

Article

Socio-Economic Impact of the Imposed Lockdowns in Food Chains: A Case Study in Cyprus

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Abstract: COVID-19 has affected the entire existence of humans. Despite the mass vaccination programs globally deployed, some governments are still struggling to minimize human losses, high rates of virus transmission, and the socio-economic shock the entire planet has been going through. COVID-19 has seriously affected all global socio-economic sectors. In this direction, agriculture, food-security and the environment could not be outside of the high-scale negative impacts, especially during the first year of the imposed lockdowns on both national and global scales. The present study provides information on the impact of COVID-19 and the lockdowns imposed, having as its study area the Republic of Cyprus. The study focuses on potato cultivation and production, and on which level entire agricultural procedures were affected during the examined period of the lockdown. A survey methodology study was done with questionnaires distributed to local potato farmers across the country to quantify and identify the link between the pandemic and the potato sector of the island. It was revealed that manpower was limited due to the lockdowns, the distribution of crops to markets disrupted, long delays in transactions in the agricultural sector were experienced, and economic uncertainty, in general, in Cyprus was experienced, among other impacts. Results of the study indicated that—since COVID-19 is not going to be the last disease—a global transition towards a more resilient and spatially localised food network is required.

Keywords: COVID-19; lockdowns; agriculture; potato-sector; questionnaires; potato-sector; Cyprus



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1. Introduction

1.1. Epidemiology—Pathophysiology—Transmission

The COVID-19 pandemic is pushing public healthcare systems to their limits. Sohrabi et al., underlined the extent of this pandemic, with the World Health Organization (WHO) declaring the pandemic as a global emergency [1]. The virus is affecting and altering a wide spectrum of human life. The new disease was spotted and announced in Wuhan, China, and its first cases were associated with the Huanan seafood market [2].

COVID-19 is recorded as the third zoonotic coronavirus disease, following SARS which originated in Foshan, China, and the Middle East respiratory syndrome (MERS) in 2012 in the Arabian Peninsula. Most zoonotic diseases are spread from animals to humans and originate from wildlife environments [3]. Such cases were the burst of the H5N1 avian influenza, which originated from the industrial poultry farming sector [4], as well as the burst of MERS transferred from bats to humans, with camels as an intermediate host [5]. As relevant literature indicates, foodborne zoonotic pathogens (FZP) are bursting in late decades with an increased frequency ratio [6]. As Zhu et al. reported, SARS-CoV-2 is a β -coronavirus belonging to the subgenus botulinum of Coronaviridae [7]. Being large, enveloped, single-stranded RNA viruses, the Coronaviruses are spread in humans and

several mammals, such as dogs, cats, and poultry [8]. Seven out of 40 different species of the coronavirus family have been confirmed to have been transmitted to humans [9]. Benvenuto et al., claimed that SARS-CoV-2 is narrowly related to the coronavirus isolated in 2015 from the Chinese chrysanthemum-headed bats [10], while it also embraced the theory that the transmission was initiated from bats to humans. In accordance with Zhou et al., and Wu et al., the sequence homology between SARS-CoV-2 and SARS-CoV reached 79.5%. Additionally, they indicated that SARS-CoV-2 had high homology with bat coronaviruses, supporting that the SARS-CoV-2 was derived from bats, although the “stepping stone” hosts of SARS-CoV-2 have not been determined [7].

