long as prices are competitive compared to usual stores and supermarkets.

The main threats identified were the following:

- Perception that consumers do not have the power to bring about positive changes in the food supply chain and fair prices to farmers.
- Being able to see and touch the product is key to the choice of fresh food purchasing channel. For this reason, their purchase through e-commerce is very limited.
- High lack of knowledge about the existence of direct purchasing models from smallholders, such as consumer groups, artisan markets, or e-marketplaces.
- Consumers are quite price-sensitive and believe that buying directly from farmers would be more expensive for them, even though they would benefit the farmer.
- Egocentric buying behavior. When assessing their willingness to buy directly from the farmer, personal benefits (price, convenience) are more important than non-personal benefits (support for the local economy, environmental benefits, or contribution to the economic sustainability of the farmer's business through the payment of fair prices).

Based on these qualitative findings, the survey was designed. The overall results reflected a low intention to subscribe and to purchase through an e-marketplace, with values close to the midpoint of the scale (3.46 and 3.61 out of 5, respectively). In addition, the intention to buy is considerably reduced if the consumer has to accept prices slightly higher than those found in his or her usual store (Table 2). The probability of participating in this type of digital platform would increase if recommendations were received from trusted people, but not so much by advertising or information received through the media or social networks. And, like the comments obtained in the focus groups, consumers recognize that, to a certain extent, their intention to purchase would increase if certain requirements are met, such as return guarantees or the possibility of ordering small quantities of product. Again, note that specificities inherent to the country studied may affect the transferability of the outcomes to other settings with different environmental, economic, or social conditions.

Table 2. Subscription and purchase intention in an e-marketplace.

	Average	Standard Derivation
I would subscribe to a platform of this type if there were no subscription costs or obligation to remain a subscriber.	3.46	1.216
I would be more likely to subscribe to this platform if it were recommended to me by someone I trust (a friend or relative).	3.56	1.073
I would be more likely to subscribe to this platform if I read or saw a news item about it in a trusted media organization or social network.	3.04	1.050
I would buy on this platform if the prices (including delivery costs) were similar to those I find in my usual shop.	3.61	1.115
I would shop on this platform even if the prices were slightly higher than those I find in my usual shop.	2.61	1.097
I would increase my likelihood of buying on this platform if there were positive reviews from other customers.	3.34	1.042
I would be more likely to buy on this platform if they guaranteed a refund in the event that the order arrived in poor condition.	3.74	1.100
I would buy on this platform if I could order small quantities of the product to adapt it to the needs of my household.	3.77	1.046
I would buy on this platform if I could buy directly baskets containing a variety of products (several fruits and vegetables) without having to buy each product from different producers.	3.52	1.136
I would be more likely to buy from a farmer through this platform if they had organic farming or sustainable agriculture certificates.	3.29	1.029

Note: direct scale of 1 to 5.

The results presented in Table 2 show that potential consumers primarily value competitive pricing, purchasing flexibility, and confidence in the transaction process, while sustainability and external recommendations play a relevant but secondary role. These findings lead to several practical implications for the design and management of agri-food e-commerce platforms: (i) implementing competitive pricing strategies that ensure the final cost (product + delivery) does not exceed that of traditional channels; (ii) offering adapted purchasing formats, such as small quantities and multi-product baskets, to address household convenience needs; (iii) building trust through clear refund and return policies, visible customer review systems, and sustainability certifications as differentiating features; and (iv) leveraging trust networks through communication strategies based on word-of-mouth recommendations and reputable media channels that reinforce the credibility of the platform.

On the other hand, for the sample as a whole, a slightly positive attitude towards this type of fresh food sales channel is observed (Table 3). In relation to the attitude towards the products, it is considered that this channel guarantees the quality of the product purchased; however, it is again expressed that lower prices than those that the consumer can find in physical stores are not guaranteed. And, in relation to the attitude towards the socioeconomic benefits of buying directly from the smallholder, very high values are obtained, reflecting the positive belief of the consumer that fair prices would be paid to the farmer, also favoring the development of rural areas and sustainability.

Table 3. Attitude towards buying in an e-marketplace.

