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Italian farms during the COVID-19 pandemic: main problems and future perspectives. A direct analysis through the Italian FADN

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Abstract. The spread of the COVID-19 virus in Italy during the first phase of the pandemic (February-May 2020) has caused a large-scale crisis, with an almost immediate decrease of industrial production and a consequent contraction in domestic consumption and external trade. However, the issue of food security was immediately recognized as one of the most sensitive, so that the Government has decreed the priority role of the food system, which has been included among those considered fundamental services and economically essential, allowing the related activities to be carried out during the lockdown. Agricultural production activities transformation, and commercialization remained fully operative during the lockdown; nevertheless, the sector has faced many difficulties related to the contraction of some of the marketing channels (restaurants, on farm sales, agritourism, problems with the logistics and many other ones). To better understand the effects of the initial phase of the pandemic on the Italian agricultural sector and provide useful information to the government and decision makers, a survey was carried out with a CAWI (Computer Assisted Web Interviewing) sent to over 10,000 farmers belonging to the sample of the Farm Accountancy Data Network (FADN). The number of respondents has been of 733 farms, which represents around 7% of the Italian FADN sample. The results of the questionnaire have been matched with FADN data on the structure and the economic performance of farms, allowing a more precise evaluation of the condition and effects of the pandemic. The results highlight a relevant effect of the COVID-19 pandemic emergency on the agricultural sector: 37% of the interviewed farmers declared a significant liquidity crisis, while 60% predicted a contraction in turnover. These effects are more relevant for the wine, olives, and horticulture types of farming and more frequent in medium/large farms. A better situation has been found for farms which usually outsource processing and/or marketing/sale of the products.

Keywords: COVID-19, farms, farm income, Italy, FADN.

JEL codes: Q12, Q18.

1. INTRODUCTION

The COVID-19 pandemic in Italy started to become dramatic in February/March 2020, a bit earlier than other European Countries, and is still ongoing, albeit with reduced diffusion. The initial pandemic diffusion led to a severe lockdown in all the Country, causing a severe stress not only to the health system, but also to the financial, economic, and social situation of the population. To curb the spread of the infections, the national and regional authorities adopted severe restrictive measures, closing a lot of economic activities and dramatically limiting the social life of people. The crisis triggered by COVID-19 caused a significant slowdown in production activity, a sharp contraction in internal demand for some types of goods and services, and a reduction in commercial and trade activities. Consequently, in the first quarter of 2020 National Gross Domestic Production (GDP) decreased by 5.3% compared to the previous quarter (ISTAT, 2020a) and data for the year 2020 show a global reduction equal to -9,2% (Banca d'Italia, 2021; ISTAT, 2020b), pushing the country towards the most dramatic crisis faced since the post second war period.

In this situation of emergency, the issue of food security was recognized as one of the most sensitive, so that the Government has decreed the priority role of the food system, which has been included among those considered fundamental services and economically essential, allowing the related activities to be carried out during the lockdown (art. 1, co. 4, DPCM 11/03/2020). However, the authorization to maintain the operation of agricultural production, trade of agricultural products, and marketing activities (except for the Hotel, Restoration and Catering, Ho.Re.Ca.) did not prevent several difficulties related to the lockdown, which effects have been depending on the positioning of each company on the supply chain, the range of activities carried out, the geographical area, the organization, and the management of the production activities.

Available statistics show that just in the first quarter of 2020 an important reduction of the agricultural activity has been registered, with a reduction (with respect to the last quarter of 2019) of -1.9% in the added value and -1.8% of the work units (CREA, 2020a). These reductions are mainly due to the scarcity of temporary workers, lack of liquidity, reduction/lack of other gainful activities together with the impossibility non-postponement of necessary operations (seedling, cure of livestock, veterinary visits, crop's phytosanitary treatments, and fertilization, etc.). During the year, difficulties became more evident as showed by ISTAT (2021), which estimated the reductions of the sectoral value added higher than

-6% and of the work unit equal to -2,3%, mainly due to a smaller use of employees. This result seems related principally to the trend of vegetal productions (notably olive oil), to the reduction suffered by agricultural services (-4,1%), and mostly to the dramatic fall of secondary activities (-20,3%), mainly driven by the restrictions enforced for the agritourism services (Buonaccorsi, 2020). These trends are confirmed by a FAO report (FAO, 2020) which states that in Italy "lockdown measures and border closure disrupted the usual organization of work and flow of labour, causing risks of seasonal workers shortages for the spring harvest. Rural tourism was impacted due to the cancellation of all farms' stay accommodations".

Therefore, needs and problems of farms have different relevance, according to the type of farming, the specialization in different productions and activities, the organizational and managerial schemes adopted (use of family labor, presence of permanent workers vs. seasonal/foreigner workers, outsourcing services), commercial channels utilized, and final markets of the products. The relevance of the structural and organizational characteristics in managing the responses to the post pandemic crisis has been put in evidence in many other countries, as emerges from the literatures published in the months following the spread of the COVID-19 (Aday and Aday, 2020; Gruère and Brooks, 2021; Marusak et al., 2021; Weersink et al., 2021).

At the same time, food industry has faced the challenge to quickly reorganize working spaces and shifts, for ensuring the safety of employees and granting the regular delivery of processed food to the distribution companies, in addition to the necessity to retrieve all required raw materials, often of foreign origin (CREA, 2020c; Ecovia Intelligence, 2020; ISMEA, 2020a e 2020b). In this case, the index of industrial production has showed a more significant decline (about -4%) in comparison with same period of 2019 (March), and the negative trend has been confirmed in the following month, with a further reduction of -2% (CREA, 2020a). In addition, within the phase of the industrial processing, the sector of beverages has suffered the highest reduction; in particular, the index of alcoholic products has showed a dramatic reduction (less 39% in March and -74% in April). These trends are summarized in a decrease of the added value of the food industry, estimated by ISTAT equal to -1,8% (2021) and in a severe reduction of employment (-6,7%).

The performance of the retail sector has been different, thanks to the role played by Large Scale Retail Trade and food and beverage distribution in replacing the market spaces of the Ho.Re.Ca. (FIPE, 2020), to ensure

the compliance of the lockdown rules¹. So, the value of sales has showed a positive trend (+10%) in March and also traditional retailers and specialized and small shops have increased the sales in the lockdown period (CREA, 2020a). Other distribution channels, such as proximity stores, short supply chains, home deliveries and online or digital sales, have acquired a strategic relevance, because they have been able to provide specific types of services or sales conditions more suited to the new and unexpected circumstances (ISMEA, 2020b). Given this general framework, the agricultural sector deserves a special attention and analysis, because its activities may be only partially and slowly adjusted to the situation deriving from a lockdown. Often, the main difficulties suffered by farms regarded the availability of specific production factors. Particularly critical has been the availability and health protection of workers, in particular foreign ones, whose movements were heavily reduced by restrictions of mobility and by anti-contagion rules (e.g., the reduction of international connections and the obligation of quarantine) (ILO, 2020; ISMEA, 2020a and 2020b, Macri, 2020). In other cases, the undesirable effects of the crisis affected the organization of production activities, caused by the weakness of some essential services, including the structural lack of infrastructure and technological equipment in agriculture. In addition, some specific sectors have more severely hindered the negative impact of the economic slowdown, suffering a quite total stop of important market channels (as in the case of the floriculture or wine sector) (ILO, 2020; Mediobanca, 2020).

Furthermore, the slowdown of the agricultural activities has generated serious damages in terms of food waste (as well as a related environmental damage), due to the loose of edible products remained not harvested and/or unsold (ILO, 2020).

The scope of this work is to provide a picture, albeit partial, of the main difficulties that have affected the management of agricultural production activities and the financial situation of Italian farms in the short term (during the lockdown of spring 2020), as well as the expectations expressed by farms for policy actions considered necessary to mitigate the difficulties arising from unpredictable and global event, such as the recent pandemic. The aim is to identify the areas of most significant weakness that can reduce the organizational and economic capacity of farms, threatening their functionality. Knowledge about these aspects is of great importance for the programming of the CAP 2023-2027 and

other support actions aimed at overcoming some of the critical issues come to light.

The paper is organised as following: the next section describes the rationale of the questionnaire and the methodology adopted for its submission to a sample of Italian farms belonging to the Farm Accountancy Data Network. The third section presents the results of the analysis, matching the responses of the questionnaire and the structural, economic and financial data of the FADN dataset. The fourth section focuses on the main measures taken in the short term to respond, both at EU and national level, to the emergencies triggered by COVID-19 pandemic, also offering useful directions in the medium-term aimed at stemming future crises. In the conclusions some implications are discussed, for the next future, offered by the results of the analysis.

2. MATERIALS AND METHOD

During the first phasis of the emergency attention was focused on aspects related to availability, distribution, and consumption of food and agricultural products, while analysis on the effects of pandemic on agricultural production and farms have been relatively scarce.

