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How did Italian diversified farms tackle Covid-19 pandemic first wave challenges?

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\textbf{ABSTRACT}

The spread of the Covid-19 pandemic in Italy, in the period March–May 2020, quickly triggered a deep crisis, causing an immediate economic slowdown and consequently a strong contraction in domestic demand and trade. The food supply chain faced severe difficulties, although its anti-cyclical nature allowed for greater resilience compared to other economic sectors. In this framework of ongoing uncertainty, it is important to understand the response of farms to the crisis, and their role in the sustainability of the post-pandemic food supply chain, even for future policy interventions in the short and medium term. The purpose of the paper is to investigate how diversification affected the response of farms to the Covid-19 crisis, and explore whether the changes required by the post-crisis scenario can produce opportunities for their activities. The study investigates a sample of fifteen farms in central Italy through semi-structured interviews, performing a lexicon-based text and sentiment analysis. The results highlight the importance of farm diversification in dealing with the Covid-19 crisis, and emphasise the role of diversified farms for the sustainability of the agri-food system. These results have interesting policy implications, particularly regarding support for the competitiveness of farms by improving sustainable logistics, electronic commerce and exchanges of knowledge and innovations among farmers; these measures should be taken into account to target the future agricultural, rural and food policies, at both national and local level.

\textbf{1. Introduction}

The environmental pressures related to population growth, urbanisation, the exponential increase in international transport, and the role of climate change increase the risks and the spread of health emergencies considerably [1]. In the first two decades of the twenty-first century, the frequency of such emergencies has significantly increased, compared with the pandemic episodes recorded throughout the twentieth century [2]. The main pandemics and flu of the last two centuries are listed chronologically in Fig. 1.

The Covid-19 pandemic has caused extraordinary socio-economic upheaval due to the severe preventive measures adopted by governments. Verikios [3] has studied the relationships between epidemiological and economic models, highlighting how unlike other Covid-19 epidemics it is of longer duration and more serious in its economic effects, given the greater uncertainty surrounding its nature.

Despite the anti-cyclical nature of the agri-food sector, the Covid-19 pandemic has caused significant shocks for agricultural and food systems on a global scale [5]. The Covid 19 pandemic reached Italy in February 2020. After the death of the first registered patient, the implementation of the red zones was triggered in some municipalities between two regions in the north of the country, specifically Lombardy and Veneto. In March, the situation quickly precipitated, cases of contagion increased, and Italy was the first Western country to adopt severe and restrictive measures to counter the spread of the pandemic.

During the first wave of the health emergency (March–May 2020), the Italian agri-food system was relatively less affected than other economic sectors by the effects of the lock-down following Covid-19 [6,7]. However, the extent of some factors affecting farms and agri-food processing companies emerged significantly, particularly micro, small and medium-sized enterprises, from producers, manufacturers, traders and food processors to transporters and retailers [8,9]. Restrictions on selling food in public spaces, on the use of public transport, as well as on mobility in general, including limitations in agricultural operations, caused disruptions in food production and supply in urban, peri-urban and rural areas [10].

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The mandatory closures imposed during the lockdown had a significant effect on the Hotels–Restaurants–Catering (Ho.Re.Ca.) channel, and on export flows [8]. In general, the fractures in value chains, the destruction of production capacity, the transformations related to business strategies, the effects on some food chains – in particular the meat, wine and fisheries value chain - are some of the most evident effects, which created systemic uncertainty from a social and economic point of view [5,8].

Moreover, the Covid-19 pandemic has modified the food choices of families; they have changed their preferences and their purchasing patterns, so reducing food waste [11].

Fig. 2, starting from the analysis of the most recent studies shows the stylised facts by distinguishing the impacts recorded during the first wave of Covid-19 pandemic, when the more stringent restrictive measures were in force, and the short-term subsequent effects.

The blockade of the Ho.Re.Ca channel led to a reduction in demand for all upstream sectors, while the increase in domestic consumption and the crisis in supply chains caused an increase in the consumer demand for food from farms [12,13]. Relations between farmers and the food processors in some supply chains were interrupted at the international, national and local levels [1]. Some markets and many commodities prices experienced high uncertainty and volatility. In agriculture, the first phase saw the difficulty of accessing the labour force linked to the restrictive measures of the lockdown, with effects on labour-intensive crops in the subsequent phase [9]. The role of logistics was highlighted, assuming a critical function of true bottlenecks in food supply chains, especially for fresh products [12]. Small- and medium-sized catering enterprises were particularly affected by the crisis, and more exposed to risk. At the endpoint of the chain, consumers experienced changes in lifestyles and a general increase in attention to prices linked to the phase of the economic recession, and to the risks associated with an increase in poverty and inequalities [1,8].