	Average	Standard Derivation
I think it guarantees the freshness of the food you buy.	3.74	0.978
I believe that it guarantees that during transport the food is properly preserved so that it arrives in good condition.	3.63	0.903
I believe that it guarantees that the producer will not take advantage of the system to send defective food or food in poor condition.	3.69	0.907
I believe that the product will be harvested at the right moment of ripeness and just when the order is being prepared.	3.76	0.938
I think the prices of these foods are cheaper than in physical shops.	3.21	1.087
Buying from these types of platforms guarantees a fair price for smallholders and livestock breeders.	4.03	0.938
Buying from these types of platforms encourages sustainable and ecological production.	3.90	0.950
Buying on these types of platforms reduces the environmental impact of trade.	3.75	1.033
Buying on these types of platforms supports the development of rural areas.	4.20	0.927

Note: direct scale of 1 to 5.

The analysis of the attitude scale indicates that consumer adoption of agri-food e-commerce platforms is primarily driven by perceived product quality, freshness, and proper handling, as well as the platform's positive socio-environmental impacts, including fair compensation for smallholders, sustainable production, and rural development. Price appears to play a secondary role, suggesting that platform design should prioritize trust, quality assurance, and social and environmental benefits.

After observing significant differences in the values of the responses within the consumer sample, a segmentation was carried out to identify groups of consumers with different attitudes and intentions. The first step was to perform a factor analysis of the three study variables to reduce the items to a smaller number of factors. The scale measuring the intention variable has a Cronbach's alpha of 0.932, and the factor analysis reduced the ten items to a single factor, with an explained variance of 62.37% and a high KMO value (0.940). The scale measuring the attitude towards the product purchased directly from the smallholder reached a Cronbach's alpha of 0.855, and the five items were reduced to a single factor, which explains 65.55% of the variance, with a KMO of 0.855. And finally, the scale measuring attitude towards the socioeconomic benefits of buying directly from small farmers has a Cronbach's alpha of 0.903, and the factor analysis reduced the four items to a single factor with an explained variance of 77.69% and a KMO of 0.834.

A K-means cluster analysis was applied to the three resulting factors to identify 3 different consumer segments according to their level of intention and attitude towards these e-marketplaces (Table 4). The segments identified were as follows:

- Consumers reluctant to buy online directly from smallholders: they represent 20.9% of the sample and express a very low intention to participate in an e-marketplace, as well as neutral attitudes about the quality of the food purchased through this channel.
- Consumers willing to participate in this type of purchasing channel: they represent 48.6% of consumers. They give a high score to the intention to subscribe to the platform and to buy from it, based on very positive attitudes both in terms of product quality and socioeconomic benefits.
- Indifferent and distrustful consumers: their attitudes towards everything derived from this type of buying and selling platform are neutral. However, they give average

values to their predisposition to subscribe and buy through them, which may indicate that they would be trial buyers, i.e., buyers who would try the experience once but would be unlikely to repeat the purchase.

Table 4. Consumer segments.

	Reluctant Consumers	Willing Consumers	Indifferent Consumers
Factor: intention to subscribe and purchase	−1.52471	0.57305	0.12979
Factor: attitude towards products	−0.71222	0.72803	−0.67210
Factor: attitude towards socio-economic benefits	−0.68951	0.68816	−0.62415

5. Results of the Research with Smallholders

Several key points reflecting the reality of smallholders and their representatives (from sectoral associations and cooperative companies) were identified from the analysis of the interviews held with them:

- Prices volatility or concentration of purchasing power in a few intermediaries generates a highly volatile and complex environment. In this context, cooperation among farmers emerges as an effective strategy to improve their bargaining power, share risks, and optimize resources, for example, through joint management of logistics and distribution activities.
- Alternatives to product marketing through cooperatives as the predominant strategy: some producers have explored the possibility of operating independently, targeting niche markets, generally local, with higher profit margins. However, this approach entails higher levels of risk, uncertainty, and less stability in product commercialization.
- Limitations related to difficulties in accessing essential resources, particularly labor during harvesting.
- Perception of e-commerce as an opportunity with great potential, although still far from the sector's reality. Among the main obstacles to its implementation are legal barriers, logistical difficulties, or having a catalog of products attractive to the consumer and at a competitive price.

In addition to the above information, the interviews also allowed us to identify the two main patterns of business models that coexist in the Spanish fruit sector:

- Cooperative model: Most smallholders in the study region participate in cooperatives or similar entities, adopting the cooperative business model as their own. This strategy allows them to benefit from economies of scale, improve their access to markets, and reduce individual risks.
- Independent model based on local markets: Some smallholders in the study region have chosen to develop their own commercial strategies, identifying opportunities in specific market niches. This model is based on direct sales to local distributors or retailers, allowing greater control over marketing and pricing but with greater challenges in terms of stability and risk management.