However, the need to investigate the problems faced by Italian agricultural farms and related solutions has been highlighted by many institutional and non-institutional actors, such as government authorities, professional organizations, and associations. Indeed, to define possible actions to support farms and prevent the risks of other emergencies, it is crucial to have a deeper understanding of the effects of the covid pandemic and related policy actions on the agricultural sector and the farmers behaviors.

Currently, these issues are widely documented mainly through journalistic investigations or experts-based research methods, while there is a lack of direct information from the farmers. To contribute to cover this lack of information this work is based on a direct survey collecting data and information from farms.

The asked research questions are the following:

Following the COVID-19 emergency and the measures adopted to contain the pandemic, which kind of difficulties did the farms face in relation to the conduct of their activities?

- Which actions did the farms put in place to face the pandemic situation and the lockdown?
- Do the size, farm structure, production sector, marketing or other specificities have resulted in significant differences in terms of problems and adopted solutions?

¹ With the exception of those actors (bar, restaurant, catering) which have rapidly reorganized the supply towards the home delivery or take away services.

- What were the forecasts of farms with respect to the immediate future, in terms of both difficulties/solutions and economic results?
- Did farmers expect a change in the total production of their farm? In what percentage?

The hypothesis is that, although the restrictive lockdown measures regarded most of the other productive sectors but not directly the agricultural production, the effects of the COVID-19 emergency have largely affected agriculture, although to diverse extents and in different ways.

To carry out the survey quickly and reach enough farmers, the CAWI (Computer Assisted Web Interviewing) methodology was used (via web), also ensuring compliance with public health and safety regulations. Despite this methodology reaches only those who have access to Internet and does not allow statistically representative sampling, it guarantees a remarkable speed in the collection of information and the CAWI is rather easy to be filled by the respondents.

The questionnaire was structured in 5 sections aimed at collecting information on: the difficulties faced by Italian farms due to the COVID-19 emergency; the actions taken to deal with them; the public support granted for supporting farms; the forecasts for the future, in terms of possible difficulties / solutions; and the expected change in the farm’s output. Each section was organized in a set of closed-ended answers (with the possibility of multiple choice), in which also an open-ended answer was included, to collect additional unexpected input.

To overcome the representativeness problems associated with CAWI method, the questionnaire was sent to over 10,000 farmers belonging to the sample of the Farm Accountancy Data Network (FADN), distributed throughout the national territory. In this way it has been possible to match the data and information collected with the questionnaire to all the individual farm data

already available in the FADN dataset (Total Output, production, costs, income, structural information on the farm, etc.).

The questionnaire was available online for 14 days (April-May 2020); 733 farms, operating in all the Italian regions and covering all productions, filled out it with a response rate covering over 7% of the FADN sample (Tab. 1).

The data from the questionnaire were analyzed to estimate the impact of pandemic on some relevant farm indicators, using the economic results of farms recorded in the Italian FADN survey in the 2016-2018 period as baseline. The matching of the farmer to which the questionnaire was sent with the farm code registered in the FADN database made it possible to link the responses of the questionnaire to the technical and accounting information found in the FADN survey.

The baseline consists of 30,374 observations and includes the farms recorded in 3 consecutive accounting years. The annual sample, of about 10,100 units, is statistically representative of the universe (field of observation) of Italian farms. However, based on the European FADN regulations, only a part of the farms is considered in the field of observation, i.e., those having a Standard Production (SP) greater than 8,000 euro. The field of observation of Italian FADN represents only 50% of the farms estimated by the Farm Structure Survey (FSS) but more than 96% of the Standard Production and almost 90% of the agricultural area used in Italy, guaranteeing an almost total coverage of the Italian agricultural production.

Being the FADN sample designed using a rigorous methodology, it is statistically representative and it is therefore possible to extend its results to the entire field of observation of the survey with a good statistical precision at level of administrative Region, Type of farming, and economic size class. In addition, the estimates can also refer to structural elements of farms, such as the use of family and wage labour.

In synthesis, among FADN variables, the following economic variables have been identified and used for the analysis:

- (1) *Total Output*; (2) *Specific Costs*; (3) *Value Added*; (4) *Agricultural Working Unit*.

To facilitate the reading of the economic results between the various typological classes of farms, the selected economic variables were also analyzed as working unit indices. To exclude anomalous values (outliers) within the layers considered, the dataset has been subject to statistical treatment.

Table 1. Structure of questionnaire and number of respondents.

Survey Sections	Number of answers
A. Kind of difficulties faced by farms due to the COVID-19 emergency	733
B. Actions taken to deal with different difficulties	535
C. Priority support actions by State and Regions	528
D. Difficulties expected by farms during the following months	600
E. Expected change in Total Output following the COVID-19 emergency	639

Source: own elaboration on collected data.

The 10 types of farming (TF-10) used in the analysis represent the most representative TF (in term of Standard Output) at national and regional level. In term of economic size, we aggregated the farms based on 3 classes of economic dimension (*Small, Medium, Large*) to allow an easier representation of the stratification of the sample.

To eliminate annual variation of economic figures, three-year average values were used in the analysis.

The Added Value (AV), in absolute or index form, constitutes the most appropriate FADN indicator for this type of analysis. For a better understanding of the results, it needs to be considered that there is a strong relationship between the economic size of the farm and the average levels of income produced, productivity, and profitability indexes. In every TF, smaller farms are characterized by lower income and productivity (per Work unit) with respect to larger ones.

Figure 1 describes the similarities and differences between the FADN sample and the subsample of respondent to the questionnaire.

Respondents are proportionally less than the FADN sample in southern regions and insulas (Sardinia and

Sicily) while they are more than the FADN sample (as proportion) in North-West, North-East and Central regions.

Considering the gender and age of respondents, no relevant differences appear between the subsample of respondent and the FADN sample, similarly for the organic/conventional classification of farms. Indeed, a relevant difference can be seen in the variable describing the diversification of farm activities: the proportion of diversified farms (agritourism, educational farms, etc.) is almost double in the subsample of respondent with respect to the FADN sample. One possible explanation for that could be the fact that these farms have a greater propensity to use social networks and participate in surveys. In addition, they are more sensible to the effects of the lockdown because their activities have been almost completely cancelled during the pandemic, so they are more interested to communicate it (ISMEA, 2020c)

The Farm Type (FT) and Size differences between the subsample of respondent and the FADN sample are less relevant but still interesting. Regarding the FT, Figure 2 shows on its left part that the respondents are pro-

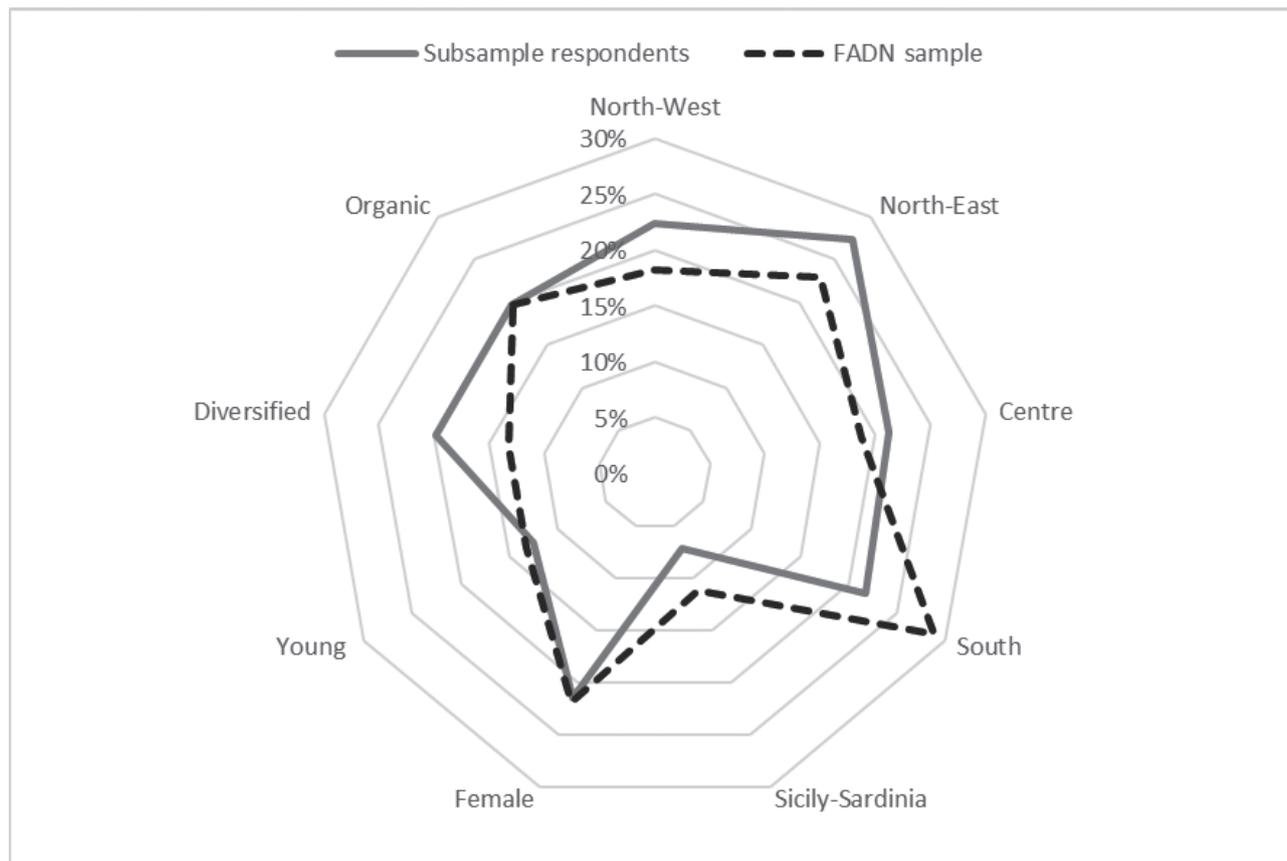


Figure 1. Comparison of FADN sample and subsample of respondents. Source: own elaboration on FADN and collected data.