SARS-CoV-2 has a diameter between 60–140 nm and distinctive spikes. Spike lengths are calculated to be between 9–12 nm. The appearance of the virus resembles a solar corona. Relevant studies confirm that the process of droplets expelled during talking or coughing is the major pattern of transmission [11]. Epidemiological data suggest that SARS-CoV-2 infection is divided into three phases. The first phase is composed of an asymptomatic incubation period with or without detectable virus; the second phase is distinguished by a non-severe symptomatic period but with the presence of the virus, while the last phase includes a severe respiratory symptomatic period with high viral load [12]. Applicable knowledge of the disease indicates complications of COVID-19 linked to the deteriorated function of the lungs, brain, heart, kidney, liver, and the coagulation system. Thus, COVID-19 can direct to myocarditis, cardiomyopathy, ventricular arrhythmias, and hemodynamic instability. In their study Huang et al., counted that 98% of their patients had fever, of which the 78% had a temperature above 38 °C [13]. Their conclusions indicated that 76% of their patients had coughs, 44% experienced complications of fatigue and pain in muscles, and 55% of patients encountered dyspnea. A minor part of the examined patients developed expectoration (28%), headaches (8%), hemoptysis (5%), and diarrhea (3%). Guan et al., examined during their study 1099 infected cases infected [14]. It was documented that the major symptoms were fevers (87.9%) and coughs (67.7%). On the other hand, diarrhea (3.7%) and vomiting (5.0%) were rather rare. Chest computed tomography images revealed abnormalities incidents reaching 96% of the SARS-CoV-2-infected patients, and lymphopenia was recorded in a percentage of 82.1% [15].

1.2. The COVID-19 and the Agriculture Impact

Data about the disease’s impact on the environment or/and agricultural activities and production are limited, and the majority of studies in the literature refer to logistics and/or distribution aspects [16]. This study aims to link the pandemic with agricultural procedures affected during the imposed lockdowns in the micro-scale of Cyprus. Specifically, the study focuses on the potato sector of the island and the range of impacts raised during the period of the first imposed national lockdown at mid of March to May 2020.

Zoonotic diseases recorded during the last decades, HIV-AIDS (1970s-), SARS (2003), H5N1 (2005–2010), H1N1 (2009), MERS (2008-present), Ebola (2015), and nowadays SARS-CoV-2 (2020-present), apart from severely hitting the public health systems, have notable impacts on food security. However, those impacts vary depending on transmissibility and the type of animals hosting the pathogens. Indicative examples are Ebola, MERS, and SARS, which were linked with high rates of lethality, but they mainly stressed food chain systems in those specific areas where they were spread [17]. Despite their low lethality rates, H5N1 and H1N1 resulted in pandemics with heavy negative impacts on the food production sector rather than the entire supply chain. Additionally, during that period a great decrease in the demand for animal products was noted. In 2009, 64% of consumers in China drastically reduced their consumption of pork [18].

The current pandemic has triggered decelerations and discontinuity in the food production industry, in retail procedures, as well as in global consumption. The Global Food Crisis Report (2020) affirmed that 83 to 132 million people may have gone to bed hungry because of the pandemic outbreak. Similarly, the World Food Program (WFP) noted that COVID-19 is “threatening with severe impacts millions of humans setting them vulnerable

by food insecurity and malnutrition.” [19]. The abrupt break of the food chain during the period of lockdowns, is affecting the entire globe, but countries with low economic GDP, are hit the hardest [20]. Sumner, Hoy, and Ortiz-Juarez concluded that by validating the extreme schema of 20% income or consumption contraction, then approximately 420–580 million people are estimated to move into poverty conditions [21]. Restrictions on travel, long-term closures in trade and strict lockdowns of entire countries have also affected the influx of imported foods. This problem lies severely in densely populated cities [22]. Urban areas with 10 million or more inhabitants, which need to import daily 6 thousand tons of food, travelling on average about 1000 km are vulnerable and fragile to the pandemic [23].

COVID-19 sets in strain on global agricultural production with on-farm problems counted in many countries. In Ethiopia, for example, vegetable farmers counted income loss as their overstocked products were increasing. In northwest India, harvesting was disrupted due to labour non-availability [24]. In developed countries, such as Canada and the United States, excessed quantities of milk, poultry and fresh vegetables were dumped [25]. To ensure national food security some countries have imposed measures by restricting the export of several staple commodities. Russia imposed limitations on grain shipments, Serbia, Kazakhstan, and Vietnam set analogous limitations on exporting, sugar, potatoes, flour, and sunflower oil [26].