A gap was observed between the currently predominant business models and the three innovative models that are intended to be promoted on the platform. In companies with traditional business models, there is little knowledge, little experience, and scarce resources to apply digitization technology, either for their commercial activity or for the relationship with other agents in the agri-food value chain. And, although progress has been made in recent years, especially with the expansion of crops under organic farming certification, there is no widespread commitment to assess and disseminate the environmental impacts of farms. In conclusion, this gap became evident for most of the potential users.

6. Results of Stakeholders Research

The following qualitative results were extracted from interviews with different stakeholders: two policymakers, two transport company managers, and a large-scale producer and exporter. Some relevant results from the policymakers interviewed are highlighted below:

- Regarding their knowledge about the functionalities of the platform, the policymakers considered them as quite useful, assigning 4 points out of 5.
- Regarding the usefulness of the functionalities related directly to the small farmers, the policymakers assessed them as the most relevant, with a valuation of 4.5 out of 5. The usefulness of the platform as a repository obtained an average valuation of 3.5 out of 5.
- Other remarkable comments about the functionalities of the platform were the following:
 - “I would recommend including functionalities that are easy to use and that allow a fluid and manageable exchange of information, including the possibility for users to attach video or audio files”.
 - “In addition, it would also be interesting to create informal cooperation and/or marketing groups, both horizontal and vertical, in order to generate synergies in the agri-food sector and promote restructuring processes to encourage the integration of small farms into supra-structures for the marketing of their businesses”.
- Regarding the potential use of the platform, the policymakers mentioned some advantages of using this kind of technology in their relationship with smallholders, for example: access to updated data on farms; monitoring of product traceability; possibility of interaction with small- and medium-sized producers for the exchange of detailed information; as a way of creating a relationship of trust between public administration and smallholders; to analyze the current context for possible immediate, medium- and long-term interventions; to define strategic plans to support smallholders in the short, medium, and long term; or to produce predictive actions and react in time.
- Among the advantages of using the platform for smallholders, the public authorities mentioned (1) the possibility of making contributions, in an accessible way, in the regulatory processes that, directly or indirectly, could affect them; (2) as a specialized information point for certain administrative procedures or formalities; (3) as a way of communication with smallholders to identify, explore, and understand their problems and expectations as well as their needs in order to be able to assist, support, and monitor them; or to define adequate diffusion programs.
- Finally, the policymakers identified some advantages of using the platform for other stakeholders, for example, to know the costs related to the entire supply chain of a given agricultural product, to intervene correctly and beforehand with other political decision-makers, or to gain insights into market needs.

Secondly, from the interview with a large fresh food producer and exporter, the aspects highlighted can be observed as follows:

- Overall, the expert found the SMALLDERS platform attractive, facilitating production management and integrating producers and buyers.
- However, he showed concerns regarding its viability due to the difficulty for smallholders to reach a sufficient volume of business to achieve profitability. In this regard, the interviewee proposed an alliance between smallholders to eliminate this

barrier, as well as a geographic segmentation to design the platform with a focus on local trade.

- The interviewee valued positively the functionalities planned for the stakeholders' module in the platform, as they will generate trust and transparency, which would motivate its use by stakeholders, smallholders, and consumers. The job offers module was especially highlighted as positive, as he considers it key in view of the sector's current problems in recruiting human resources.

Finally, from the interviews with transport companies' managers, the following aspects are worth highlighting:

- They consider that the main obstacle to making the SMALLDERS platform viable for both smallholders and transporters is to achieve a sufficient volume of business.
- In this regard, the solutions proposed by the transporters interviewed differ. One of them points to the grouping of smallholders as a way of consolidating order. The other one points to vertical integration, with the smallholder taking on the entire logistics process.
- They believe that the most suitable carrier profile as a user of the SMALLDERS platform is that of a self-employed or small carrier with a single small vehicle.
- They advocate that the distribution process should be centralized both at origin and destination through distribution centers that reduce the number of routes and facilitate the collection and delivery of products.