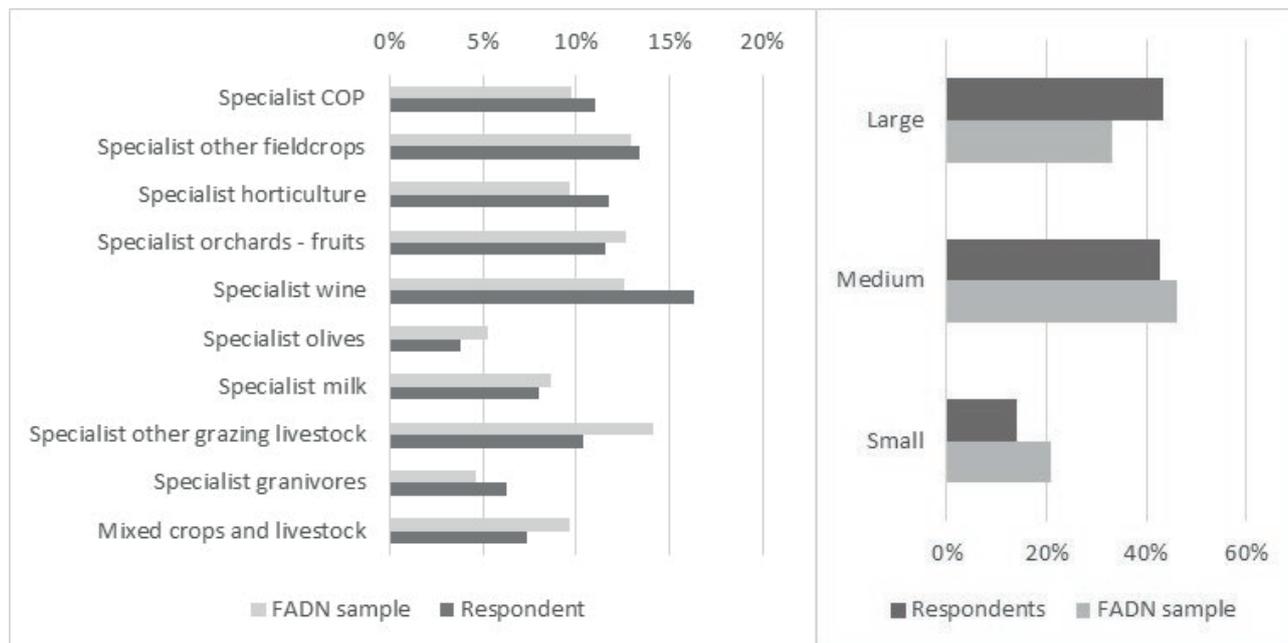


Figure 2. Comparison of FADN sample and subsample of respondents per FT and FS. Source: own elaboration on FADN and collected data.

portionally more numerous in the FTs “specialist wine” and “specialist horticulture” while farms specialized in livestock production (milk and grazing) are less frequent in the subsample of respondents. Regarding the Farm Size (FS) there is clear evidence that large farms are more represented in the subsample of respondent than in the FADN sample. Overall, we can assume that farmers who forecast major losses as an effect of the pandemic are more propense to answer the questionnaire, as clearly demonstrated by the results of the analysis of the questionnaire.

This framework shows differences according to various issues covered by the questionnaire, as described in the following paragraph.

3. MAIN RESULTS AND PRELIMINARY EVALUATIONS

The answers given by the 733 farms of the FADN sample who accepted to fill the questionnaire show some elements of great interest.

The answers reporting a reduction in the Farm Total Output (FTO) are prevalent, with over 60% of the responding sample expecting a decrease in the FTO (for 13% of respondent the reduction is estimated to be higher than 50%). In all types of farming, estimates of negative changes in FTO are prevalent, so that the distribution in the first three quartiles and the median

are always below zero; this highlights the respondents’ expectation of marked contractions and significative FTO decreases. This is particularly evident for some TF such as wine, olive, and horticultural ones, in which most of the observations are positioned on reductions that reach even 50%, with contractions in FTO that in the last quartile reach almost 100% (Fig. 1). The relatively more negative forecasts regarding the FTO recorded for the wine, oil, and vegetable sectors mainly depend on the closure of the Ho.Re.Ca. channels, which also affected the reduction in exports, the contraction in tourism and, in the case of horticultural products, by the penalization suffered in general by perishable products compared to those preserved or frozen and by fears about the availability of foreign labour for harvesting activities (Coluccia *et al.*, 2021).

The distribution of the responses received is shown in the box plot chart below (Fig. 3), with the expected changes in FTO in relation to the types of farming.

However, some of the respondents also expect an increase in agricultural revenues, albeit with variations among the TF. With reference to wine and horticultural farms, a quarter of the responses expected positive variation of the revenues even higher than 50%. Positive changes in revenues, but more sporadic, are found for the fruit, granivorous, and arable crops (including cereals).

To better understand the situation, the information on the expectation in term of Farm Total Output

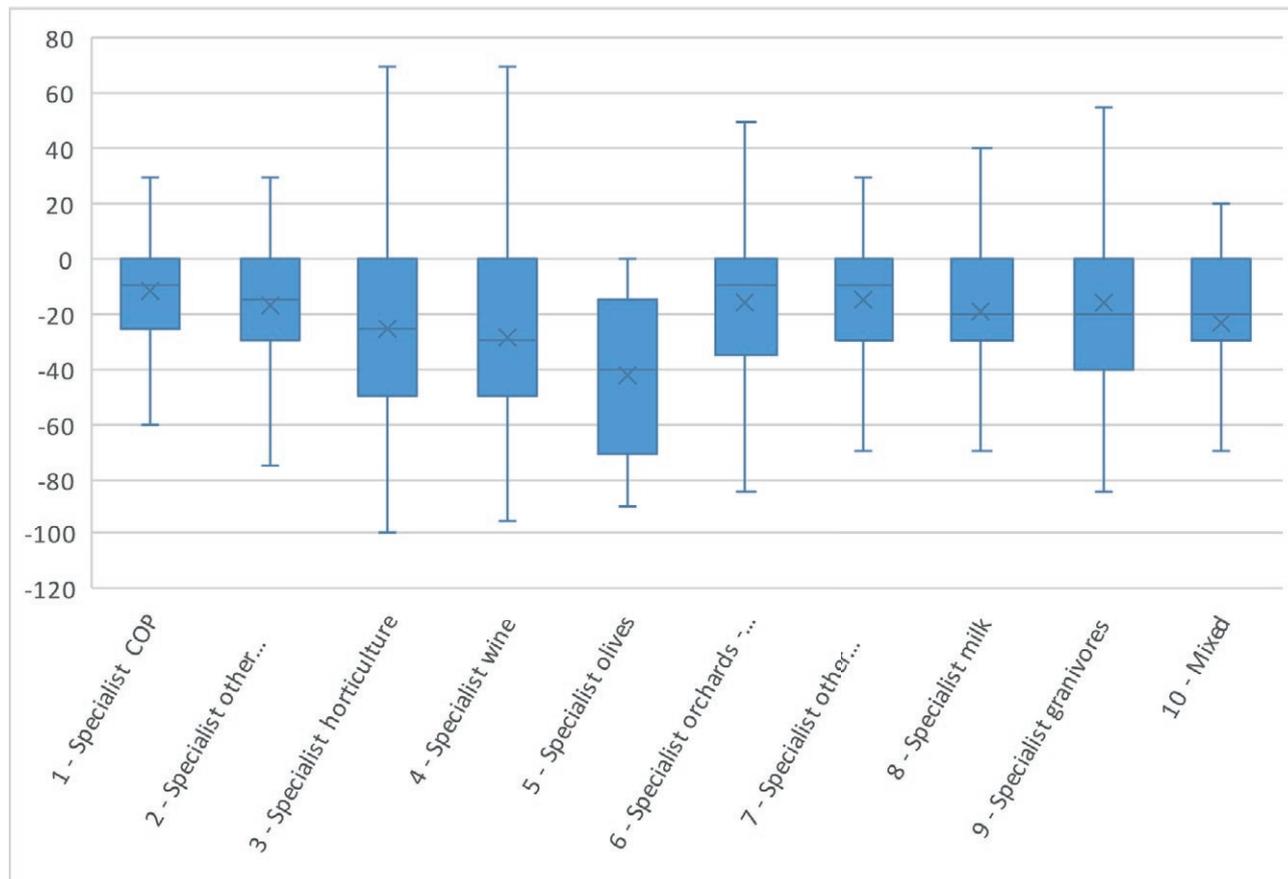


Figure 3. Expected changes in farm Total Output in relation to the different Types of Farming. Source: own elaboration on collected data.

resumed from the questionnaire has been coupled with the sales channels adopted by respondent farms (derived from the FADN database).