The impact of COVID-19 on agriculture is mainly set in food supply chains. They involve a multiplex spectrum of interconnections between the transportation sector, manpower, agriculture inputs, and the processing industry in general. The direct impact of the pandemic on agricultural production is mainly the shortage of labour. Additional impacts involve variables directly linked with logistics and supply chain disruptions. For example, globally placed limitations for farmers to access markets to buy fertilizers, chemicals, seeds, and other agricultural supplies. Finally, zoonotic diseases may result in more direct impacts on related sectors, such as consumption habits. Since foodborne zoonotic pathogens (FZP) are burst in humans through animal intermediate hosts, such as pigs and poultry, consumer buying trends may result in an abrupt and steep drop in domestic demand or even on an international scale [27].

1.3. Cyprus Case

In 2018, in the EU-28, potatoes were cultivated on 1.7 million hectares. This area corresponded to 1.6% of all arable land in the EU. Almost 76.9% of the EU’s cultivated area of potatoes in 2018 was in seven member states. Poland, Germany, and France were listed as the major potato cultivation members. Table 1 presents indicators referring to potato production, areas of cultivation and the total share per country. Countries are selected randomly, while the indicators represent the status in 2018.

Table 1. Data referring to potato cultivation in 2018 Adapted from: [28].

	Area (1000 ha)	Share of EU-28 Area (%)	Harvested Production (1000 Metric Tons)	Share of EU-28 Harvested Production (%)
Belgium	93.3	5.5	3045.4	5.9
Denmark	52.0	3.1	1806.8	3.5
Germany	252.2	14.9	8920.8	17.2
Ireland	8.2	0.5	279.7	0.5
Greece	18.9	1.1	543.0	1.0
Spain	67.2	4.0	2002.9	3.9
France	199.9	11.8	7871.0	15.2
Italy	46.4	2.7	1307.6	2.5
Cyprus	4.2	0.2	106.5	0.2

Potatoes are cultivated throughout most of the year in Cyprus (particularly in Famagusta and Larnaca districts), usually producing three crops per year (winter crop, intermediate crop, and spring crop) [29]. The above-mentioned districts are situated in the south-eastern part of the country, mostly characterised by flat lands and red clay soils. The climate in the wider area is semi-arid with mild, wet winters and long, dry summers. The average annual rainfall in the wider area is estimated at 300 mm, while the annual temperature reaches up to 20.3 deg. Celsius [30].

Potato production in Cyprus is one of the most important agricultural sectors and a significant source of foreign income. Cyprus exports mainly early potatoes to the EU, to Western European countries and to the Middle East. Those exports represent 85 to 90% of the total production [2]. The agricultural sector in Cyprus contributes around 2% to the GDP (from 6.9% in 1990) and 2.1% to the labour force. Crop production mainly involves potatoes, but also citrus, vegetables, and grapes [31]. In 2016, across the Republic of Cyprus, the number of holdings producing potatoes under traditional methods of cultivation reached 1570 units. Table 2 presents the quantity (metric tons) of exported spring crop potatoes in 2020, according to data extracted from the Cyprus Ministry of Agriculture [32].

Table 2. Export-Trade of spring crop potatoes in 2020 (March—October).

Y2020	Quantity (Metric Tons)
March	2002
April	9833
May	12,316
June	11,264
July	3320
August	1816
September	2850
October	1697
TOTAL	45,098

For winter crop exports (November 2019–March 2020), the quantity amounted to 14,215 tons. A short decline in the exports indicator is noted—referring to spring crops—compared to the same period in 2019 before the COVID-19 era, as during that period the total turnover amounted to 50,576 tons. This stands for a percentage decline of 11%. In 2020, Greece, Germany and the UK were the major importers of the spring potato crops. Table 3 presents all countries and quantities imported from the Cyprus Republic.