7. Conclusions

This paper describes the development of the European R&D project SMALLDERS, which aims to develop a technological platform that will provide smallholders with tools for operational improvement and resilience in the face of the challenges and difficulties they have been facing for decades, and which have intensified in recent years. The main novelty of the SMALLDERS platform is the possibility of including all the agents of the agri-food value chain, something that differentiates it from other similar projects, such as SMARTCHAIN, <https://www.sustainablefoodplatform.eu/en/smartchain-project> (accessed on 13 August 2025), or SKIN, <https://shortfoodchain.eu> (accessed on 13 August 2025), that provide examples of best practices of digitalization on Small Food Supply Chains but without providing an all-in-one environment where the different actors of the agri-food supply chain can interact to achieve their own goals.

As a previous step to the technological development of the platform, a series of investigations have been carried out to evaluate both its attractiveness for the agents involved and to identify relevant aspects for the design of the platform. Especially relevant is the information gathered to design the module that will help small producers to implement an innovative business model, based on the digitization of the sales process, sustainability, and cooperative relationships with other agents in the value chain and stakeholders.

On the market side, the research conducted among Spanish consumers has identified three segments in terms of their willingness to participate in an e-marketplace for agri-food products: (1) reluctant, representing 20.9% of the sample, and expressing a very low intention to participate in an e-marketplace; (2) consumers willing to participate in this type of purchasing channel, representing 48.6% of consumers, and giving high scores to the intention to subscribe to the platform and buy from them; and (3) indifferent and distrustful consumers, with a neutral attitude towards these platforms, but with a certain predisposition to subscribe and buy through them. The second segment represents the potential market for this type of e-marketplace and is the one to which the communication and promotion strategies of the platform manager and the smallholders attached to it

should be directed. The results of this study of potential consumers represent an advance with respect to the studies of consumers on e-marketplace platforms carried out to date, since these had focused only on real consumers, already registered on these platforms (Robina-Ramírez et al., 2022) [27].

In addition, considering the qualitative and quantitative results, a series of barriers were identified that hinder the acceptance of an e-marketplace as a fresh food purchasing channel. Based on these, a set of recommendations were extracted to guide the functionalities that the commercial module of the SMALLDERS platform should have. The key recommendations are as follows:

- On the product policy: To consider the use of small quantity boxes/baskets, adapted to the size of small households, and the use of multi-product boxes/baskets, as well as to encourage associations between nearby producers for joint sales.
- On the target market: To refocus the platform to turn it into a B2B sales channel as well, not just B2C. To widen the target market of these platforms to customers other than the end consumer, such as the owners of small local shops or people responsible for sourcing products for restaurants or canteens.
- On logistics: To include transport companies as an additional participant in the e-marketplace. Since the success of the platform depends on offering competitive prices, logistics costs could be better controlled if there were a system of collaboration between the producers selling their products and the transport companies.
- On communication and promotion policy:
 - To design clear messages about the freshness of the fruit and vegetables delivered, highlighting them in an attractive way on the website.
 - To include in the platform the option of using the buyer's location to offer products of nearby origin.
 - Preferably, to highlight personal benefits for the shopper and, secondarily, environmental and social benefits. These benefits would focus on the quality of the product and its freshness (time of harvest and delivery time), positioning it as something that cannot be found in large supermarkets or usual shops.
 - To include some videos showing the preparation of a real order to appreciate the process and the quality of the products, and a chat to resolve doubts.
 - To collect opinions and evaluations from other users would be very useful.

Regarding the role of other actors such as critical stakeholders, transport companies, and policymakers, the pessimistic view of both critical stakeholders and transporters on the commercial viability of the platform stands out. Both considered the low business volume of smallholders as the main obstacle and proposed strategies such as the association between producers or vertical integration in the logistics function to overcome it.

Nevertheless, both these stakeholders and policymakers provided a positive assessment of the functionalities available on the platform. On the one hand, critical stakeholders and transport companies highlighted the usefulness of certain functionalities, such as the integration of producers and buyers, transparency in transactions, and the job offers module, which is seen as a solution to recruitment problems in the agri-food sector. On the other hand, the policymakers expressed a great interest in the SMALLDERS platform and assessed very positively its functionalities for making decisions based on the information provided by different users, especially, by the smallholders. Several advantages of using the platform were identified by policymakers. Specifically, using the platform as an information and communication channel with smallholders and as a way to create long-term relationships. In addition, policymakers also indicated other strong points of the platform, such as its ability to improve market conditions for smallholders or as a repository of information.