During the health emergency, farmers operated in a constantly changing socio-economic-political context [1]. The FAO has highlighted how, among the impacts of the pandemic, we can expect a reorientation towards the local dimension of agri-food chains [11]. In particular, an increase in interregional trade, which could translate into shorter food chains and greater market outlets for farms, improving access to both input and food [12].

In the European Union (EU), the “Farm to Fork Strategy” recently promoted within the European Green Deal, aims to make food systems fair, healthy and environmentally friendly. The Strategy considers the sustainability of food systems as a condition for their resilience, and aims, among other objectives, to favour the redistribution of power in food supply chains, in particular for primary producers. In this framework, it appears particularly important to investigate the response of diversified farms to the Covid-19 pandemic, their resilience and adaptation to the crisis, and more effective risk management.

Within the framework of the European strategy, the Italian government launched some extraordinary intervention measures during the first wave, linked to supporting the most affected enterprises in the Ho.Re.Ca sector, and to the work of emigrants, whose absence created a serious crisis in some phases - such as harvesting - of the supply chains, in which the role of migrant farm workers is crucial.

In the current phase, the agricultural sector has been assigned an important role within the National Recovery and Resilience Plan (PNRR), which addresses the issues of ecological transition, the circular economy, competitiveness, the fight against climate change and hydrogeological instability. Support for organic farming continues to be a crucial line of development in sustainable agriculture, with three projects related to supply chain contracts, agricultural parks, logistics. In the context of ecological transition, interventions are made to support sustainability in the agri-food and forestry chains, energy efficiency, the production of renewable energy, digitalisation and innovation in agriculture and rural areas.

Farm diversification refers to expanding the range of agricultural production of goods and services, including towards extra-agricultural activities, with the aim of diversifying income and avoiding risk factors. Diversification can take place on-farm, or within the territory, and can be within agriculture or outside the sector; it involves diversifying the use of factors of production, such as land, labour, or capital, which were previously engaged in conventional agricultural activities [13]. Examples of related activities are agritourism, the processing of plant and animal products on farm, the production of bioenergy, tastings and...
recreational activities, the contracting of agricultural equipment and care farming.

Diversification can therefore also be seen as an element of multifunctionality [14], which concerns the capacity of agriculture to produce secondary goods and services, together with the production of food products, and implies innovation in a farm’s organisation and business, as well as technical choices [15], on both family farms and diversified farms [16]. At farm level diversification mitigates the risks arising from holding the primary position in the market, and increases stability and cash flow level [17], as well as primary capital turnover, and finally at territorial level strengthens the relations between farms and local economies, and the agroecosystem [18], particularly in marginal and mountain areas [19,20].

Some authors [21,22] have explored the resilience shown by farms that diversify, focusing on what allows farms to adapt to transformations, both inside and outside the farm. Darnhofer [23] recently discussed how, in the Covid-19 pandemic, the resilience of farms linked to the workload, knowledge, the role of agriculture in the food supply chain and wider social structures, can be key to better adapting to the changing conditions that will increasingly characterise the volatile and uncertain future.

Laborde et al. [24] and the FAO [12] have highlighted vulnerabilities of farm strategies that focus on specialisation, process optimisation, relationships with the global market, the intensification of production, increased efficiency and cost reductions in Europe.

Analysing the lesson we learned from Covid-19, Lioutasab and Charatsari [25] focused on mechanisms that can mitigate the impacts of crises or disasters in agriculture, highlighting the role of supporting diversified agricultural production systems to enter value chains and linking them with new markets. Moreover, the role of diversification can be useful for investigating resilience-promoting policies and the regionalisation of food systems. In this scenario, it is assumed that diversified farms can cope better with the pandemic than specialised ones, and therefore we chose to focus on this type of farm, without testing the difference.

Based on these considerations, the paper investigates how diversified farms responded to the first wave of the Covid-19 pandemic. A small sample of Italian diversified farms were interviewed. The main research questions that triggered our analysis are: I) What were the main consequences of the first March–May 2020 lockdown on diversified farms? II) How have farmers responded to the challenges of the post-crisis period, and what are their expectations in terms of policy support?

This study contributes to the literature by analysing the impacts of the Covid-19 pandemic on the business decisions of farms, as well as on the role of the Short Food Supply Chain. The results provide some useful elements for future sustainable local food policies, and also for rural policies at European, as well as national and regional, levels.

