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Will recent world events shift policy-makers' focus from sustainable agriculture to intensive and competitive agriculture?

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ABSTRACT

The events of recent years (pandemic and conflict in the European area) have led to a rethink of traditional policies on trade and support for domestic production. The concept of national "self-sufficiency" is being consolidated to the detriment of globalization and the possibility of buying raw materials on the world market at the lowest price. European agriculture, affected by the Common Agricultural Policy (CAP) review for the 2023/2027 programming period, is not exempt from this process. Therefore, the construction of National Strategic Plans may partly dampen the drive towards sustainability undertaken with the Green Deal and related strategies (from Farm to Fork, Biodiversity 2030, and Circular Economic) up to the 2030 Agenda Goals because producers are demanding greater freedom in production intensification. The research, conducted in a traditionally agricultural area in Italy, shows that competitive and sustainable agriculture can coexist thanks to entrepreneurial choices based on values and interest in the territory. Despite the difficulties arising from the changing conditions of the international scenario, which have led to an increase in production costs and a contraction of market opportunities, agriculture has become resilient thanks to sound agronomic practices and the sustainability of the process. Therefore, a model of agriculture more closely linked to the territory's characteristics is proposed.

1. Introduction

The COVID-19 pandemic and the Russia-Ukraine conflict triggered a long period of economic depression manifested in soaring energy and commodity prices, which were also felt in global agricultural commodity production and markets [1].

Rising production costs (primarily for energy, fuel, and fertilizer) due to the speculative bubble affected all production chains [2,3]. At the same time, market disruptions (supply-demand relationships) were felt mainly in the wheat and maize sectors, cereal derivatives, animal feed, and livestock [4].

This situation is partly due to the world trade agreements (WTO) and the economic and agricultural policies of the various countries [5,6]. These countries have found it economically advantageous to liberalize trade to facilitate the supply of raw materials at the best price on the world market by opening up to diplomatic, political, and trade agreements [7]. However, now they suffer from a negative trade balance [8]. Hence the typical difficulties of the war economy in the European area, which, between the interruption of trade relations and the sanctions decided by the international community against Russia, have generated the consequences mentioned above [9,10].

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On the European side, the EU, through the Common Agricultural Policy (CAP), has intervened in both domestic and foreign markets and has promoted the competitive and multifunctional development of the different agri-food sectors for economic and social reasons [11–13]. Today, however, it must face new emergencies:

- The recovery after the pandemic crisis, which has led both to the extension to 2022 of the 2014/2020 CAP programming period and to the activation of National Recovery and Resilience Plans, containing financial resources to support agriculture in member countries;
- the organization of the new CAP 2023/2027, through the construction of National Strategic, Plans consistent with the political commitments of the Green Deal and the Farm to Fork, Biodiversity 2030, and Circular Economy [14] (EU, 2022) strategies;
- the approval of extraordinary short-term measures (e.g., set-aside derogation).

As a result, these events present new challenges to European agricultural production systems regarding food security, social justice, guaranteed access to food, consumer vulnerability, and economic and inflationary expenditure resilience [15]. They highlight the age-old dualism between competitive, resilient, multifunctional, and sustainable agriculture [16]. The dilemma is determining whether resilience to shocks of this nature, which pose a severe threat to the functioning of agri-food systems, is an attainable goal, not only through intensive production and consumption models. Through improving production solutions based on contemporary agroecological methodologies, productivity, environment, and biodiversity are successfully connected (such as digitization, precision agriculture, and biotechnology) [17,18]. Therefore, the consultations between the Regions, the State, and the European Commission are crucial for defining the objectives, targets, and operations to be implemented under the CAP pillars (EAGF and EAFRD) to improve agricultural productivity and efficiency, a view to environmental sustainability. Indeed, it's believed that the simplification process requested by the European Commission (from a compliance-based system to a performance-based one), if not accompanied by an intervention logic based on a careful assessment of territorial needs, risks being frustrated [19,20].

Indeed, it's necessary to accelerate the transition of regional, national and European agriculture towards an innovative model supported with specific and rapid interventions, mainly for the production of small and medium-sized enterprises, which implement virtuous behaviors and need to maintain competitiveness within their production sector [21,22]. Failure to implement a change/-transition forever risks excluding many businesses in the EU rural territory.

In this dynamic and complex context, a study in Sicily (Italy), a rural area boasting important naturalistic and environmental