Table 3. Export countries of spring crop potatoes in 2020.

Countries of Export	Quantity (Metric Tons)
Germany	8620
Greece	15,404
UK	7995
Belgium	3999
Italy	1399
Poland	2468
Ireland	2580
Austria	218
Spain	801

Table 3. *Cont.*

Countries of Export	Quantity (Metric Tons)
Netherlands	515
Sweden	388
Croatia	105
Switzerland	269
Bahrein	170
UAE	167
TOTAL	45,098

2. Materials—Methods

Research has been focused internationally to capture the effects of the pandemic, i.e., via data collection. For instance, in China via an online survey run by the Chinese Academy of Agricultural Sciences (CAAS) on 1501 rural households reported that 51.19% of the participants had difficulties buying agricultural chemicals, while 20.39% had no access to purchasing the above necessities [33].

The present study used questionnaires to assess the lockdown effect on potato cultivation in Cyprus. Closed-ended questions were selected in the questionnaires, and in several cases, the respondent is asked to choose only one of the existing answers (Rank Order Multiple Choice Questions type) was chosen. In most of the questions, the format of a typical five-level Likert scale was used. The research questions were not expressed as hypotheses, however, each of the questions is asked implying a specific belief in the research questions, which the respondent should accept or reject (and how much) by following the five-point Likert scale. To achieve homogeneity of the period the study investigates, the questionnaires set a reference period for the time of implementation of the first lockdown that prevailed in Cyprus, starting from 16 March 2020, until 1 May 2020. The questionnaires were delivered directly to local potato producers in Cyprus who practice agriculture as their main professional activity.

The data collection that was used in this research consists of both primary and secondary data. The selected philosophy chosen for our research was pragmatism. Pragmatism uses the view of epistemology, ontology and axiology. The researcher can have multiple views to answer the research question adapting to both objective and subjective points of view. Regarding the research approach (deductive or inductive), the deductive approach starts with theory and moves towards the research question. In the end findings from the collected data would either confirm or reject the research question. The inductive approach on the other side, makes it possible to create a theory instead of accepting an existing theory as with the deductive method. The deductive approach is often used with quantitative research whereas the inductive approach is based on qualitative data. Quantitative research is based on numbers, measurements, and quantity, whereas qualitative research is data that includes personal opinions, descriptions and personal accounts. This research project used the inductive method since the outcome of the hypothesis were based on the analysis of both quantitative and qualitative data.

The sampling method selected was cluster sampling. This method is suitable for surveys addressing extended spatial areas with dispersion. In addition, this method is applied to cases where the examined participants are not known and recorded. The scope of the examined sample was mainly based on the spatial coverage of the largest possible areas of potato cultivation across the island. The sample number that was finally collected reached 3970 acres corresponding to 24 questionnaires.

The structure of the questionnaires was divided into four (4) categories of questions:

- Questions exclusively about COVID-19;
- Questions concerning exclusively the implementation of the lockdown;

- Questions concerning exclusively agricultural activity, raw material prices and access to markets;
- Questions concerning exclusively production quantities and selling prices of agricultural products.

Regarding research limitations, although a higher number of questionnaires would have been useful since the land of the survey participant owners-farmers of the 24 questionnaires corresponds to almost 4000 acres, the sample was deemed sufficient since it represented a large sample of the sector's total area harvested in the country. Furthermore, the study was focused only on the potato sector since it is one of the most organized agricultural sectors in Cyprus with clear access to data.

Regarding the coding and the processing of the questionnaires, i.e., the conversion of the answers into numbers, symbols, or quantitative representation of the results, this concerned the creation of diagrams-charts in Excel™ 2020 spreadsheets. Spatial mapping of the areas from which questionnaires were received is presented in Figures 1 and 2 below with background maps extracted from the Google Earth Pro application, concerning two of the areas from which data were collected. The wider residential areas of Xylofagou and Achna that both belong to the province of Famagusta.