The remainder of the paper is structured as follows: Section 2 illustrates the data collection steps and the methodologies employed, which include text and sentiment analysis; Section 3 presents the results of the analyses and discusses them; Section 4 concludes the study with some final remarks.

2. Dataset and methods

The dataset consists of the transcription of the interviews administered to 15 farmers, whose activities are located in three regions of Central Italy (Fig. 3): Lazio (4 farms), Abruzzo (9 farms) and Molise (2 farms). The interviews were conducted during May–July 2020, after the first Covid-19 pandemic wave, by means of direct conversation via electronic platform.

The farms were chosen based on their diversified activities, which make them the most dynamic and competitive compared to those without other gainful activities (OGA); indeed, the Italian Institute of Statistics (Istat) Report 2019 highlights that farms implementing diversification strategies, record on average better economic results in terms of productivity and profitability [26]. The sampled farms located in Abruzzo and Molise sold their products in the municipalities most severely suffering from the pandemic wave, and which were involved in more stringent virus containment measures than those for the so-called “red zone”, concerning the whole Italian territory. The farms from Lazio have Rome as reference market, the biggest Italian one. Owing to the
restrictions on movement during the pandemic wave, the choice has been done among a group of farms already known, basing on a purposive sampling having the goal to achieve a certain heterogeneity in the variables employed.

The questionnaire was semi-structured, with a general section concerning farms’ features, and five open questions, involving: Q1. The main effects of the pandemic on farm activities; Q2. Farmer responses to restrictions on movement during the pandemic wave, the choice has
- Q3. Changes in relationships with the other players in the territory; Q4. Changes planned to adapt to the post-crisis situation; and Q5. The policy support needed to overcome the crisis.

A pilot interview was conducted with a privileged witness - identified trade union representative - prior to the beginning of the survey, in order to test the effectiveness of the questionnaire.

The first treatment of the data concerned the detection of groups of farms which were homogeneous with respect to their structure, type of other gainful activities, markets and sales channels, in order to verify the reaction of these groups, more than single farms, to the stresses caused by Covid-19. The variables are reported in Table 1.

The “Size” variable was coded with the values “small” (up to 15 ha of extension), “medium” (between 15 and 50 ha), “large” (between 50 and 150 ha), and “very large” (more than 150 ha). It should be noted that these categories do not correspond to those usually employed by Istat, which considers many classes for smaller farms (which are the majority), and reaches a maximum class of ‘100 ha and more’. It was decided to adopt this different classification, because the sample consists of units which are much bigger than the average diversified Italian farm [26]. This naturally led to a Cluster Analysis (CA), exploiting Gower’s similarity measure, $G^d_{ij}$, suited for any kind of variable [27]:

$$G^d_{ij} = \sum_{k=1}^{p} s_{ijk} a_{ijk}$$

where $s_{ijk}$ is a similarity measure between units $i$ and $j$ with respect to variable $k$, and varies according to the type of variable (quantitative, qualitative or dichotomous); $a_{ijk}$ represents the ability to make a comparison, and assumes a value 1 if the comparison is possible, and 0 otherwise. Once Gower’s index has been obtained, the corresponding dissimilarity measure, $G^d_{ij}$, is simply calculated through:

$$G^d_{ij} = 1 - G^d_{ij}$$

In our case, starting with 15 units (farms), the matrix of Gower’s dissimilarity measures was a table with 15 rows and 15 columns, with $G^d_{ij}$ representing the dissimilarity between farms $i$ and $j$. A hierarchical CA was performed based on this matrix, through a Ward-like algorithm. The resulting partition is composed of three clusters, whose characteristics are presented in the following section.

The second analysis consisted of quantitative text and sentiment analysis; the chosen method is lexicon-based, enabling us to identify significant keywords with semantic strength [28]. In this framework, sentiment is the underlying feeling, attitude, evaluation, or emotion associated with an opinion, which, for statistical purposes, is quantified through its semantic intensity [29]. We mainly refer to the paper by Welbers et al. [30] in the description of the passages followed, with the support of R open-source software. We implemented a dictionary consisting of the individual words spoken in each answer by the interviewees (a total of 5 different dictionaries), giving a sentiment (semantic intensity) to each word, ranging from $-2$ (strong negative sentiment) to $+2$ (strong positive sentiment); a value of zero denoted no

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**Table 1**

Variables selected for Cluster Analysis (in parentheses, absolute number of farms).