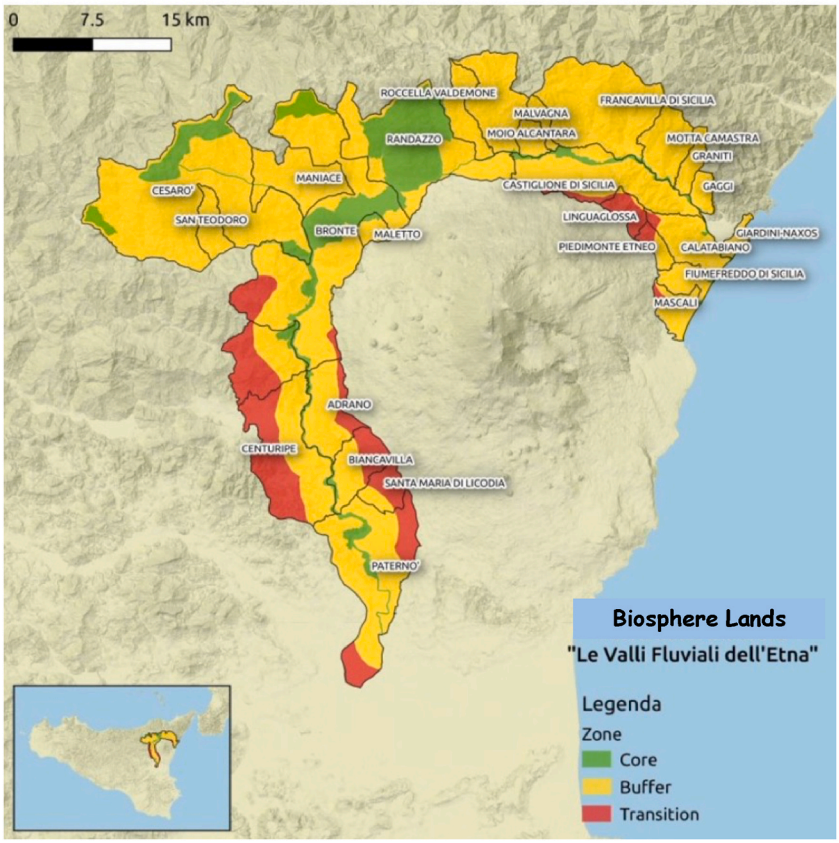

Fig. 1. The study area.

specificities, can provide an opportunity for discussion [23]. The consequences of the events above on the agricultural system and the various kinds of agriculture that might be used for economic and territorial development (competitive, multifunctional, innovative) were thoroughly investigated [24]. The focus was on the sector's unique structural traits, which, more than others, demonstrate its vulnerability. On the one hand, changes in the external context and economic and environmental conditions change. The aim is to contribute to a reflection on the advisability of maintaining proposals, objectives, and tools that are still in line with a sustainability dimension within the CAP, despite what is happening today, also in order not to postpone the achievement of the AGENDA 2030 sustainable development objectives [25].

More specifically, the research sought answers to the following questions to contribute to the current debate:

- (Q1) can rising production costs due to global events threaten farms' economic sustainability and resilience?
- (Q2) is there a risk that extraordinary measures (derogations from CAP rules) may shift the focus towards less environmentally sustainable forms of agriculture?
- (Q3) are areas with high environmental value more exposed to the "competitive vs. sustainable agriculture" dualism?

The answer to these questions is believed to provide a further contribution to the literature on sustainability and the future of CAP support of agriculture. The concrete risk we are witnessing is that at a political level a confrontation between countries with different production realities and between the different souls of sustainability (environmental, economic, social and cultural) may generate obligations and incentives for farmers in addition to good agricultural practices that will not be able to achieve an adequate balance between environmental and social sustainability, and that the effects of the recent economic crisis on incomes will not be contained by multifunctionality alone [26].

2. Materials and methods

2.1. Characteristics of the area in which the study was conducted

The Reserve "Terre Della Biosfera: Etna's river valleys" in Sicily represents a large and diversified area that includes two provinces (Catania and Messina), three regional nature parks (Nebrodi, Etna and Alcantara), four nature reserves (Fiumefreddo River, Malabotta Wood, Simeto Lava Gorges, Ponte Barca Oasis on the Simeto river) and, in addition, incorporates and connects numerous SCIs (Sites of Community Importance) and SPAs (Special Protection Areas) of the European network "Natura 2000" (Directive 92/43/EEC "Habitat"). It provides three-part zoning to achieve natural resource conservation and sustainable development through promoting ethical and cultural activities and values linked to environmental conservation and education, sustainable use of resources, and good agricultural practices (Fig. 1).

In particular, in the "core" area, which is the area with the highest naturalistic value, actions have been planned for the conservation of natural places and habitats not used by people, as well as the protection of rare and endemic plant and animal species; in the "buffer" area, which surrounds the core area and protects it from excessive harmful anthropic interventions through the reduction of all those activities with a strong ecological impact, there are territories destined for requalification with the creation of ecological corridors, support for systems of sustainable use of forest resources, conservation of the fragmented agricultural structure and support to ecological agriculture and the promotion of typical local products; finally, the "transition" area is characterised by an anthropic solid presence, both at demographic level as it includes built-up areas, and at an economic level for the pursuit of activities such as agriculture, tourism and small industry and includes actions for the tourist enhancement of the area, the improvement of local transport infrastructures, the creation of a brand and the promotion of handicrafts and local traditions.

2.2. Sample surveyed and data collected

In the "Terre Della Biosfera - Etna river valleys," a sample of 106 farms were interviewed using a questionnaire form with the objectives of:

1. Assess resilience to economic shocks;
2. Determine the criticalities and problems of farmers, as well as their level of satisfaction and adherence to the Common Agricultural Policy (CAP);
3. To assess the level of knowledge and practice of good agricultural practices for the conservation and protection of biodiversity.