Figure 1. Potato plots selected in the Xylofagou area.



Figure 2. Potato plots selected in the Achna area.

3. Results

The resilience of the global agricultural sector is being tested by the COVID-19 crisis [34]. Food and Agriculture Organization reported, the pandemic is setting under strain the agricultural supply chains (ASCs) on two critical aspects namely, the demand and the supply of food. Those two aspects are highly related to food security; therefore, global food security is at risk [35]. In order to better prepare for future food systems threats, the UN Sustainable Development Goals (SDG) should be taken into account more gravely [36]. Urban areas are in severe need of food access alternatives addressing food security on a local level. A possible future outbreak can disrupt the agricultural production again [37]. The agriculture sector represents one of the most fundamental components globally, while ASCs are a complex network which includes phases of production, processing, transportation, storage, costs, labour, and retail services [33].

Focusing on the aspect of labour, the non-accessibility and/or non-availability of labour during the pandemic has harmed agricultural activities in various ways. The COVID-19 crisis negatively affected not only rates of global unemployment but is also raising issues of changing the structures, and status of traditional labour as it was known before the pandemic. For instance, Mitaritonna and Ragot indicated that the new pandemic “potentially will result in the adoption of robots for picking fruits and vegetables within the European Union fields” [38]. On a global scale, the agricultural sector is struggling to maintain its personnel. Zhang reported that in China, cattle were starving because of the unavailability of both animal food and workforce labour. The lack of personnel affected countries which are highly dependent on seasonal foreign workers, such as the United States, Canada, France, Germany, and Australia [39]. Portugal regularised immigrants pending residence permits, while Germany from May to June 2020, permitted 80,000 foreign seasonal workers to enter the country. Spain addressed the lack of labour, by authorizing farms to employ up to 80,000 immigrants or unemployed until 30 June 2020. Similar surveys examined the levels and the status of employment of immigrants in Italy. Macri et al., in 2017, claimed that in Italy, out of a million workers employed in the agriculture sector, 34.2% were immigrants [40]. The same condition also was reported in Cyprus, as quantifying results of the questionnaires 67% of the participants stated the difficulty in finding available agricultural personnel to carry out cultivation works in their potato fields. Further analysis of the questionnaires revealed the size of the pandemic’s impact on the potato sector across the country, which in some cases was hit drastically. Figures 3–6, having been processed and converted to chart-diagrams, present visually the responses obtained via this study.

- Questions concerning exclusively the implementation of the lockdown

Regarding the responses on whether the information about COVID-19 disease was satisfactory, 25% replied negatively, 25% ranked it as moderate and only 17% characterised it as satisfactory. An interesting finding refers to whether the newly imposed COVID-19 health protocols to secure safety in work environments are easy to be applied in agricultural holdings and agricultural spaces across the country. 63% suggested that those protocols it is not likely even to a minimum level to be applied, while only 8% responded positively. Finally, the opinions are equally divided in terms of whether COVID-19 is going to bring changes in the practice profiles and status of traditional agriculture.

- Questions concerning exclusively agricultural activity, raw material prices and access to markets

Regarding the question proposed about the necessity of the imposed general lockdown to contain the pandemic, 25% of respondents replied negatively, while 33% noted the high importance of that. Another significant finding of this study was that 80% of the respondents reported the difficulty (during the period of lockdown) of consumers and the wholesale market in general, in accessing available agricultural products. Additional findings in this topic of questions, refer to 38% of participants replying positively that during the period of lockdown, they visited physically local agricultural stores and sale

markets to buy agricultural chemicals, while additionally, 42% accepted physical aid from local agricultural agents, experts, and local agricultural companies for their crops. COVID-19 triggered delays in payments from buyers (retail and wholesale market) in sales of agricultural products. This situation illustrates clearly how COVID-19 affected the economic interactions in Cyprus, entering a period of economic uncertainty. 71% suggested that there were much longer delays in payments compared to the same period in 2019.