| Features          | Variable          | Type of variable | Values                                      |
|-------------------|-------------------|------------------|---------------------------------------------|
| Structure         | Legal form        | Qualitative      | Individual company (10); Ltd company (5)    |
|                   | Size              | Qualitative      | Small (5); Medium (5); Large (3); Very large (2) |
|                   | Type of farming   | Qualitative      | Crop (7); Livestock (3); Mixed (5)          |
|                   | Farming technique| Qualitative      | Organic (12); Integrated (3)               |
| Other gainful activities | Agritourism       | Dichotomous      | 1 = Presence (7); 0 = Absence (8)          |
|                   | Dairy             | Dichotomous      | 1 = Presence (2); 0 = Absence (13)         |
|                   | Educational       | Dichotomous      | 1 = Presence (4); 0 = Absence (11)         |
|                   | Energy production | Dichotomous      | 1 = Presence (2); 0 = Absence (13)         |
|                   | Livestock         | Dichotomous      | 1 = Presence (4); 0 = Absence (11)         |
|                   | Processing        | Dichotomous      | 1 = Presence (2); 0 = Absence (13)         |
|                   | Oil mill          | Dichotomous      | 1 = Presence (2); 0 = Absence (13)         |
|                   | Vegetables        | Dichotomous      | 1 = Presence (10); 0 = Absence (8)         |
|                   | Windmill          | Dichotomous      | 1 = Presence (1); 0 = Absence (14)         |
| Markets           | International     | Dichotomous      | 1 = Presence (2); 0 = Absence (13)         |
|                   | Markets           | Dichotomous      | 1 = Presence (2); 0 = Absence (13)         |
|                   | National Market   | Dichotomous      | 1 = Presence (2); 0 = Absence (13)         |
|                   | Local Market+a    | Dichotomous      | 1 = Presence (15); 0 = Absence (0)         |
|                   | Farmer’s Markets  | Dichotomous      | 1 = Presence (2); 0 = Absence (13)         |
|                   | Solidarity        | Dichotomous      | 1 = Presence (7); 0 = Absence (8)          |
|                   | Purchasing Groups | Dichotomous      | 1 = Presence (1); 0 = Absence (14)         |
|                   | Box Schemes       | Dichotomous      | 1 = Presence (1); 0 = Absence (14)         |
|                   | Direct Selling+b  | Dichotomous      | 1 = Presence (15); 0 = Absence (10)        |
|                   | Stores            | Dichotomous      | 1 = Presence (6); 0 = Absence (9)          |
|                   | Canteen & Catering | Dichotomous    | 1 = Presence (2); 0 = Absence (13)         |
|                   | Hotel, Restaurants| Dichotomous      | 1 = Presence (3); 0 = Absence (12)         |
|                   | & Coffees         | Dichotomous      | 1 = Presence (7); 0 = Absence (8)          |
|                   | Cooperatives      | Dichotomous      | 1 = Presence (7); 0 = Absence (8)          |
|                   | Wholesalers       | Dichotomous      | 1 = Presence (6); 0 = Absence (9)          |
|                   | Processors        | Dichotomous      | 1 = Presence (5); 0 = Absence (10)         |

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*a* All of the variables were employed in Cluster Analysis, except for ‘Local Market’ and ‘Direct Selling’, since they are not discriminatory for the analysis.
specific sentiment attributed to the word. The total sentiment expressed by the \( k \)-th respondent in answer \( j \) was calculated as:

\[
TS_{ij}^{(k)} = \sum_{i \in D_j} s_i m_i
\]

where \( D_j \) is the dictionary built for the \( j \)-th answer; \( s_j \) is the sentiment attributed to word \( i \) in the \( j \)-th answer, and \( m_i \) represents an enhancer (downtoners, such as “few”, “less”, and so on; or amplifiers, such as “more”, “bigger”, and so on) or a negation. In the first case, the semantic intensity of the word was diminished (downtoners) or augmented (amplifiers); in the second case, the word inverted its polarity (from negative to positive, or vice versa). The search for an enhancer or a negation was automated, and referred to 7-g, that is, groups of 7 words whose central word was \( s_j \).

Once the sentiment analysis results were obtained, we focused on three main outputs: 1. One table reporting, for each of the clusters detected in the first phase and for each answer, the total and the relative sentiment – this latter obtained as the ratio between total sentiment and total number of words pronounced; 2. For each answer, a graphic representation of the words with highest and lowest sentiments; and 3. The mean values of the sentiments, calculated in each cluster for each answer.

These results are all presented and discussed in Section 3.

3. Results and discussion

The first result refers to the CA performed on the variables shown in Table 1. As mentioned in Section 2, the final partitioning consisted of three clusters, which can be characterised as presented in Table 2.

Sales to local markets, and the participation of the farms in at least one Short Food Supply Chain (SFSC) are traits common to all the clusters.