The interviews were carried out from December 2021 - to March 2022. Various stakeholders in the area (associations of agricultural entrepreneurs, officials from the Sicily Region's Department of Agriculture and Food, Networks of professional agronomists, etc.) have provided their cooperation in identifying companies to be surveyed and in critically interpreting the problems experienced by companies concerning international economic events.

The selection of farms was carried out respecting the criteria of representativeness of the area's agriculture by:

- production address and crops practiced (taking care to survey the prevalent and established addresses in the area by the socio-economic impact);
- type of enterprise (the prevalent ones);

Table 1
List of variables considered for the analysis.

Variable	Acronym	Measuring level	Variable	Acronym	Measuring level	Variable	Acronym	Measuring level
Production method	ME_PRO		Difficulty Business planning					
Biological		1	Very Low	BU_Plan_Di	1	EU CAP subsidies	EU_CAP	
Conventional		2	Low		2	None		1
Conventional with good agricultural practices		3	Neutral		3	Unique Application		2
Integrated		4	High		4	Agri-environmental measures		3
Other		5	Very high		5	Compensatory allowance		4
						Basic payment		5
Level of company infrastructure availability	LO_ICA		Market attitude	MARKET		Greening		6
Very Low		1	Very Low		1	Young farmers' support		7
Low		2	Low		2	Coupled payment		8
Neutral		3	Neutral		3	CMO		9
High		4	High		4			
Very high		5	Very high		5	Attitude to innovation	INNOVA	
						Very Low		1
EU aid utility	EU_Aid		Environmentally friendly	FRI_Envi		Low		2
Production		1	Very Low		1	Neutral		3
Processing		2	Low		2	High		4
Marketing		3	Neutral		3	Very high		5
Risk management		4	High		4			
Income security		5	Very high		5	Connection to the territory	TERRIT	
Other		6				Very Low		1
						Low		2
Reasons for non-interest in RDP			Attitude to sustainability	SUSTAIN		Neutral		3
Failed attempts	NON_Int_RDP	1	Very Low		1	High		4
Company structure		2	Low		2	Very high		5
Low ranking		3	Neutral		3			
Excessive bureaucracy		4	High		4	Attitude to biodiversity	BIODIVER	
Lack of minimum requirements		5	Very high		5	Very Low		1
Lack of financial resources for co-financing		6				Low		2
Limited assistance in planning		7	Evolution of land values	E_LValue		Neutral		3
Lack of measures and their adequacy to business needs		8	Very Low		1	High		4
Not interested		9	Low		2	Very high		5
			Neutral		3			
CAP reform suggestions			High		4			
Changing the response time of the ranking lists (maximum 60 days after submission of the application)	Su_Ref_CAP	1	Very high		5			
Creation of open calls for proposals, with the possibility of submitting projects		2						

(*continued on next page*)

Table 1 (*continued*)

Variable	Acronym	Measuring level	Variable	Acronym	Measuring level	Variable	Acronym	Measuring level
periodically (3/6/12 months)								
Possibility of having part of the grant advanced		3						
Other		4						

- degrees of activity and farm labor force.

The participants gave their full approval for the survey to be conducted under any circumstances, including those that the researcher and the participants both expected. These included voluntary participation, participant withdrawal at any given time, data protection (guaranteeing anonymity and privacy as required by EU Reg. 2016/679 and Legislative Decree 101 of 10 August 2018), and data dissemination in aggregate and not in individual form.

The questionnaire was structured in two sections: the first one was dedicated to the acquisition of the primary socioeconomic information of the farm; the second one was articulated in 24 questions (closed with multiple-choice or with a list of options to be evaluated with a Likert scale) aimed at collecting general information on EU aids, business support instruments, farm design capacity, territory, biodiversity, good practices adopted, etc., as detailed in Table 1.

A large amount of qualitative and quantitative information was collected through the questions and subjected to further statistical processing and reduction. The sample was divided into two universes, represented by "competitive" and "sustainable" farms according to the market destinations downstream of the production process, integration in the respective production chain, and the degree of connection and interdependence with the sectors upstream and downstream of agricultural production proper. All information collected was treated with multivariate analysis (factor analysis).

The decision to focus on factor analysis stems from the possibility of using this technique in the search for the existence of latent variables, not directly measurable, to explain the intention towards sustainable agriculture or towards competitive agriculture or the possible presence of facilitating conditions with a significant impact on the decision to implement sustainable agricultural practices [27].

In particular, the basic model of factor analysis expressed in the equation was used [28]:

$$Z_{in} = a_{il}F_{1n} + a_{i2}F_{2n} + \cdots + a_{ik}F_{kn} + \cdots + a_{iK}F_{Kn} + U_{in}$$

$$\sum_{k=I}^{K} a_{mk}F_{kn} + U_{mn}$$

where:

- Z_{in} is the standardized score of the i-th variable for the n-th respondent firm;
- a_{ik} is the factor loading of the i-th variable on the k-th factor, with $k < m$;
- F_{kn} is the standardized score of the k-th common factor for the n-th respondent firm (factor score);
- U_{in} is the standardized score of the i-th factor unique to the i-th respondent firm.

Each factor can, therefore, be ideally decomposed into:

$$U = S + E$$

where S represents the specific factor affecting the corresponding manifest variable Z, and E is the accidental error.