Finally, the main conclusion derived from the opinions of the smallholders is that they perceive the future is moving towards the adoption of digitalization technologies (as indicated by Kruk et al., 2021) [5], but they are not ready for it and perceive many limitations and barriers derived from the lack of experience and resources. Regarding the development of business models for implementation in the SMALLDERS platform, it is worth noting the existence of a gap between the currently predominant business models and the three innovative models identified (Miranda et al., 2023) [7]. In addition, a lack of knowledge and experience of the smallholders interviewed in the design of business models was observed, which demonstrates the need to implement in the technological platform a functionality that would allow them, in the simplest possible way, to transition from their current business model to the recommended new business model.

The contributions of this study to the academic literature on business models for smallholders are multiple and span several dimensions.

- First, from a market perspective, the research identifies the potential for distributing agricultural products through e-commerce platforms, characterizing consumer segments, their size, and the exclusionary motivations that may prevent them from becoming effective buyers. Previous research has highlighted that market participation for smallholders is strongly shaped by consumer information flows, perceptions, and collective marketing efforts (Ismail, 2024) [31]. The results confirm and extend these findings in the Spanish context, identifying informational barriers and the importance of clear, quality message delivery—including word-of-mouth mechanisms—for fostering participation. This opens new research avenues on the commercial strategies required to effectively stimulate these segments.
- Second, the study broadens the analysis beyond the traditional relationship between suppliers and consumers by proposing the design of a multi-actor electronic platform that incorporates management tools for smallholders in their interactions with other stakeholders, such as workers, policymakers, and distributors. In this regard, this paper suggests for future research an integrative and collaborative approach that considers the entire agri-food value chain and examines how each link contributes to the achievement of producers' objectives, adding empirical depth to conceptual models of supply chain collaboration (Mahdad, 2022) [15].
- Third, the study provides empirical evidence on the usefulness and validity of such integrative platforms and offers a practical extension of the main business models previously identified in the literature for smallholders, proposing their implementation through technological tools and highlighting three key vectors to reduce the vulnerability of small-scale farmers: sustainability, digitalization, and cooperation.

Although the conclusions obtained from the different studies carried out have helped to design the technological platform and move from a technology readiness level (TRL) of TRL2 to TRL6, certain limitations must be mentioned. Firstly, there is a limitation derived from the fact that the geographical scope of the study has focused exclusively on one of the 4 countries participating in the project. Secondly, the number of participants in the qualitative studies conducted with farmers and stakeholders is small. From these limitations stem the potential lines of future research: extending the studies to actors in France, Italy, and Tunisia. Like Spain, these are Mediterranean countries with the similarities that this entails in terms of certain aspects of the agricultural sector. However, they also have different elements in the agri-food distribution chain, with a different average size of the agri-food industry and a different rate of penetration of the large retail food distribution companies. These aspects are compounded by the existence of consumers with different nuances in aspects relating to organic and sustainable agriculture or in the perception of the problem of the rural world.

Author Contributions: Conceptualization, J.M.G.-G., A.C.-M., V.V.-A. and S.R.; methodology, J.M.G.-G., A.C.-M., V.V.-A. and S.R.; validation, J.M.G.-G., A.C.-M., V.V.-A., M.M.-J., P.R., M.T.M. and S.R.; formal analysis, J.M.G.-G., A.C.-M., V.V.-A., M.M.-J., P.R., M.T.M. and S.R.; investigation, J.M.G.-G., A.C.-M., V.V.-A., M.M.-J., P.R., M.T.M. and S.R.; resources, V.V.-A., M.M.-J., P.R. and M.T.M.; writing—original draft preparation, J.M.G.-G., A.C.-M., V.V.-A. and S.R.; writing—review and editing, J.M.G.-G., A.C.-M., V.V.-A., M.M.-J., P.R., M.T.M. and S.R.; supervision, S.R. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by the PRIMA Program supported by the European Union, with co-funding from the Agencia Estatal de Investigación, through the grant PCI2022_132924 funded by MCIN/AEI/10.13039/501100011033 and by the European Union NextGenerationEU/PRTR.

Institutional Review Board Statement: Participation was completely voluntary in all cases, and compliance with ethical principles established in the Declaration of Helsinki was guaranteed.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Acknowledgments: This research was carried out within the framework of the SMALLDERS project. The SMALLDERS project is part of the PRIMA program supported by the European Union. This project received funding from the MUR (Italy), ANR (France), AEI (Spain) and MHESR (Tunisia).