Cluster 1 includes three farms, located in Abruzzo. They are individual companies of small and medium size, specialised in mixed productions. The prevalent farming technique is organic. Their other gainful activities are mainly livestock and vegetables processing. These farms sell at local markets, preferably to cooperatives.

Cluster 2 consists of six farms, located in Lazio and Molise. They are all limited companies, and they are of large or very large size. These farms are mainly specialised in livestock and mixed production, and all adopt organic farming techniques. Other gainful activities include agritourism and educational activities. These farms sell on national markets, in addition to local ones, and have a strong diversification of sales channels.

Cluster 3 includes six farms, located in Abruzzo. They are small and medium size individual companies, specialising in crops. They adopt mainly organic farming techniques, and they have in-house vegetable processing plants. They sell solely to local markets, especially to cooperatives.

Table 3 presents the five questions in full, and shows absolute and relative sentiments by clusters and questions. Absolute sentiment is the sum of the sentiments obtained by each word in the indicated question; relative sentiment is the ratio between absolute sentiment and the total number of words pronounced. Indeed, it is worth pointing out that there was no limit to the number of words for each answer. These two sentiments allow a comparison among the semantic intensities shown in the different topics discussed, especially when they are averaged according to the number of words.

The most immediate observation is that only the farms belonging to Cluster 2 show negative sentiment, relative to Q1, regarding the effects of the crisis. This may be due to the fact that the farms involved have agritourism as an OGA, and sell their products on national markets, so suffered more than the others due to the restrictions imposed during the lockdown. The farms within the other two clusters have succeeded in limiting the adverse effects of the crisis: this may depend on their small-medium size, which allows for more flexibility, and the local dimension of the markets.

The highest sentiment, both absolute and relative, is shown in the responses of Cluster 1 farms to Q4 (the changes planned to adapt to the post-crisis situation): this means that these farms pay great confidence in the interventions foreseen for overcoming the difficulties posed by the emergency.

The following Figs. 4–8 present the absolute global sentiment by words, and the mean sentiment by cluster, calculated on the same words.

### 3.1. Q1: effects of the first pandemic wave

Fig. 4(a) highlights an increase in direct sales, in particular to Solidarity Purchasing Groups (SPGs) and supermarkets located inside cities, which also included processed products. Domestic consumption has increased as a result of the pandemic (e.g., ingredients for preparing pasta, pizza and bread) [4]. There were also strong sentiments about the word “Customers”, which refers both to the consolidation of relationships with existing clients, and to the establishment of new contacts. It should be noted that, as opposed to large retail chains, the interviewees maintained the prices of their products as unchanged; and this has probably had positive effects on both demand and revenues, ensuring the necessary cash for the farms’ activities. The pandemic confirmed the importance of sales to SFSCs: these market channels, born from the loss of trust in the globalised food system, are trying to shorten the gap between farmers and consumers [31–33]. They are based on the construction of a different place-based agri-food chain, and envisage a re-localisation of the space near the final market [34]. SFSCs contribute to strengthen the relationship between farmers and consumers [35–37]. In this sense, they can contribute to the transition and resilience of agri-food within the context of the current Covid-19 crisis [38].

Among the negative consequences of the crisis, the respondents report in primum the damages deriving from the increase in wildlife (in particular wild boars), as a result of the restrictions to mobility. Indeed, farmers were compelled to share their land with wildlife, inherently involving conflicts between animal conservation and agriculture [39]. Mammals and birds may damage crops and livestock [40] directly by eating and trampling them, or indirectly by damaging infrastructure, especially irrigation systems and fences. Relevant negative effects have been highlighted with respect to agritourism and leisure activities, and also sales to restaurants and to FMGs. When the pandemic spread all over the world, restrictions to mobility were imposed across countries [41],

| Table 2 | Characterisation of the three clusters obtained as the CA result. |
|---------|---------------------------------------------------------------|
|         | Cluster 1 | Cluster 2 | Cluster 3 |
| No. of farms | 3       | 6       | 6       |
| Legal form | All Individual companies (2) | Almost all Ltd companies (5) | All Individual companies |
| Size | Small (2) or Medium (1) | Large or Very Large | Small or Medium |
| Type of farming | All Mixed | Livestock (3); Mixed (2); Crop (1) | All Crop |
| Farming | Organic (2); Integrated (1) | All Organic | Organic (4); Integrated (2) |
| processing | Agritourism | Educational activities processing | Vegetables processing |
| Markets | National markets | Local markets | Local markets |
| Sales channels | Cooperatives | Stores | Cooperatives |

Cooperatives | Hotels, Restaurants & Coffeens | Wholesalers | Processors |
affecting tourism \cite{42}, causing it very serious problems \cite{43,44}. Covid-19 significantly affected educational farms, which share strong connections with agritourism activities \cite{45,46}. Agritourism is an important factor in rural development \cite{47,48} and has important social, economic and environmental implications \cite{49–51}. A sudden and sharp contraction of these activities may have negative effects on growth in rural areas.