2.3. Data processing

Much qualitative and quantitative information was collected and subjected to further statistical processing and reduction (thanks to factor analysis, which allows for explanation and repeat of the relationships between empirically correlated variables due to common factors). The sample was divided into two universes, represented by "competitive" (CF) and "sustainable" farms (SF) according to the market destinations downstream of the production process, the integration in the respective production chain, and the degree of connection and interdependence with the upstream and downstream sectors of agricultural production proper. Different behavior of the farms towards the economic events due to the pandemic and the conflict in the European area was detected, suggesting a different adaptive response to the scenarios and a different perception of the CAP's role in supporting the specific expectations.

The values of the sample adequacy measure for each variable (equal to or more than 0.80, except in a few circumstances) and the KMO test (equal to 0.83 and 0.74, respectively, and thus adequate in both samples) show the validity of the study (Table 2).

3. Results and discussion

3.1. Sample structure and composition

The sample expresses the structural variability of agriculture in the investigated region. Therefore, it is distributed between the typical size of micro-small farms (less than 3 ha, for 33%) and large farms (7.5% over 100 ha). The significant variability is expressed by the percentage coefficient of variation (167%), shown in Table 3.

Fruit growing prevails (almost 38%), followed in order of importance by citrus growing (14%), arable crops (12%), meadows and pastures (9%), and others. The land is 50% owned, and most farmers are in the 40–60 age group (47%). Agricultural activity in the area can boast a close intergenerational link, indicated by the high value attributed by respondents to generational turnover (score 4 for 30% and 5 for 17%).

The workforce is traditionally family-run (49%), but there is no shortage of farmer-capitalist and farmer-capitalist enterprises with external labor. There is a great variety of situations in farming. However, adopting conventional methods with good agricultural practices is noteworthy (41%), demonstrating interest in the environment, the land, the market, and future generations.

The orientation towards innovation is mainly expressed through the use of mechanization technologies (29%); also worthy of attention is the use of digital innovations (9%) and e-commerce (9%), attesting to a ferment in line with the ecological and digital transition promoted by national and European recovery and resilience policies (Next Generation EU).

Finally, the crises have shown their impact on the companies and, in particular, an increase in production costs (especially for energy, fuel, fertilizers, feed, and other imported raw materials, for 78%), but also a decrease in commercial relations with the market (in particular, for high export products such as citrus fruits, wine, cheese, oil, etc., for 56%).

The resilience of farms varies according to the combinations of production costs and revenues and the conditions and relationships established within the supply chain in each production sector (Table 4).

These farms are forced to endure unfair supply chain practices due to their connection to the market (despite EU interference in the markets) and poor bargaining strength. Not only that, but the variability of market prices and quantities produced, amplified by the effects of climate change (with an increase in the intensity and frequency of extreme weather events and greater exposure of production to sanitary and phytosanitary risks), is also the cause of limited cash flow, liquidity problems and uncertainty regarding expected income. These factors, together with low profitability, can lead to low investment, resulting in a loss of competitiveness and innovation in the long term. Vulnerability is also exacerbated by dependence on foreign countries for energy and chemical inputs [29].

3.2. Effects of economic events on farm management in the sample

An in-depth examination of the problems encountered in the sample of companies surveyed is shown in Fig. 2, given the different impacts of the economic events on the various production directions. The difficulties in running the business were thus organized into groups, distinguishing between increases in production costs resulting from the means and services of production and connection to the market, especially concerning demand and the selling price of products.

Thus, it is visible how the increase in the costs of raw materials or services is a significant concern in some directions (citrus, horticultural, livestock, meadows, and pasture, to name a few). In contrast, liquidity (in terms of Net Working Capital) and market demand and price are more excellent issues for others (in the former case, especially for vineyard, livestock, and mixed, while in the latter case for horticultural, livestock, meadows, and pasture).

The question is whether farmers will change their typical business management decisions to contain expenses. Or whether the need

Table 2
Sampling adequacy test (KMO) and Bartlett's sphericity test on the sample of consumers in the survey areas (*).

		Competitive farms	Sustainable farms
Kaiser-Meyer-Olkin's measure of Sampling Adequacy		.830	.744
Bartlett's Test of Sphericity	Approx. Chi-Square	116.863	106.422
	df	59	91
	Sig.	.000	.000
Determinant		0.229	0.368

(*) Our elaboration. This test is preparatory to exploratory factor analysis (EFA), a statistical technique that helps make sense of the data by identifying the underlying factors that explain correlations between variables.
The formula for the KMO test is:
Kaiser-Meyer-Olkin.

$$MO_j = \frac{\sum_{i \neq j} r_{ij}^2}{\sum_{i \neq j} r_{ij}^2 + \sum_{i \neq j} u}.$$

where:
R = [rij] is the correlation matrix.
U = [uij] is the partial covariance matrix.
Σ = summation notation ("add up").

Table 3
Descriptive sample statistics.