As shown in Table 2, the expectations for a reduction in TO are significantly different for each sales channel.

The most significant prospects for a reduction in FTO regard farms with agritourism (75%), with direct sale in the farm or by vending machines. These farms declare to expect the revenue in the next future to close to zero. On the other hand, the least negative expectations are found in farms selling a part or the entire production, including a part of transformed products, to cooperatives or transformation industries. It is therefore evident that the higher importance of the direct sale of products and services will make these farms more sensitive to current and future market difficulties.

However, it should be recalled that the questionnaire was submitted to farmers in the very first phase of the lockdown, when there was still uncertainty on the duration of the epidemic and the possible schedule of reopening of markets was unknown by farmers.

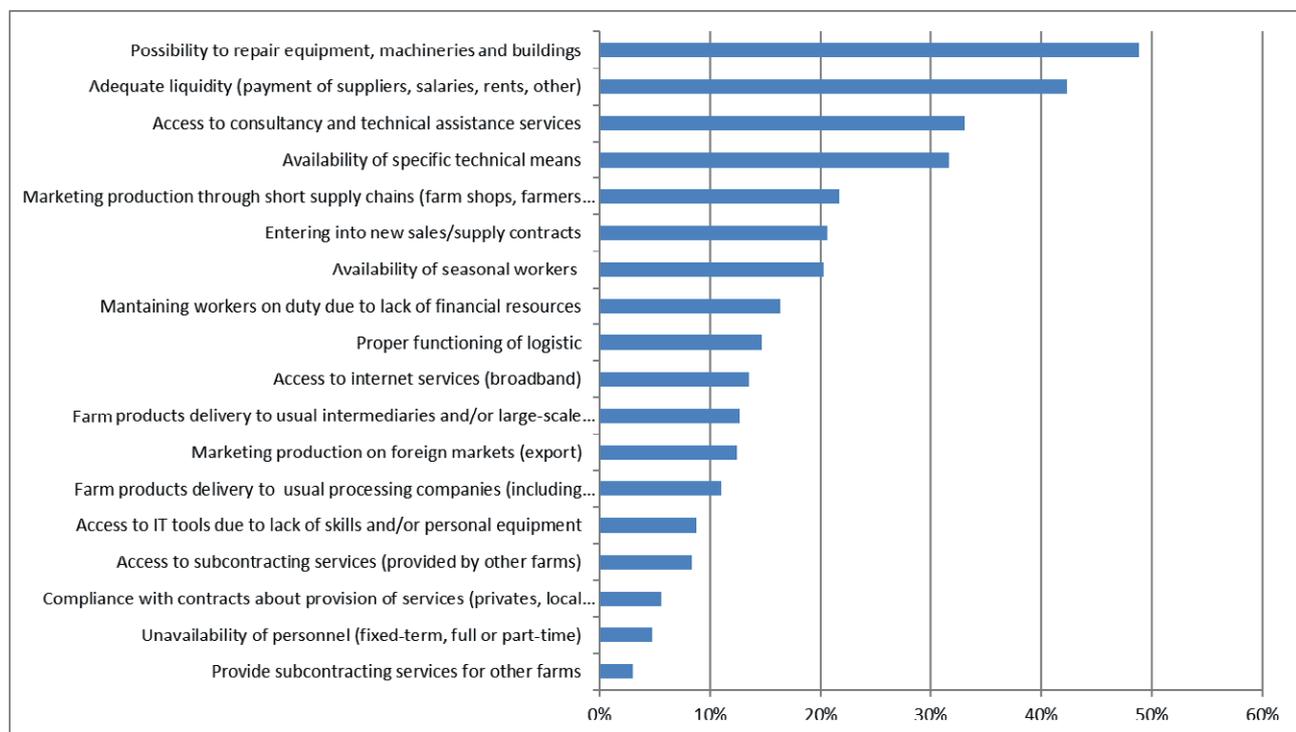
The availability of adequate financial liquidity was one of the difficulties most reported by the respondent farms: as shown in Fig. 4, 42% of respondents declared this issue as relevant, preceded only by the difficulties of repairing equipment, machineries, and buildings during this emergency period (49% of the participants). The difficulties in accessing advisory services and technical assistance services, or in finding technical means are also reported by a significant number of respondents (approximately 1/3 of the total), followed shortly after by the complications linked to the marketing of the products and the signing of new sale contracts.

Farmers declare they intend to cope with financial difficulties in this emergency period by resorting above all to their own savings and/or forms of corporate self-financing and, more rarely, by accessing financing and emergency instruments put in place by the Government or bank credit. This last option probably has been evaluated by farmers as less timely and less effective in responding to contingent needs. However, it should be remembered that the questionnaire was submitted in the

Table 2. Expected changes in Total Output by sales channel for the surveyed farms.

	Negative >75	Negative 50-75	Negative 25-50	Negative 0-25	None	Positive	Total
Wholesales, large-scale distribution, exporters	7%	7%	26%	27%	26%	9%	100%
Industry	5%	6%	27%	27%	25%	10%	100%
Retailers	7%	9%	26%	22%	22%	13%	100%
Other farms	5%	5%	23%	31%	27%	9%	100%
Direct sale in farm and automatic distribution	13%	14%	25%	22%	22%	5%	100%
Agritourism	25%	22%	19%	8%	17%	8%	100%
Cooperatives	1%	7%	21%	26%	32%	12%	100%
Others	3%	8%	23%	28%	29%	8%	100%
Undetermined	7%	7%	25%	23%	28%	10%	100%
Total	6%	7%	24%	25%	27%	10%	100%

Source: own elaboration on collected data.

**Figure 4.** Difficulties faced by surveyed farms during the lockdown (%). Source: own elaboration on collected data.

first phase of the lockdown, when some measures had not yet been implemented and/or not adequately known.

It is interesting to note that respondents who declared problems of financial liquidity are not homogeneously distribute per geographic area and specialization: farms located in central and southern Italy are more affected by liquidity problems/concerns, while no relevant differences are registered in term of age and gender of the farmers. At the same time diversified and organic

farms are more affected by liquidity problems than the average of respondent.

For other relevant questions of the questionnaire, like the problem of repairing machinery and equipment similar differences are less relevant.

The main results from the survey conducted on the FADN farms have been considered for the formulation of simulations on the impacts on farm income, by interfering the subsample of respondents with the FADN