In Fig. 4(b), Cluster 1 is characterised by an increase in processed products to new customers, and by the damage due to mobility restrictions, which have led to the cessation of livestock processing; damage to crops due to some wildlife has been another consequence of reduced mobility. Cluster 2 registers an increase in sales to supermarkets and shops, while sales to restaurants have decreased. The biggest farms, belonging to this group, have been obliged to switch part of their sales from national markets to local ones. They have also experienced major problems with the cancellation of bookings for agritourism. Finally, Cluster 3 shows an increment in requests from SPGs, while sales to FMs have decreased. Ultimately, revenues have increased.

Table 3
Sentiment analysis results by cluster and question.

| Question                                                                 | Clus1 Absolute sentiment | Clus2 Absolute sentiment | Clus3 Absolute sentiment | Clus1 Relative sentiment | Clus2 Relative sentiment | Clus3 Relative sentiment |
|-------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Q1 – What were the effects of the pandemic on farm activities?          | 32.25                    | −73.25                   | 327.50                   | 0.047                    | −0.059                   | 0.381                    |
| Q2 – What were the interventions carried out in order to face the crisis? | 97.25                    | 260.50                   | 294.25                   | 0.307                    | 0.396                    | 0.344                    |
| Q3 – How did your relationship with the other players in the territory change? | 86.00                    | 175.00                   | 270.00                   | 0.366                    | 0.451                    | 0.652                    |
| Q4 – What are the changes you planned to adapt to post-crisis situation? | 339.00                   | 331.75                   | 300.00                   | 0.677                    | 0.625                    | 0.561                    |
| Q5 – What are the policy supports you need to overcome the crisis?      | 161.50                   | 201.00                   | 156.50                   | 0.605                    | 0.624                    | 0.479                    |

Fig. 4. Answers to Q1: Effects of the first pandemic wave. (a) Global absolute sentiment; (b) Mean sentiment by cluster.

Fig. 5. Q2: Farm responses to crisis. (a) Global absolute sentiment; (b) Mean sentiment by cluster.
3.2. Q2: farm responses to the crisis

The interviewees have responded to the effects of the Covid-19 crisis by implementing several interventions (Fig. 5(a)). The terms of product delivery appear to be the most effective response, showing the strongest positive sentiment. With particular reference to SPGs, pandemic containment measures have prevented the gathering of people in common spaces, and as a consequence, products have been delivered to customer houses, whereas before the crisis they were delivered to a single distribution centre. Another effective response to the pandemic has been the recourse to e-commerce, which has emerged as a valid tool to connect producers and consumers inside the agri-food system [52]. It

Fig. 6. Q3: Changes in relationships with the other players in the territory. (a) Global absolute sentiment; (b) Mean sentiment by cluster.

Fig. 7. Q4: Changes planned to adapt to the post-crisis situation. (a) Global absolute sentiment; (b) Mean sentiment by cluster.

Fig. 8. Q5: Policy support needed to overcome the crisis. (a) Global absolute sentiment; (b) Mean sentiment by cluster.
can be a factor for success in agriculture markets [53]. E-commerce opens new perspectives to farms selling through SFSCs, and leads to increased profitability and reduced costs [54].

Negative sentiments were expressed regarding deliveries by couriers; on the one hand, they have increased their prices owing to increased demand; on the other, the increased workload has delayed deliveries. This resulted in a need to transport goods using the farmer’s own vans. It is useful to underline that e-commerce is based on reliable logistics [55]. Logistics strategy is considered one of the critical factors in the success of local food producers, affecting their performance [56]. SFSCs imply specific logistics solutions which depend on product, distribution system and network characteristics [57]. Appropriate logistics arrangements have the considerable potential to improve the environmental impact of SFSCs [58] and can also increase their economic and social performances [59].

As seen in Fig. 5(b), Cluster 1 is characterised by a strongly positive mean sentiment towards e-commerce, and home deliveries of transformed food (e.g., flour); at the opposite end, the weakest mean sentiments involved the postponement of farming operations (e.g. pruning). The positive attitude towards online operations may be due to the fact that, being of small-medium size, these farms had almost never previously experienced this sales channel. Cluster 2 farms confirmed their ability to relocate sales from national to local markets, and to change trade channels from wholesalers to local sellers (supermarkets and stores). Another positive response to the crisis involved agronomic assistance for crops, which has been attained by means of telematic platforms, with a substantial reduction of costs. Cluster 3 shows a positive change in delivery terms and in sales volume to SPGs; these changes have been necessary to remedy both the closure of FMIs and to the redefinition of relationships with couriers.