Variable	Frequency (%)	Mean	VC (%)	Variable	Frequency (%)	Mean	VC (%)
Farm area, ha	**100.0**	**26.8**	**167.3**	**Aptitude for generational change**	**100.0**	**3.2**	**42.2**
Up to 3 ha	33.0			not at all = 1	17.5		
From 3.1 to 20 ha	40.6			low = 2	12.5		
From 20.1 to 50 ha	10.4			none = 3	22.5		
From 50.1 to 100 ha	8.5			high = 4	30.0		
Over 100.1 ha	7.5			very high = 5	17.5		
Production address	**100.0**		**48.5**	**Employed**	**100.0**	**3**	**73.9**
citrus	14.2			Family labor only	49.1		
fresh and dried fruit	37.7			Up to 3 outside workers	32.1		
horticultural	6.6			3 to 6 outside workers	14.2		
olive grove	7.5			More than 6 employees	4.7		
vineyard	6.6						
arable	12.3			**Management method**	**100.0**		**39.6**
mixed	1.9			organic	25.5		
livestock	3.8			conventional	20.8		
meadows and pastures	9.4			conventional with good farming practices	41.5		
				integrated	9.4		
Ownership of land	**100.0**		**52.8**	organic + integrated	2.8		
ownership	50.0						
lease	14.2			**Use of firm financial resources**			
mixed	30.2			New crops and new varieties		21%	119.2
free use	5.7			Process innovations		20%	131.5
				Innovations in agricultural mechanization		29%	94.7
Age	**100.0**	**46**	**31.9**	Digital innovations		9%	182.3
Up to 39 years old	39.6			E-commerce		9%	160.3
40–60 years old	47.2			Other		12%	213.8
Over 60 years old	13.2						
Change in …. …. ….. due to Covid19 and War-crisis				**Change in …. …. ….. due to Covid19 and War-crisis**			
change in production cost	**100.0**		**19.6**	change in sales	**100.0**		**54.6**
decrease	4.7			decrease	56.5		
no change	17.0			no change	3.2		
increase	78.3			increase	40.3		

(*) Our elaboration.

Table 4
Distribution of the sample of farms surveyed in each production address by classes of production costs and average revenue (*).

	Classes of average agricultural income (gross income)			
Classes of average production costs (gross costs)	Up to 2000 euros/ha	From 2001 to 7000 euros/ha	From 7001 to 12,000 euros/ha	Over 12,001 euros/ha
Up to 1500 euros/ha	Arable			
From 1501 to 6000 euros/ha		Mixed		
From 6001 to 10,500 euros/ha			Olive groves/Meadows and pastures	
Over 10,501 euros/ha			Citrus/Fresh and dried fruit/ Vineyard	Horticultural/ Livestock

(*) Our elaboration.

to adapt to the new conditions imposed by cyclical events will lead to a further intensification of their production processes despite the environment, despite concerns about difficulties on the cost side, the increase in current expenses, or the difficulties connecting with the market.

As many as 49% of the farms that have changed their decisions to lower costs have chosen to use fewer specific inputs (with citrus, livestock, and vineyard having very high incidences), 20% have delayed purchases (32% for vineyard), 18% have altered their cultivation plans, and 10% have altered the formulation of feed rations for raised animals. Some (around 11% in total) reported an actual downsizing of their business or employment of employees or contractors, sometimes offset by an increase in family work. The search for different suppliers was also an option pursued by some farms. Finally, liquidity is holding back investment in the technology, infrastructure and training needed to improve agricultural productivity sustainably [30].

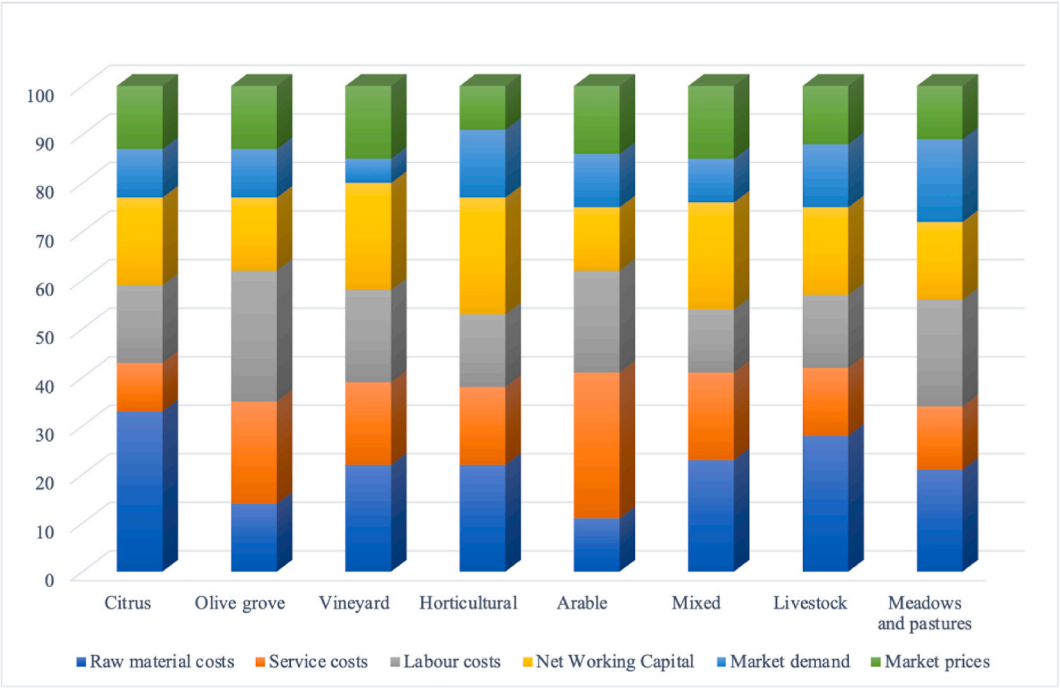

Fig. 2. Problems raised by the farms surveyed per production address (values in %).