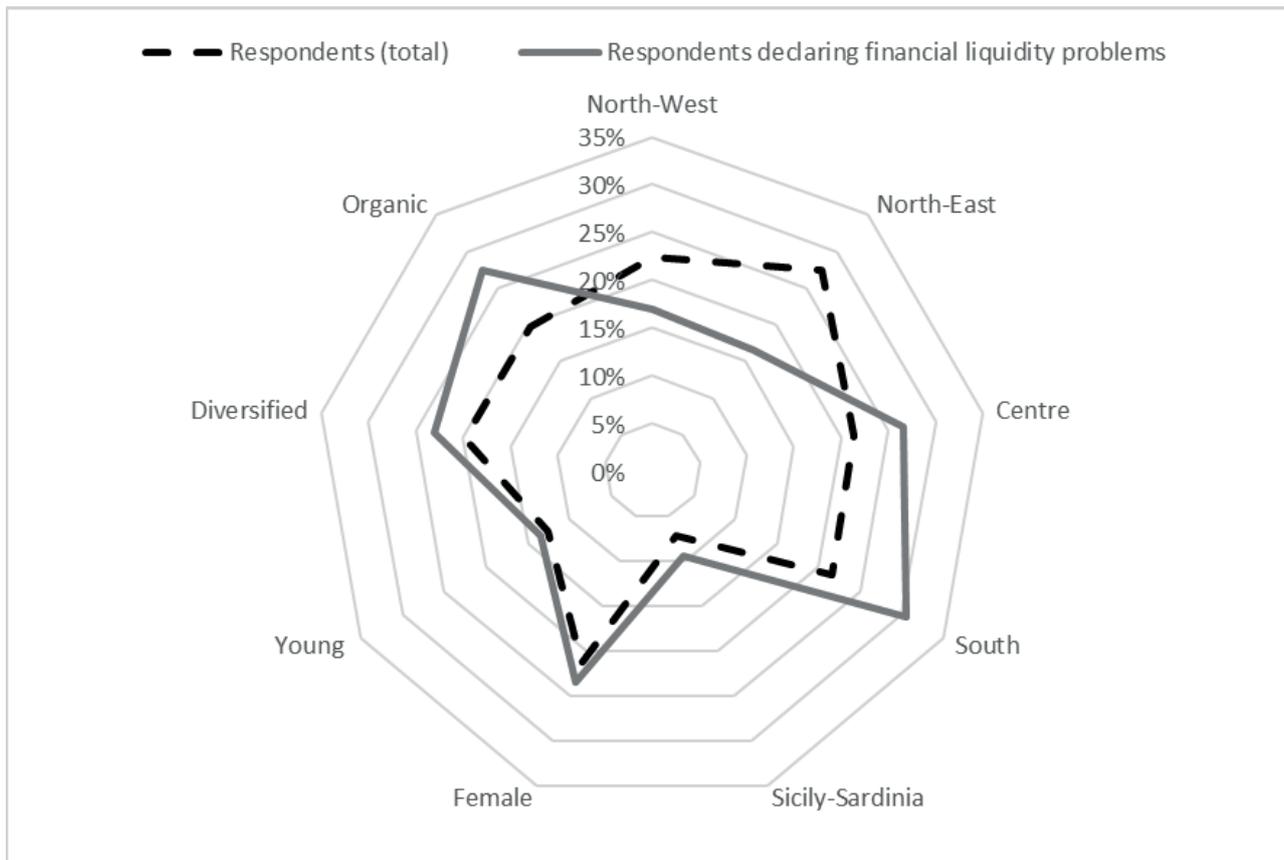


Figure 5. Focus on financial liquidity problems. Source: own elaboration on collected data.

database. More precisely, the contraction of Total Farm Revenues (TFR) has been calculated in the three-year average 2016-2018, considering the median value of the responses, stratified according to the three classes of economic size of farms. In addition, starting from FADN data, the incidence of current costs on revenues was calculated, obtaining the farm added value (AV) as difference between farm Total Output and current costs; the AV was then ratioed to farm Agricultural Working Units (AWU) (Fig. 6).

It is important to emphasize that the high incidence of current costs amplifies the effect of the contraction of revenues in the more intensive farm types, such as horticulture, viticulture, and granivores, causing a significant reduction in productivity per unit of work, expressed by the AV/AWU index, much larger than the expected contraction in farm revenues.

The assessment of the real economic effects deriving from the current health emergency should therefore consider not only the organizational structure of the farm and the prevalent type of production, which evidently influences farmers' expectations, but also the dif-

ferent cost structures characterizing the farm typologies. Therefore, for the same reduction in revenues, the effects on farm income can also be significantly different.

Finally, examining the future expectations of the farms interviewed, financial liquidity remains the most felt concern, also for the future, given that almost 2/3 of the survey participants identify it as the main problem to be faced in the next few months (Fig. 7). It seems to emerge in the farms that participated in the survey a deep concern about their ability to meet the needs of current expenses necessary for carrying out production activities in the next future, probably cause of a reduced consistency of monetary liquidity.

In this regard, farms of medium and large economic sizes express, to a greater extent, their concern for a possible unavailability of financial resources in the coming months, expressed by almost 2/3 of the respondents, against a steady expectation recorded for small farms. The latter, however, are characterized by a profile that is hardly identifiable with a professional management of the agricultural activity and closer to a connotation of non-professional farms, or farms that are characterised

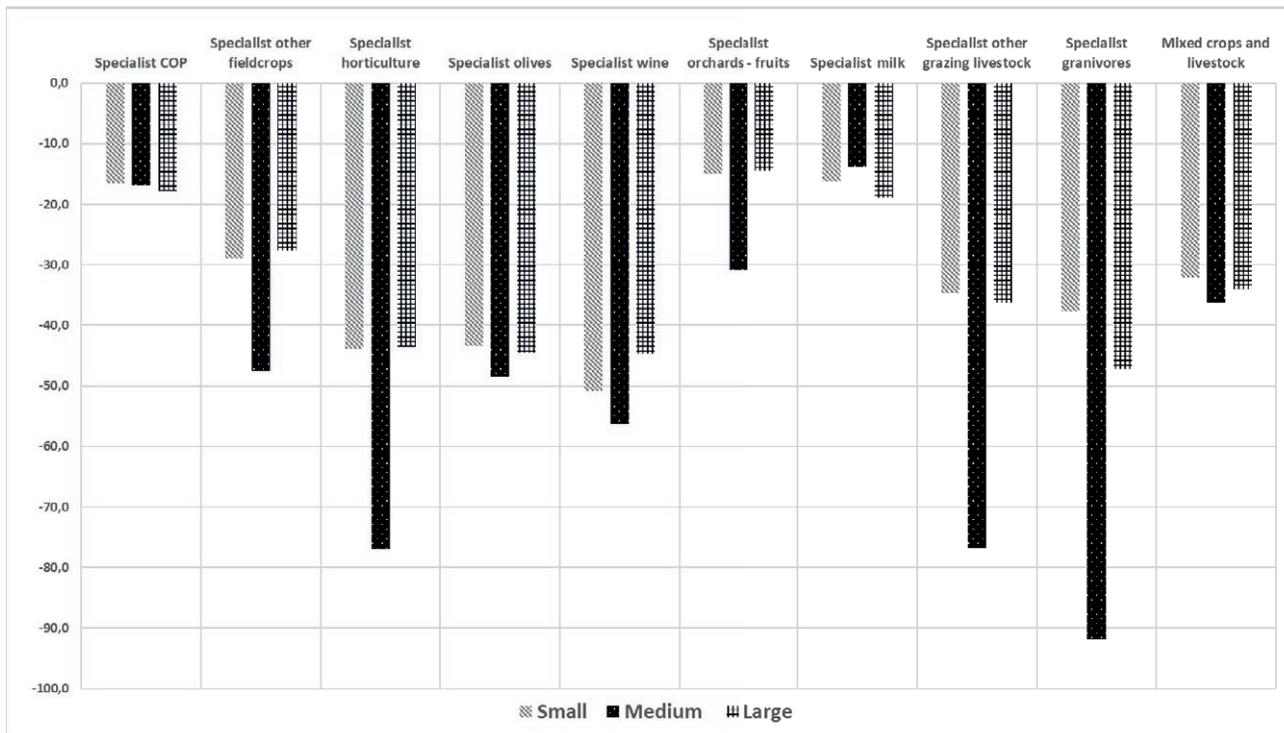


Figure 6. Changes in the ratio AV/AWU based on the estimated variations of Total Farm Revenues. Source: own elaboration on collected data.

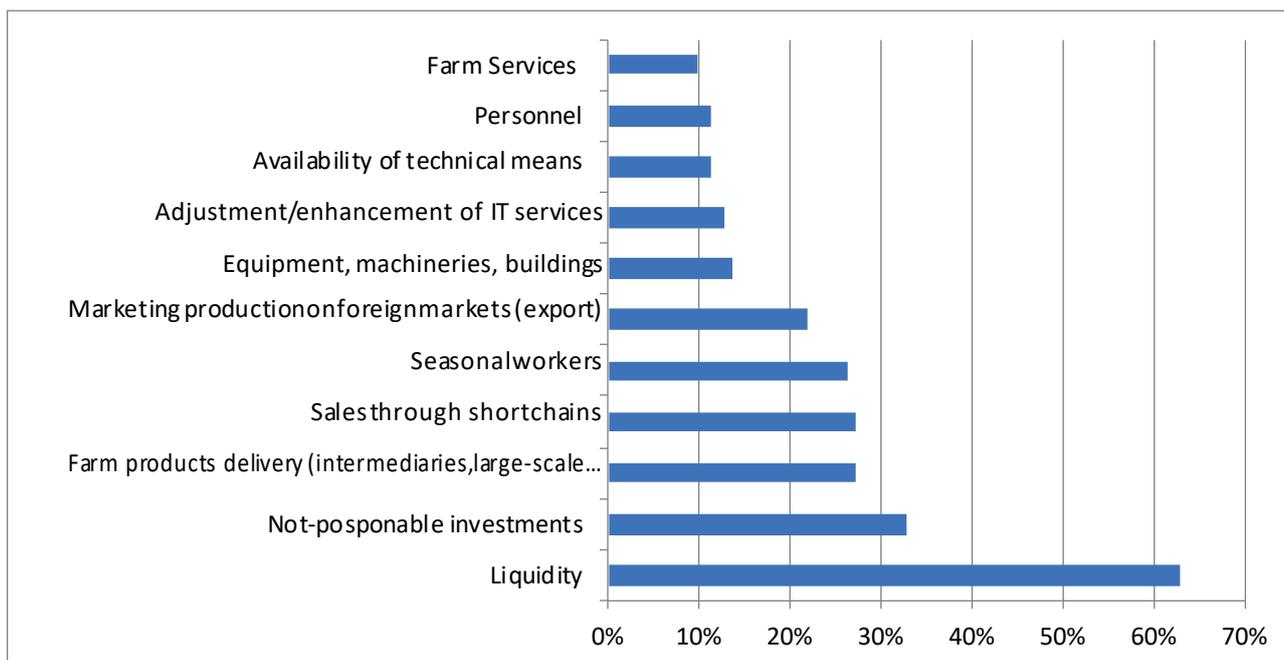


Figure 7. Difficulties expected by surveyed farms in the months following the lockdown. Source: own elaboration on collected data.

by the integration of other income. This peculiar condition may have affected the assessments expressed regarding the adequacy of future financial resources.