Conflicts of Interest: The authors declare no conflicts of interest.

References

- Orr, A.; Donovan, J.; Stoian, D. Smallholder Value Chains as Complex Adaptive Systems: A Conceptual Framework. *J. Agribus. Dev. Emerg. Econ.* **2018**, *8*, 14–33. [\[CrossRef\]](#)
- Abraham, M.; Pingali, P. Transforming Smallholder Agriculture to Achieve the SDGs. In *The Role of Smallholder Farms in Food and Nutrition Security*; Springer: Cham, Switzerland, 2020; pp. 173–209.
- Balkrishna, A.; Choudhary, K.; Dhyani, A.; Arya, V. Virtual Farmers' Market: A Single-Step Solution to Sustainable Agriculture and Food Security. In *Sustainable Agriculture for Food Security*; Apple Academic Press: Palm Bay, FL, USA, 2021; pp. 345–370.
- Samoggia, A.; Beyhan, Z. Fairness-Enabling Practices in Agro-Food Chain. *Sustainability* **2022**, *14*, 6391. [\[CrossRef\]](#)
- Kruk, S.R.L.; Kloppenburg, S.; Toonen, H.M.; Bush, S.R. Digitalizing Environmental Governance for Smallholder Participation in Food Systems. *Earth Syst. Gov.* **2021**, *10*, 100125. [\[CrossRef\]](#)
- Janita, M.S.; Miranda, F.J. Exploring Service Quality Dimensions in B2b E-Marketplaces. *J. Electron. Commer. Res.* **2013**, *14*, 363–386.
- Miranda, F.J.; García-Gallego, J.M.; Chamorro-Mera, A.; Valero-Amaro, V.; Rubio, S. A Systematic Review of the Literature on Agri-Food Business Models: Critical Review and Research Agenda. *Br. Food J.* **2023**, *125*, 4498–4517. [\[CrossRef\]](#)
- Mehrabi, S.; Perez-Mesa, J.C.; Giagnocavo, C. The Role of Consumer-Citizens and Connectedness to Nature in the Sustainable Transition to Agroecological Food Systems: The Mediation of Innovative Business Models and a Multi-Level Perspective. *Agriculture* **2022**, *12*, 203. [\[CrossRef\]](#)
- Herzig, J.; Zander, K. Determinants of Consumer Behavior in Short Food Supply Chains: A Systematic Literature Review. *Agric. Food Econ.* **2025**, *13*, 21. [\[CrossRef\]](#)
- Esposito, B.; Sessa, M.R.; Sica, D.; Malandrino, O. Towards Circular Economy in the Agri-Food Sector. A Systematic Literature Review. *Sustainability* **2020**, *12*, 7401. [\[CrossRef\]](#)
- McDougall, N.; Wagner, B.; MacBryde, J. Competitive Benefits & Incentivisation at Internal, Supply Chain & Societal Level Circular Operations in UK Agri-Food SMEs. *J. Bus. Res.* **2022**, *144*, 1149–1162. [\[CrossRef\]](#)
- Latino, M.E.; Corallo, A.; Menegoli, M.; Nuzzo, B. Agriculture 4.0 as Enabler of Sustainable Agri-Food: A Proposed Taxonomy. *IEEE Trans. Eng. Manag.* **2023**, *70*, 3678–3696. [\[CrossRef\]](#)
- Di Vaio, A.; Boccia, F.; Landriani, L.; Palladino, R. Artificial Intelligence in the Agri-Food System: Rethinking Sustainable Business Models in the COVID-19 Scenario. *Sustainability* **2020**, *12*, 4851. [\[CrossRef\]](#)
- Lezoche, M.; Hernandez, J.E.; Alemany Díaz, M.d.M.E.; Panetto, H.; Kacprzyk, J. Agri-Food 4.0: A Survey of the Supply Chains and Technologies for the Future Agriculture. *Comput. Ind.* **2020**, *117*, 103187. [\[CrossRef\]](#)
- Mahdad, M.; Hasanov, M.; Isakhanyan, G.; Dolfsma, W. A Smart Web of Firms, Farms and Internet of Things (IOT): Enabling Collaboration-Based Business Models in the Agri-Food Industry. *Br. Food J.* **2022**, *124*, 1857–1874. [\[CrossRef\]](#)