3.3. *Approach and willingness to sustainability*

As shown in Table 5, "vision and prospects" are the aspects that significantly influenced entrepreneurs' evaluation in both types of production structures, thus representing the first factor extracted that alone explains over 22% of the total variance in CF and over 17% in SO. Among the attributes, considerable importance was given to the production method, EU aid, and the endowment of farm infrastructure, which can accompany entrepreneurial choices. The different point of view of the two types of companies appears evident in the value attributed to European support and the ability of companies to develop organizational infrastructures capable of accompanying the possibility of achieving economies of scale, which is helpful for competitiveness in the market.

The attributes more related to aspects of the environment in which the companies operate (which together explain more than 18% and 13% of the variance, respectively, in the two types) showed how respect for the environment, the ability to achieve high sustainability performance, and connection with the territory represent relevant evaluation elements for the company.

Table 5
Results of factor analysis on the comparison of competitive farms vs. sustainable farms (*).

Variable Attribute	Factor loading	
	Competitive farms	Sustainable farms
Factor 1 ("Vision and prospects"): variance explained %	**22.2**	**17.6**
Production method	−.789	.677
EU aid utility	.777	.568
Level of company infrastructure availability	.683	.533
Factor 2 (Attitude towards the environment in which one works): variance explained %	**18.3**	**12.9**
Environmentally friendly	.638	.820
Attitude to sustainability	−.533	.715
CAP reform suggestions	.474	−.656
Connection to the territory	.105	.520
Factor 3 (Resilience to changes in the competitive scenario): variance explained %	**15.6**	**11.6**
Evolution of land values	.714	.790
Market attitude	.690	.609
Attitude to innovation	. 674	.542
Difficulty Business planning	. 511	.309
Factor 4 (Competitivity v/s Sustainability): variance explained %	**10.8**	**9.8**
EU CAP subsidies	.646	.696
Attitude to biodiversity	. 388	.610
Reasons for non-interest in RDP	−.546	.394

(*) Our elaboration.

Furthermore, these develop the CAP's approach and role in supporting businesses in different ways (between the two models), allowing Pillar I's welfare role to re-emerge (most notably linked to income support which does not always lead businesses to approach the market) in comparison to Pillar II's ability to support modernization and adaptation of businesses to changing external conditions. The implementation of this policy, the unequal distribution of resources, and the development of a framework for a policy that doesn't always meet the expectations of potential beneficiaries are all contentious issues.

Some aspects of resilience to changes in the competitive scenario (collectively responsible for just under 16% and 12% of the variance) show variable importance. This depends on the increase in land values observed over the last twenty years due to the search for land to create production units more suited to the challenge of the markets. The opening up of the market for the placement of end products and the openness to innovation has led businesses to introduce new crops and varieties, new irrigation systems to manage water resources, new agricultural machinery, and recent digital innovations (sensors, computers that manage crops, etc.). These aspects must then be related to the company's planning capacity.

Finally, the comparison "competitiveness v/s sustainability" is the last of the extracted factors and explains only 11% and 10% of the extracted variance. There is widespread awareness of CAP subsidies' role in business survival and the potential of using biodiversity. Sustainability-oriented farms show a critical approach to EU rural development policy, in some cases, declaring their lack of interest in size, organization, accessibility to advance credit, regional bureaucracy, and professional skills available in the region.

In order to understand whether there is a certain interdependence between sustainability and competitiveness, in light of the possibilities of contact and contamination at the territorial level, Table 6 was drawn up, which highlights the further ability of companies to integrate sustainability into their business model.

Using a scale of 1 (low level of integration) to 5 (high level of integration), some high priorities were found in investments in the quality of the final product (score 4 received on average 39% of the preferences in the companies surveyed), to guarantee the consumer, and in relations with local communities (score 4 with 39% concentration of responses). Relations are important for fostering innovation and building relationships with supply chains. Risk management and the transition to energy autonomy are still little explored but have high potential for demonstrating social, environmental and economic commitment.

3.4. Techniques adopted that put the principles of sustainability into practice

The research focused on sustainability's environmental, economic, social, and cultural dimensions.
Among the relevant aspects we highlight.

a) the presence in the area of farms that regularly apply good agricultural practices, with work provided by family members, thus assuming a strategic social role (Fig. 3); the inadequacy of policies to promote products on the market;

b) the difficulty in accessing funding measures due to the associated bureaucratic and administrative burden;
c) the presence of considerable biodiversity, with rare species of flora and fauna;
d) the willingness of the farmers interviewed to continue their contribution to biodiversity conservation.