4. FROM EMERGENCIES TO RESPONSES: EXPECTED MEASURES AND POLICY IMPLICATIONS

After the first lockdown in March 2020, some buffer measures at EU and national level, through State Aids and a more extensive use of CAP resources, were activated to mitigate the liquidity crisis faced by the Italian farms during the phase of more severe restrictions and afterwards (CREA, 2020d), also detected through the survey addressed to FADN farms of May 2020.

At EU level, this was mainly implemented by the European Commission through the introduction of “Measure 21” in the framework of RDPs. The new measure was activated by almost all the Italian Regions (17 out of 21), allocating a maximum of 2% of the financial resources of the RDPs in favor of agritourism, educational farms, social farming and the sectors considered most exposed to the pandemic effects by each Region. Therefore, a non-repayable grant of up to seven thousand euros per farmer and 50 thousand for processing and marketing Small and Medium Enterprises (SMEs) was arranged. Furthermore, the advance on CAP contributions was raised from 50% to 70%.

As in numerous other EU Member States, different schemes have been activated through the mechanisms of State Aids to support agriculture, animal husbandry, forestry, and related sectors with different measures (e.g. renegotiation of mortgages, issue of zero-rate mortgages, establishment of the “Fund for the development and support of agricultural, fishing and aquaculture chains”, favorable tax regimes, exemption from the payment of social security and welfare contributions by employers, for farms belonging to agricultural supply chains, intervention by the Guarantee Fund also in favor of agricultural SMEs). Other measures were aimed at simplifying some procedures that the COVID-19 emergency would have hindered (e.g., suspension of visits to the farms by certification bodies to issue the certificate of suitability, suspension of certificates of qualification for sale, consultancy and purchase and use of plant protection products and extension of existing ones, extension of terms and derogations from agricultural sector legislation).

Regarding agricultural labour, the survey of the FADN farms highlighted two problems: 1) keeping it on the farm, avoiding dismissal; 2) ensure the availability of seasonal workers, especially foreign ones (about 300,000 units). To facilitate agricultural enterprises, therefore, on

the one hand, the extraordinary exemption or the suspension of the payment of social security and welfare contributions of workers by employers and the wage supplement for agricultural workers, for example, have been introduced. In the case of seasonal workers, on the other hand, the duration of residence permits was extended until the end of July 2021 and agricultural professional organizations were authorized to set up databases to recruit people to be hired temporarily on farms, a tool that minimally resolved the problem (Contignani *et al.*, 2020). Nevertheless, the regularization of agricultural workers was unsuccessful (Legislative Decree no. 34/2020), with only about 2,000 units regularized (May 2021; Bettini and Coderoni, 2021). Furthermore, in Italy the green corridors, aimed at facilitating the entry of seasonal workers, have not yet been activated, with the exception of the Autonomous Provinces of Trento and Bolzano, because the active quarantine protocols have not been officially recognized by the State. Therefore, the solution to the seasonal labour problem has been left mainly to the private initiative (Bettini and Coderoni, 2021).

Also, the difficulties of marketing farms’ products in Italy and abroad, due to the closure of the Ho.Re.Ca. channels and canteens, both public (especially school) and private, or due to the contraction of tourist flows and of the reduction in the subscription of new sales contracts, have been faced by public authorities with extraordinary campaigns of purchases financed by European and national extra funds. These measures were aimed at readdressing a more sensitive group of unsold products - such as, fresh milk, typical cheeses (Pecorino Romano, Parmigiano Reggiano, Grana Padano, Fontina etc.), extra-virgin olive oil, cured meats and so on - and supporting the increasing share of citizen affected by economic deprivation. However, in a medium-term perspective, the only remedies appear to be the restoring of traditional markets, mainly thanks to the results of vaccination campaign, still in progress, and the gradual reopening of the activities. About marketing, it is worth highlighting once again the results reported from farms involved in cooperative’s system. Indeed, data confirm the relevance of the implementation of measures for strengthening networks or cooperatives, especially for those sectors in which this type of organization is weaker, such as proposed also in the framework of the CAP 2023-2027.

Other critical issues highlighted by the survey addressed to the FADN farms (difficulties in maintaining / repairing machineries, equipment and buildings, finding technical means, access to consultancy and technical assistance services, making non-deferrable investments, marketing of production via short supply

chain), on the other hand, currently appear less serious than one year ago, as the supply of goods and services upstream and downstream of farms has been reorganized to comply with safety standards and operators have adapted to work in adverse conditions, thanks to the widespread use of protection systems and the gradual results of the vaccination campaign. However, these problems can recur with the recurrence of situations similar to the COVID-19 pandemic, their evolution, or due to “catastrophic” natural events.

As resulted by the survey, one of the main challenges of new policies in favor of the agricultural sector should be to prevent the negative impact of new possible global crises, health and non-health, through structural interventions, promoting resilience of farms. In the long run, the resilience of farms is fundamentally affected by the availability of liquidity, inputs, including labour, and services. Farms, therefore, between now and 2030, should reorganize their production processes to reduce their dependence on the outside and the production costs with the support of the public sector, which should provide them with a range of services, positively also influencing the availability of liquidity.

In particular, the latter problem could be mitigated by expanding to pandemic risk the mission of the EU toolkit for risk management in agriculture (insurances, mutual funds, and income stabilization tools), currently mainly addressed to mitigate the effects of climatic and health emergencies (epizootic and plant diseases, parasitic infestations) and sectoral income losses (durum wheat, fruit and vegetables, etc.). These measures should be better promoted, also favoring greater synergies among them, in addition with the adoption of strategies differentiated for business model, as well as their financial reinforcement in the next CAP programming period, for reaching a wider range of farms, currently still too limited (Capitanio, Adinolfi, 2013; Trestini et al., 2017; Severini et al., 2018; Capitanio and De Pin, 2018). In China, for example, agricultural insurance has been activated, on the one hand, to stabilize the incomes of farmers who produce fruit and vegetables, reducing their risk in agricultural production and operation during the COVID-19 pandemic, and, on the other, to guarantee a constant supply of these products to consumers in urban areas (Gu and Wang, 2020).

With reference to other emerging issues highlighted by the survey, it must be emphasized the relevance of the opportunities offered by the recent policy documents and financial instruments launched by EU, ranging from the *European Green Deal* (European Commission, 2019) and the *Farm to Fork Strategy* (European Commission, 2020c), up to massive amount of resources offered by the

Next Generation EU (NGEU) (European Commission, 2020d) and the new programming period of the CAP, that will enter in force in 2023 (De Castro et al., 2021). Programming differentiated proposals for intervention according to specific needs should be effective not only to reduce current difficulties, but also for avoiding similar situation that could occur in the future. In this view, many are the future interventions that could positively affect the resilience of the farms, territories, and the environment, giving impulse to an ecological and digital transition, in line with the Next Generation EU strategy (European Council, 2020).

The European *Green Deal* aims to promote the efficient use of resources by moving to a clean and circular economy, restoring biodiversity and reducing environmental pollution. It also promotes a fair and inclusive transition transforming climate issues and environmental challenges into growth opportunities for all sectors. The challenge of producing more with fewer resources, dissociating the growth of output from a more intensive use of factors, strongly involves and affects the agri-food sector. The objectives for the agri-food sector are defined in the *Farm to Fork Strategy*, whose ambitions are to protect the health and well-being of European citizens, to increase the EU's competitiveness and resilience, to make the EU food system a standard for sustainability at a global level. The Strategy identifies the strengthening the sustainability of food systems, both by reducing their environmental footprint and improving energy efficiency, and by increasing the availability and affordability of healthy and sustainable food options, as the set path, also functional in making farms less sensitive to various adverse conditions, similar to those detected due to the COVID-19.