3.3. Q3: changes in relationships with the other players in the territory

The Covid-19 crisis has reinforced the relationships among the players in the territory, as Fig. 6(a) clearly shows.

The connections among farmers have changed in strongly positive way; they have co-operated by exchanging products and information about Covid-19 regulations, and in product delivery. The relationships between farmers and the other players (manufacturers and sellers) in the supply chain have also been reinforced. Conversely, contacts with couriers have reduced. Before the pandemic, contacts were almost all of a physical nature; with the spread of the virus, they have become virtual, by means of electronic tools. This has made contact faster and more constant. There have been further changes in the relationships between farmers and customers, consolidating the social links in local markets.

Cluster 1 is characterised by a strong negative sentiment regarding the deterioration of the relationship with couriers (Fig. 6(b)), which has led to a change in the terms of product delivery. While the small-medium farms in Clusters 1 and 3 have suffered due to the higher prices imposed by couriers, the big farms in Cluster 2 did not experience this drawback, and they have reinforced their relationship with sellers, especially by using online platforms. Finally, the individual companies belonging to Cluster 3 have developed direct cooperation relationships with entrepreneurs and customers.

3.4. Q4: changes planned to adapt to the post-crisis situation

Fig. 7 summarises the sentiments expressed for Q4, relative to the changes planned to adapt to the post-crisis situation. Fig. 7(a) highlights the intention, of some of the respondents, to augment direct sales, especially to SPGs. Another projected change concerns the reinforcement of ICT structures in order to fully exploit e-commerce potential. Particular emphasis is placed on diversification, which is considered a strategy to integrate farm income [60]. Both farm activities (other gainful activities) and product diversifications are planned. Among OGAs, farmers want to strengthen vegetable processing, and intend to widen product supply, in order to satisfy the needs of new customers. Further planned diversification involves marketing channels, to reduce market risks.

Farm diversification can help to improve performance in the agricultural sector [61], contributing to bridging the income gap between urban and rural areas. Farm diversification also has important implications for the implementation of EU rural policies [62–64].

The characterisation by cluster, shown in Fig. 7(b), recalls the discussion already made about diversification especially for Cluster 1. The big farms in Cluster 2 emphasised the empowerment of production structures, and sales to SPGs. No special features are observed for Cluster 3, whose values are similar to the means, indicating that small-medium individual companies do not demonstrate a clear direction in projecting future diversification programs.

3.5. Q5: policy support needed to overcome the crisis

The last question concerned the policy support needed to overcome the crisis. Once again, the strongest sentiments were all positive (Fig. 8(a)). The interviewees require subsidies to improve competitiveness, through the implementation of investments aimed at enhancing farm efficiency, especially to build processing plants and upgrade machinery and equipment, and to augment sales volume through e-commerce. One clear example is the need to have available funds for the adjustment of agritourism to post-Covid standards. In continuity with the previous answers to Q4, all of these investments would reinforce the tendency towards diversification. Public funding, as a matter of fact, would play an important role in supporting business diversification [65]. The interventions solicited by the farmers are among those founded by the Common Agricultural Policy (CAP), and in particular the second Pillar, relative to rural development policies, which might have a positive effect on both farms income [66], and technical efficiency, in particular for the biggest farms [67].

Fig. 8(b) shows that the small-medium farms in Cluster 1 are particularly interested in the possibility of new investment for farm competitiveness, based especially on e-commerce. Larger farms in Cluster 2 appear to be more interested in receiving subsidies, possibly due to the agritourism and educational activities strongly affected by pandemic crisis. Finally, Cluster 3 is almost similar to the first cluster, but with a stronger request for subsidies to buy machinery and equipment.

An overall interpretation of the interview responses offers some other relevant issues. The farmers declared that in the future their management strategies will be oriented towards strengthening diversification: food processing, new sales channels, and a more stringent relationship with customers are some of the activities on their future agendas. The diversification of farms and commercial channels has enabled farms to reduce the negative impacts associated with the health emergency. Only the biggest farms have suffered negative impacts, mainly due to interrupted supply and value chains in international commercial relations, and to reduced demand for agritourism. Indeed, farms involved in SFSCs have registered a revenue increase and their customer base broadened. Furthermore, the revenues linked to the increase in direct sales allowed the farms to offset the decline linked to agritourism activities. E-commerce was an important challenge for small farms, which, moreover, have shown interest in investing in online sales as leverage for future competitiveness. The replacement of sales channels as a strategic choice made by farms: the block of farmers markets, linked to measures for social distancing, was replaced by the Solidarity Purchased Groups channel.