The research also showed high expectations for growth and innovation, opportunities to enhance the environment and improve quality of life, and more supportive and integrated activity through access to RDP funds.

Most farmers simultaneously expressed: a) sensitivity and aptitude for implementing sustainability practices and standards for the protection and conservation of biodiversity in agricultural ecosystems; and b) worry about ambiguous requirements and administrative burdens that impede their adoption.

4. Discussion

Despite the fact that the general context - due to cyclical events - leans towards intensive and competitive agriculture, some general considerations linked to the territories with their peculiarities and specific characteristics of the different agricultural systems naturally lead towards sustainability.

Firstly, the EU Common Agricultural Policy should be recalled because the payments based on farm size favor the expansion of farms and the promotion of intensive farming methods, failing to consider the agricultural sector's concentration process, constantly

Table 6
Integration of some expressions of sustainability into the corporate business model (*).

Indication	Prevalent rating from 1 to 5 (%)	Standard deviation	N. of Sustainable Farms	N. of Competitive Farms	No. of farms that did not express an opinion
Quality of manufactured products	4 (39.4)	0.84	52	45	9
Risk management	2 (33.7)	1.13	48	53	5
Relations with the local community	4 (38.9)	0.22	49	54	3
Contribution to energy transition and autonomy	2 (67.7)	1.51	51	44	11

(*) Our elaboration.

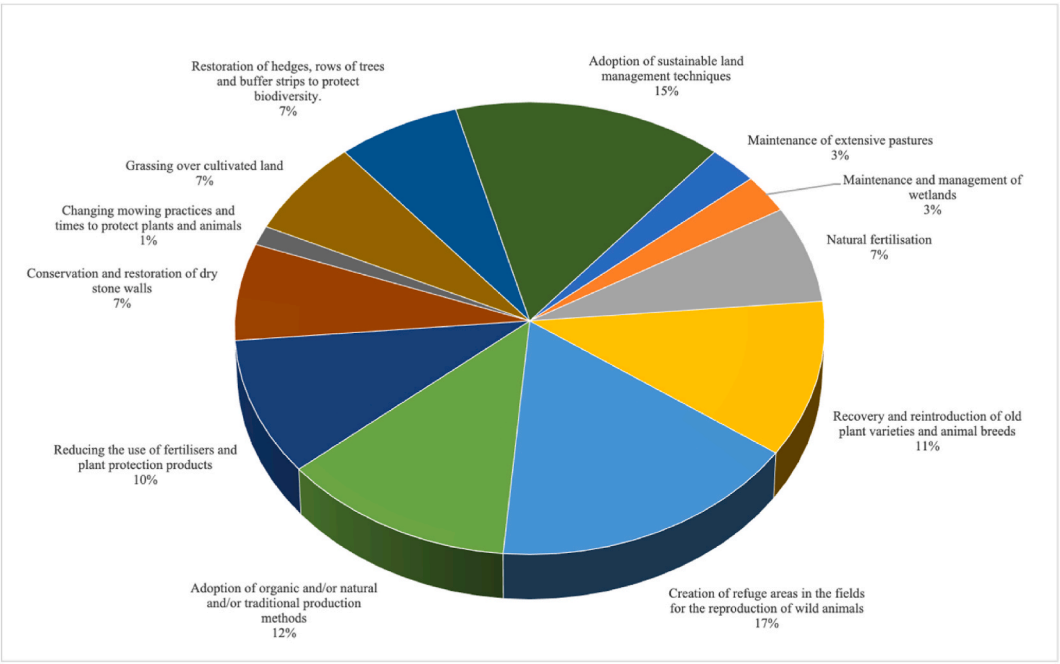

Fig. 3. Good agricultural practices adopted in the sample of farms.

losing small and medium-sized enterprises (an extensive group in Sicily). Therefore, regional value chains must be strengthened through better financing of the second pillar. Research has also shown that many farms do not benefit from CAP aid because of bureaucracy and small size, but they play a significant social (family and other work), environmental (land maintenance, hydrogeological balance, landscape), and economic (quality production, biodiversity, proximity) role [31].

As a result, the Farmers' incomes are still lower than those of other productive sectors, resulting in significant economic uncertainty for the sector. It is, therefore, necessary to reorganize and enhance local proximity chains and networks, guarantee a fair selling price, and maintain and strengthen actions dedicated to the creation of direct sales networks on the ground, as also well emphasised in the numerous existing literature on the subject [32]. Moreover, given the area's heterogeneity, it is considered appropriate to set up 'territorial development pacts.' The development of an area depends on knowledge of it, and the territorial pacts are tools that make it possible to take into account the peculiarities of individual areas and the expectations of the farmers present, as well as provide the opportunity to speak directly with the managing body present at territorial level, breaking down the current barriers between companies and institutions [33].

Given the importance of organic farming in Sicily (the first region in Italy for the cultivated area and number of organic operators according to SINAB) [34], it would be desirable to establish specific monitoring indicators for organic farms to assess the impact of these practices on biodiversity and its services.