In this view, EU regions could play an important role in the implementation of differentiated strategies, managing as much as possible the resources of the new CAP in favor of those areas and sectors with greater difficulties or more negative outlook, but which play a strategic socio-environmental role at local level (Frascarelli, 2021). This strategy should be accompanied by actions for supporting the development of the short chain, including local markets, which could allow SMEs farms to improve their economic results and consumers to continuously have local food at lower prices, in line with the *Farm to Fork Strategy* (European Commission, 2020c). These measures should also be accompanied by information and education actions on sustainability aimed at increasing the community awareness about its contribution to the maintenance of farms in the territory and on the mutual benefits of a closer relationship between producers and consumers, as it has happened

in this emergency period. Indeed, some studies highlight the importance of awareness campaigns addressed to farmers and consumers and initiatives aimed at public procurement of local products for canteens (Reis, 2019).

The issue of digitalization, including the infrastructure of the rural areas, is among the core area of interventions identified by the Italian National Recovery and Resilience Plan (NRRP; Presidenza del Consiglio dei Ministri, 2021), approved by UE within the NGEU. The NRRP provides for the implementation of structural and training interventions in favor of businesses, especially small and medium-sized enterprises (SMEs), public administration, health and tourism operators, citizens. The first step in the NRRP is the coverage of the whole territory with ultra-broadband networks (FTTH fiber, FWA and 5G), then to address resources for supporting the adoption of digital technologies by companies, so as to improve their logistics, marketing, and the efficiency of production processes. Furthermore, precision agriculture, aimed at rationalizing the use of technical means and improving the quality of products, constitutes one of the three areas of intervention of the NRRP in favor of the agricultural sector and one of the farming systems promoted by the *Farm to Fork Strategy* (EC, 2020c), together with agroecology, organic farming, carbon farming, and agroforestry, all agricultural production systems also aimed at reducing or eliminating synthetic chemical inputs. In relation to the difficulties in the supply of technical means encountered by farms and detected through the survey, the expected impact should make farms more competitive and self-sufficient, even SMEs located in the most marginal rural areas, facilitating their activities especially in times of unforeseen crisis.

Finally, the survey shows that difficulties in accessing extension services during the emergency period were reported by a third of farms interviewed. These services should be considered as fundamental policy tools in supporting farms and accelerating change towards food sustainability; however, in recent years they suffered a sharp downsizing due to the decrease of awareness about their relevance and the consequent reduction of resources allocated in their favor by public policy. Nevertheless, research, advisory services, and education have a key role in socio-economic and technical development as demonstrated in work of several authors, some of which highlighted the importance of producing tailor-made innovations analyzing the farmers' problems/opportunities (Sewell et al., 2017) and the need to enhance the interactions among different actors (Klerks et al., 2012; Hermans et al., 2015) in order to introduce innovation and promote rural development.

In the current programming period, specific inter-

ventions are foreseen to provide efficient knowledge and innovation systems (AKIS). Advisory, farmers' and advisors' training, demonstration, exchange and dissemination of knowledge, information are foreseen in the EU regulation proposal. It is a question not of new types of intervention compared to the current programming period, but of a more flexible and organized way to use them (Van Oost and Vagnozzi, 2020), to reach the aim of building a more sustainable, competitive, and inclusive Europe. Their effectiveness will largely depend on the capability to grant a better link between the new forthcoming measures and both the new policy objectives and the different characteristics of the farms.

5. CONCLUSIONS

The direct survey carried out during the first phase of the COVID-19 pandemic, combined with FADN data, allowed obtaining a very detailed information and thorough results, otherwise difficult to achieve using a single questionnaire submitted to a random sample of farms. The number of farms reached also offered the possibility of having a significant overview of the situation, in terms of different types of farming, referred to an exceptional period, characterized by uncertainty and a lack of data based on scientific evidence. The one presented in this study is, in fact, the largest Italian survey in the COVID-19 period which reached such many farms (and in general of subjects within a specific sector) using a consolidated methodology and being compliant with the sanitary emergency.

The analysis of the results has showed that the COVID-19 emergency produced severe consequences on the agricultural sector, both in relation to the development of cultivation / breeding activities and marketing. In addition, farmers' forecasts for the medium term indicated a growing concern about a possible worsening of the situation, with a significant part of interviewed which expressed uncertainty about the performance in the remaining part of 2020, forecasting negative impacts on agricultural incomes, especially in some sectors and for some types of farms. Final official data about the yearly trend have effectively showed an important reduction suffered by a large part of Italian agriculture.

But the survey has also put in evidence the presence of a large variety of situations and farms' characteristics which can give an important contribution in the mitigation of the negative impact caused by unexpected situation of general crisis. The organization of the supply chain, for example, seems to play a significant role, as it is witnessed by the less negative expectations on the

economic performance predicted by farms marketing their products towards cooperative structures. As well as smaller farms, often considered less significant within the sector, have showed expectations of a substantial balance. For these farms, with a smaller quantity of marketable production, in comparison with the medium-large ones, look promising the opportunities of development towards alternative distribution models, such as home deliveries, particularly suitable for farms located near the urban areas and / or in areas with more efficient roadway systems.

Considering the differences related to the farm size, the structural and production characteristics and the position within the supply chain, it is possible to highlight how differentiated policy measures, able to respond to specific problems of individual sectors or activities, could produce more durable effects. Then, it could be useful to deepen the analysis with a further step. A second survey could be repeated using the same FADN sample to obtain more accurate estimates on the effects of the pandemic and on the “mitigation” measures implemented by the EU and national Government.

REFERENCES

- Aday S., Aday M.S. (2020), *Impact of COVID-19 on the food supply chain*, in *Food Quality and Safety*, 4: 167–180, doi:10.1093/fqsafe/fyaa024
- Banca d'Italia (2020), *Relazione annuale*, anno 2019, CXXVI esercizio, Rome, May 29, 2020, <https://www.bancaditalia.it/pubblicazioni/relazion-annuale/>
- Bettini G., Coderoni S. (2021), *Agricoltura: le ragioni dello sciopero degli “invisibili”*, *lavoce.info*, 18 maggio 2021, <https://www.lavoce.info/archives/74471/agricoltura-le-ragioni-dello-sciopero-degli-invisibili/>
- Buonaccorsi A. (2020), *Agritourism in crisis during COVID-19: Italian farms' resilience and entrepreneurial strategies to face the impacts of the pandemic*, in *Bio-based and Applied Economics*, Published Online, DOI: 10.13128/bae-9554
- Capitanio F., Adinolfi F. (2013), *Strumenti e politiche di gestione del rischio: qual è la vera domanda? Limiti dell'attuale sistema di sostegno pubblico alla gestione del rischio in agricoltura*, in *Economia&Diritto Agroalimentare*, Anno XVIII (2): 189-208, ISSN 1826-0373 (print) – ISSN 1970-9498 (online), Firenze University Press, Florence
- Capitanio F., De Pin A. (2018), *La gestione del rischio nella zona DOCG Conegliano- Valdobbiadene, valutazioni economiche*, in *Italian Review of Agricultural Economics*, 73(1): 37-61, DOI: 10.13128/REA-23578, Firenze University Press, Florence
- CERVED (2020), *The impact of Coronavirus on Italian nonfinancial*, <https://know.cerved.com/wp-content/uploads/2020/03/Cerved-Rating-Agency-Research-Study-The-impact-of-Coronavirus-on-Italian-non-financial-corporates.pdf>
- Coluccia B., Agnusdei G.P., Miglietta P.P., De Leo F. (2021), *Effects of COVID-19 on the Italian agri-food supply and value chains*, *Food Control*, 123, Maggio, 107839. <https://doi.org/10.1016/j.foodcont.2020.107839>
- Cortignani R., Carulli G., Dono G. (2020), *COVID-19 and labour in agriculture: Economic and productive impacts in an agricultural area of the Mediterranean*, *Italian Journal of Agronomy*, 15(2): 172-181. doi:10.4081/ija.2020.1653
- CREA (2020a), *CREAgritrend*, CREA, Research Centre for Agricultural Policies and Bioeconomy, no 6, 1st quarter 2020, <https://www.crea.gov.it/web/politiche-e-bioeconomia/-/creaagritrend>
- CREA (2020b), *Misure preventive e precauzionali delle AdG dei PSR in risposta all'emergenza epidemiologica da Covid-19*, National Rural Network 2014-2020, Rome, April 2020 <https://www.reterurale.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/20941>
- CREA (2020c), *Valutazione dell'impatto sul settore agroalimentare delle misure di contenimento COVID-19*, National Rural Network 2014-2020, Rome, [https://www.crea.gov.it/-/online-il-rapporto-valutazione-dell-impatto-sul-settore-agroalimentare-delle-misure-di-contenimento-covid-19-](https://www.crea.gov.it/-/online-il-rapporto-valutazione-dell-impatto-sul-settore-agroalimentare-delle-misure-di-contenimento-covid-19)
- CREA (2020d), *Covid-19, Impatti economici nelle aziende agricole*, National Rural Network 2014-2020 and Rete di Informazione Contabile Agricola, Rome, July 2020, <https://www.reterurale.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/21450>
- De Castro P., Miglietta P. P., Vecchio Y. (2021), *The Common Agricultural Policy 2021-2027: a new history for European agriculture*, in *Italian Review of Agricultural Economics*, 75(3): 5-12. <https://doi.org/10.13128/rea-12703>, Firenze University Press, Florence
- Ecovia Intelligence (2020), *Organic Foods Getting Coronavirus Boost*, 16 aprile 2020, <https://www.ecovaint.com/organic-foods-getting-coronavirus-boost/>
- European Commission (2019), *The European Green Deal*, COM(2019) 640 final, Bruxelles, December 11, 2019, https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF
- European Commission (2020a), *European Economic Forecast, Spring 2020*, Institutional Paper 125, May 6, 2020, https://ec.europa.eu/info/publications/economic-and-financial-affairs-publications_en