16. Liu, P.; Long, Y.; Song, H.-C.; He, Y.-D. Investment Decision and Coordination of Green Agri-Food Supply Chain Considering Information Service Based on Blockchain and Big Data. *J. Clean. Prod.* **2020**, *277*, 123646. [\[CrossRef\]](#)
17. Zeng, Y.; Jia, F.; Wan, L.; Guo, H. E-Commerce in Agri-Food Sector: A Systematic Literature Review. *Int. Food Agribus. Manag. Rev.* **2017**, *20*, 439–460. [\[CrossRef\]](#)
18. Yang, X.; Chen, X.; Jiang, Y.; Jia, F. Adoption of E-Commerce by the Agri-Food Sector in China: The Case of Minyu e-Commerce Company. *Int. Food Agribus. Manag. Rev.* **2020**, *23*, 157–172. [\[CrossRef\]](#)
19. Leduc, G.; Kubler, S.; Georges, J.P. Innovative blockchain-based farming marketplace and smart contract performance evaluation. *J. Clean. Prod.* **2021**, *306*, 127055. [\[CrossRef\]](#)
20. Wang, H.H.; Jiang, Y.; Jin, S.; Zheng, Q. New Online Market Connecting Chinese Consumers and Small Farms to Improve Food Safety and Environment. *Can. J. Agric. Econ. Can. D'agroeconomie* **2022**, *70*, 305–324. [\[CrossRef\]](#)
21. Stephens, R.; Barbier, M. Digital Fooding, Cashless Marketplaces and Reconnection in Intermediated Third Places: Conceptualizing Metropolitan Food Provision in the Age of Prosumption. *J. Rural Stud.* **2021**, *82*, 366–379. [\[CrossRef\]](#)
22. Parth, S.; Manoharan, B.; Parthiban, R.; Qureshi, I.; Bhatt, B.; Rakshit, K. Digital Technology-Enabled Transformative Consumer Responsibilisation: A Case Study. *Eur. J. Mark.* **2021**, *55*, 2538–2565. [\[CrossRef\]](#)
23. Yu, Z.; Zhang, K. The Determinants of Purchase Intention on Agricultural Products via Public-Interest Live Streaming for Farmers during COVID-19 Pandemic. *Sustainability* **2022**, *14*, 13921. [\[CrossRef\]](#)
24. Liu, M.; Jia, W.; Yan, W.; He, J. Factors Influencing Consumers' Repurchase Behavior on Fresh Food e-Commerce Platforms: An Empirical Study. *Adv. Eng. Inform.* **2023**, *56*, 101936. [\[CrossRef\]](#)
25. de Man, A.-P.; Luvison, D. Collaborative Business Models: Aligning and Operationalizing Alliances. *Bus. Horiz.* **2019**, *62*, 473–482. [\[CrossRef\]](#)
26. Ménard, C.; Vellema, W. Inclusive Business Models in Agri-Food Value Chains: What Safeguards for Whom? *J. Afr. Bus.* **2020**, *21*, 395–415. [\[CrossRef\]](#)
27. Robina-Ramírez, R.; Chamorro-Mera, A.; Moreno-Luna, L. Organic and Online Attributes for Buying and Selling Agricultural Products in the E-Marketplace in Spain. *Electron. Commer. Res. Appl.* **2020**, *42*, 100992. [\[CrossRef\]](#)
28. Kitzinger, J. Qualitative Research: Introducing Focus Groups. *BMJ* **1995**, *311*, 299–302. [\[CrossRef\]](#) [\[PubMed\]](#)
29. Ting, H.; Memon, M.A.; Ramayah, T.; Cheah, J.-H. Snowball sampling: A review and guidelines for survey research. *Asian J. Bus. Res.* **2025**, *15*, 1–15. [\[CrossRef\]](#)
30. Knott, E.; Rao, A.H.; Summers, K.; Teeger, C. Interviews in the Social Sciences. *Nat. Rev. Methods Prim.* **2022**, *2*, 73. [\[CrossRef\]](#)
31. Ismail, I.J.; Amani, D.; Changalima, I.A. I share because I care! Smallholder farmers' perceptions of the usefulness of word of mouth for their market participation decisions. *IIM Ranchi J. Manag. Stud.* **2024**, *3*, 39–53. [\[CrossRef\]](#)

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.