Sicily is the first region in Italy in terms of the number and extension of Natura 2000 sites, with a total surface of 639.135 ha according to ISPRA [35]: considering that many of these sites are agricultural areas and that their natural value depends on the agronomic management of crops, it would be advisable to favor the maximum applicability and association of the RDP conservation measures in them;

The presence of landscape elements capable of supporting the conservation of populations, communities, and habitats, familiar to most Sicilian farms, should be extended to broader spatial scales to ensure the maintenance of ecosystem services; this highlights the need to implement measures that consider the interactions of farms among themselves and with the surrounding landscape [36]. This is possible thanks to the support of cooperation interventions, which should be one of the cornerstones of the following programming period. Furthermore, it is essential that future programming recognizes support for the maintenance of these natural landscape elements, also thanks to the new eco schemes tool, which is well suited to this purpose.

CAP agri-environmental conservation measures have a low level of take-up by farmers, and the most common reasons for the lack of interest are bureaucratic difficulties in accessing calls for tender, low profitability, and a general reluctance to leave the farm's comfort zone [37]; There is, therefore a need for regular and systematic communication and training of farmers on the content and aims of European, national and regional policies on agriculture, food, and the environment and to accompany them in the transition to environmentally sustainable agriculture, extending the task of training and consultancy to professionals with multidisciplinary skills [38].

In Sicily, the proportion of young farmers in the total number of farmers remains low, and the agricultural sector is gradually aging. A portion of the financial resources should be allocated to removing barriers such as access to land and capital, market risks and business competitiveness, and access to knowledge and innovations [39].

The comments show that production models are based on small farmers' aggregation [40]. They share the principles of agroecology and put the farmer at the center, becoming more and more the "custodians" of the land and biodiversity based on the criticalities discovered in the survey region.

5. Conclusion

Recent international events have led to a substantial rethinking of agricultural policies, especially in some production sectors where food supply and security concerns have grown.

At the urging of member countries, the EU has also launched a temporary derogation from the rules on crop rotation and the maintenance of non-productive elements on land cultivated with wheat and other cereals.

The derogation is temporary and requires member states to strengthen eco schemes and agri-environmental measures in the CAP's Strategic Plans, thus recovering the political commitment of the Green Deal. The balance between global food availability and accessibility, on the one hand, and the protection of biodiversity, soil quality, and part of the GAECS (Good Agricultural and Environmental Conditions) standards, on the other, have been pitted against each other on the debate. Some principles of 'sustainability' have thus been pushed aside. But the winds of war show no sign of abating, and the issues mentioned neither. To all this must be added the critical issues that have emerged in some ecosystems (e.g., prohibition of tillage and water competition; difficulties in carrying out annual pruning in olive groves; prohibition of the use of phytosanitary products in the crop rotation only, etc.), with difficulties in constructing strategic plans.

Thus, in the final analysis, the concrete implementation of sustainability in a holistic manner (economic, social, environmental, and cultural) seems to be diluted due to the abovementioned events.

In this context, the work has shown how, within an area with a strong environmental value, such as the area under study, competitiveness-oriented production, and sustainability-oriented models persist, guaranteeing the pursuit of resilience and development objectives.

Thus, the first research question (Q1) can be answered in the affirmative, as companies have changed their management by introducing adaptations to the changed conditions of the markets for the procurement of production means and services and the placement of products.

On the other hand, the second question (Q2) was answered in the affirmative, as there was a willingness towards good agricultural practices capable of continuing the path taken towards environmental sustainability, also due to the demands coming from the institutional environment (CAP, above all). As for the last question (Q3), the research has shown for both business models the importance of sustainability performance (conventional farms managed with good agricultural practices maintain sustainability performance that can compare well with organic management) and the connection with the territory.

While different roles are recognized for Pillar I and Pillar II resources: some realities that are too tied to the sustenance provided by income support still show little connection with the market. Other enterprises have benefited from the resources of rural development plans to start a process of modernization and innovation that guarantees their competitive survival in the markets. The increase in land values, also a result of the area's environmental valuation, impacts a company's ability to adapt to changes in the competitive environment. As a result, they introduce new crops and varieties, new irrigation systems for managing water resources, new agricultural machinery, and digital innovations for monitoring environmental and growing conditions.

Overall, the research yielded useful indications for stakeholders and public decision-makers engaged in the policy planning of the new CAP. In particular, insights from work suggest investing in innovative solutions for water use and supporting small and medium-sized enterprises to invest in precision agriculture to reduce the use of external outputs and mitigate the impact on climate change.

However, the work has some limitations in its coverage of the various production sectors.

It is susceptible to further investigation - at the microeconomic level - to determine production costs and incomes and their capacity to support the level of market resilience and competitiveness. All this because it is necessary to consider that there is also a profound diversity between addresses, in terms of the discontinuity of the production cycle, and its rigidity and duration, depending on the relationships between the biological cycle of plant and animal life and the financial cycles of recovery of invested capital and valorisation of products on the market.

Author contribution statement

Giuseppe Timpanaro, Alessandro Scuderi, Paolo Guarnaccia and Vera Teresa Foti: Conceived and designed the experiments; performed the experiments; analyzed and interpreted the data; contributed reagents, materials, analysis tools or data; wrote the paper.

Data availability statement

Data included in article/supplementary material/referenced in article.

Declaration of competing interest

The authors declare that there are no grounds for conflict of interest.

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