- European Commission (2020b), *EU Biodiversity Strategy for 2030, Bringing nature back into our lives*, COM(2020) 380 final, Bruxelles, May 20, 2020, https://eur-lex.europa.eu/resource.html?uri=cellar:a3c806a6-9ab3-11ea-9d2d-01aa75ed71a1.0001.02/DOC_1&format=PDF
- European Commission (2020c), *A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system*, COM(2020) 381 final, Bruxelles, May 20, 2020, https://eur-lex.europa.eu/resource.html?uri=cellar:ea0f9f73-9ab2-11ea-9d2d-01aa75ed71a1.0001.02/DOC_1&format=PDF
- European Commission (2020d), *The EU budget powering the recovery plan for Europe*, COM(2020) 442 final, Bruxelles, May 27, 2020, https://eur-lex.europa.eu/resource.html?uri=cellar:4524c01c-a0e6-11ea-9d2d-01aa75ed71a1.0003.02/DOC_1&format=PDF
- European Council (2020), *Special meeting of the European Council (17, 18, 19, 20 and 21 July 2020) – Conclusions*, EUCO 10/20, CO EUR 8 CONCL 4, Brussels, 21 July 2020, <https://www.consilium.europa.eu/en/press/press-releases/2020/07/21/european-council-conclusions-17-21-july-2020/>
- Fanelli R.M., Di Nocera A. (2017), How to implement new educational campaigns against food waste: An analysis of best practices in European Countries, *Economia Agroalimentare/Food Economics*, 19: 223–244. doi:10.3280/ECAG2017-002003
- FAO (2020), *Impacts of COVID-19 on agriculture: Italy's response*, <http://www.fao.org/sustainable-agricultural-mechanization/resources/news/detail-events/en/c/1305799/>
- FIPE (2020), *Ristorazione: -23,8% il fatturato nel I Trimestre 2020*, <https://www.fipe.it/centro-studi/news-centro-studi/item/7195-ristorazione-23-8-il-fatturato-nel-i-trimestre-2020.html>
- FMI (2020), *World Economic Outlook, April 2020: The Great Lockdown*, April 14, 2020, <https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020>
- Frascarelli, A. (2021), *Direct Payments between Income Support and Public Goods*, in *Italian Review of Agricultural Economics*, 75(3): 25-32, <https://doi.org/10.13128/rea-12706>, Firenze University Press, Florence
- Gruère G., Brooks J. (2021), Viewpoint: Characterising early agricultural and food policy responses to the outbreak of COVID-19, in *Food Policy*, Volume 100, ISSN 0306-9192, <https://doi.org/10.1016/j.foodpol.2020.102017>
- Gu H.Y., Wang C.W. (2020), Impacts of the COVID-19 pandemic on vegetable production and countermeasures from an agricultural insurance perspective, *Journal of Integrative Agriculture*, 19(12): 2866–2876. doi: 10.1016/S2095-3119(20)63429-3
- Hermans F., Klerkx L., Roep D. (2015). Structural Conditions for Collaboration and Learning in Innovation Networks: Using an Innovation System Performance Lens to Analyse Agricultural Knowledge Systems. *The Journal of Agricultural Education and Extension*, 21(1): 35-54. Doi: <https://doi.org/10.1080/1389224X.2014.991113>
- ILO (2020), COVID-19 and the impact on agriculture and food security, *ILO Sectoral Brief*, April 17, 2020, https://www.ilo.org/sector/Resources/publications/WCMS_742023/lang--en/index.htm
- ISMEA (2020a), *Emergenza COVID-19, Rapporto sulla domanda e l'offerta dei prodotti alimentari nelle prime settimane di diffusione del virus*, Rome, March 2020, <http://www.ismea.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/10990>
- ISMEA (2020b), *Emergenza COVID-19, 2° Rapporto sulla domanda e l'offerta dei prodotti alimentari nell'emergenza Covid-19*, Rome, April 2020, <http://www.ismea.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/11016>
- ISMEA, (2020c), *Rapporto RRN Agriturismo e Multifunzionalità. Scenario e prospettive*, Rome, December 2020, <https://www.reterurale.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/22114>
- ISTAT (2020a), *I trimestre 2020, Conti economici trimestrali*, Statistiche, May 29, 2020, https://www.istat.it/it/files//2020/05/CET_20q1_11_GIU.pdf
- ISTAT (2020b), *Le prospettive per l'economia italiana nel 2020-2021*, <https://www.istat.it/it/files//2020/06/Prospettive-economia-italiana-Giugno-2020.pdf>
- ISTAT (2021), *Andamento dell'andamento dell'economia agricola, Anno 2020*, 25 May 2021, <https://www.istat.it/it/archivio/258021>
- Klerkx L., van Mierlo B., Leeuwis C. (2012). Evolution of systems approaches to agricultural innovation: concepts, analysis and interventions. In: Darnhofer I., Gibbon D., Dedieu B. (eds.) (2012), *Farming Systems Research into the 21st Century: The New Dynamic*, Springer, Dordrecht
- Macri C. (2020) (ed.), *Le misure per l'emergenza Covid-19 e la manodopera straniera in agricoltura*, CREA-PB, Rome, <https://www.crea.gov.it/-/le-misure-per-l-emergenza-covid-19-e-la-manodopera-straniera-in-agricoltura>
- Marusak A., Sadeghiamirshahidi N., Krejci C.C., Mittal A., Beckwith S., Cantu J., Morris M., Grimm J. (2021), *Resilient regional food supply chains and rethinking the way forward: Key takeaways from the*

- COVID-19 pandemic, in *Agricultural Systems*, 190, <https://doi.org/10.1016/j.agsy.2021.103101>
- Mediobanca (2020), *Wine Industry Survey*, Mediobanca Research Area, May 2020, http://www.mbres.it/sites/default/files/resources/download_en/Wine_Survey_2020.pdf
- Presidenza del Consiglio dei ministri (2021), Piano Nazionale di Ripresa e Resilienza. #NextGenerationItalia, <https://www.governo.it/sites/governo.it/files/PNRR.pdf>
- Reis, K. (2019). Five things government can do to encourage local food contingency plans. *J. Environ. Plan. Manag.* 62: 2295–2312. <https://doi.org/10.1080/09640568.2018.1540772>.
- Severini S., Biagini L., Finger R. (2018), *Modeling agricultural risk management policies – The implementation of the Income Stabilization Tool in Italy*, in *Journal of Policy Modeling* (2018), <https://doi.org/10.1016/j.jpolmod.2018.03.003>, Elsevier
- Sewell A.M., Hartnett M.K., Gray D.I., Blair H.T., Kemp P.D., Kenyon P.R., Morris S.T., Wood B.A. (2017), Using educational theory and research to refine agricultural extension: affordances and barriers for farmers' learning and practice change. *The Journal of Agricultural Education and Extension*, 23(4): 313-333, doi: 10.1080/1389224X.2017.1314861
- Trestini S., Giampietri E., Boatto V. (2017), *Toward the implementation of the Income Stabilization Tool: an analysis of factors affecting the probability of farm income losses in Italy*, in *New Medit*, 16(4): 24-30, Bonomia University Press
- Van Oost I., Vagnozzi A. (2020), *Knowledge and innovation, privileged tools of the agro-food system transition towards full sustainability*, in *Italian Review of Agricultural Economics*, 75(3): 33-37, <https://doi.org/10.13128/rea-12707>, Firenze University Press, Florence
- Weersink A., von Massow M., Bannon N., Ifft J., Maples J., McEwan K., McKendree M. G.S et al. (2021), *COVID-19 and the agri-food system in the United States and Canada*, in *Agricultural Systems*, 188, <https://doi.org/10.1016/j.agsy.2020.103039>, Elsevier