4. Conclusions

The paper analysed the way that Italian diversified farms have responded to the first wave of the Covid-19 pandemic, and explored how the changed post-crisis scenario has oriented their business management
and the sustainability of the food supply chain.

The results show that diversification has enabled farms to effectively address the difficulties and uncertainty associated with the first wave of the pandemic. The main findings show that the diversified farms that have the ability to rapidly change their commercial channels and outlet markets are the most resilient.

The farms that were able to internalise all possible activities in the face of the crisis proved to be more resilient, while those that had outsourced certain functions before the pandemic - for example food processing - suffered the most from the effects of the health crisis.

The study highlights some issues regarding policy implications. Diversified farms have shown that during the first wave pandemic they were able to avoid disruptions to food production and supply chains. They played a fundamental role in guaranteeing food security, without increasing prices, and food safety, respecting the protocols and measures imposed by the crisis.

The pandemic was a challenge to innovation for diversified farms. They were able to make use of technical assistance through telematic platforms, cutting costs and demonstrating that they know how to adapt to technological change, overcoming the traditional resistance of the agricultural sector to digitisation. Furthermore, farmers were able to establish relationships with other actors in the food supply chains during the quarantine, via the internet, and with consumers themselves. This has fostered networks and cooperation, assuming the role of social innovation in rural areas and in rural-urban relations.

Diversified farms played an important role in the sustainability of the food supply chain, on both the economic side, by showing resilience and increasing the revenue from agricultural production, and on the social side, by strengthening relationships with local entrepreneurs – particularly with other farms – and with consumers. On the environmental side, logistics is still a crucial issue affecting the performance of farms and entire food chains. The main challenges are making eco-sustainable choices during all stages of food distribution, optimising the location of the nodes of the supply chain, improving the distribution path and restructuring the supply chain. In this framework, farmers have shown that they are open to a more innovative approach to distribution and transport systems, such as vertical and horizontal collaboration and cooperation.

These results suggest some policy recommendations. Firstly, policies should be implemented in order to support farms both in the development of sustainable logistics, and for the infrastructural aspects of supply, storage and storage capacity. Another crucial issue is the strengthening of the ability to activate exchanges of knowledge and innovations between farmers, and between farms and processing enterprises, favouring the active participation of farmers and consumers, and in particular those of SFSCs. The results show that the post-crisis scenario can create opportunities for improving the sustainability of the food supply chain.

Finally, in light of the results of the research path on the relationship between local food networks and the impacts of the pandemic, it would be useful for policies to move towards a transition from the relocation of agri-food chains towards planning actions for the governance of food systems, such as regional food networks, extended from the spatial point of view, and more complex from the relational point of view, which could include self-organised networks of local actors.

In the “Farm to Fork Strategy”, the European Commission promotes a global approach to the role of food sustainability, and urges national, regional and local institutions to create a broad debate on sustainable food policy, as well as on rural policies. The Commission has undertaken to formulate a legislative proposal for a sustainable food system by the end of 2023. It is necessary to identify resilience promoting tools in the implementation of the Strategy, at both European and national level, enhancing farmers abilities to change operative paradigms when change is required. This implies recognising the differences and peculiarities of different farming systems, however. Regarding the role of diversification in agriculture and the results that emerged from the study, there is a rising need to establish an appropriate balance between global and local supply chains in agriculture, with a focus on innovative practices – in rural areas - to support market access for small-scale farms, including food procurement schemes, and innovations in logistics to connect producers with consumers, such as local online platforms for e-commerce or delivery services, even as a key to strengthening rural-urban connections, promoting effective and sustainable food procurement.

This study does have some limitations. Firstly, the limited sample size makes it non-representative of the whole population of diversified farms, and consequently, no inferential method has been applied. Secondly, the farms interviewed were bigger in size than the Italian average; nevertheless, the description resulting from the interviews has offered useful information about farms with other gainful activities.

Some future research directions can be suggested. Firstly, the survey could be replicated in the same farms to understand how they will deal with the medium and long-term impacts of the pandemic and the economic recession. Secondly, the contribution of the place and the relationships with new business models such as Community-Based Cooperatives will have to be addressed, in order to highlight the role of diversified farms in improving social capital in rural areas and sustainability in food supply chains.

Author statement

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