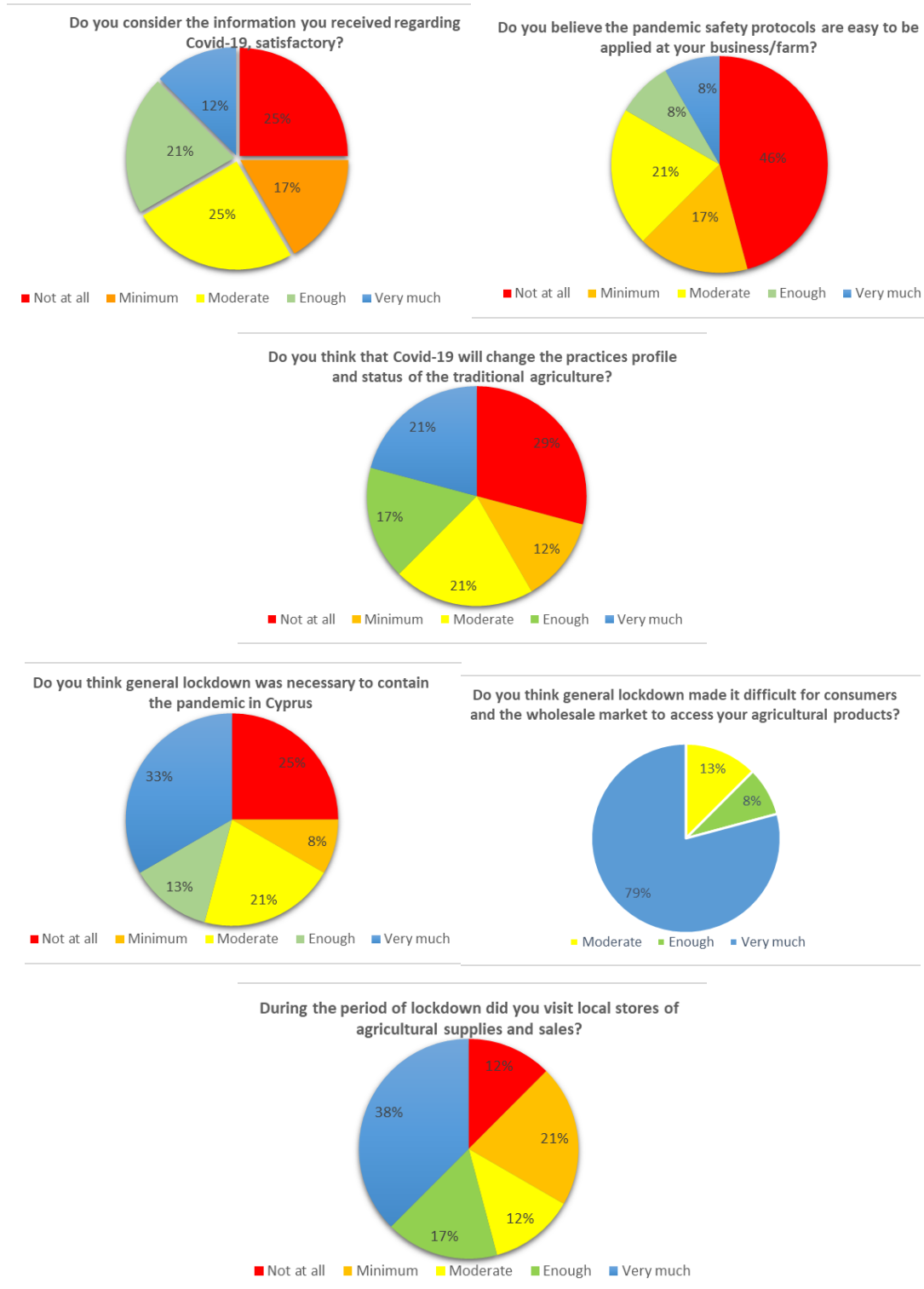
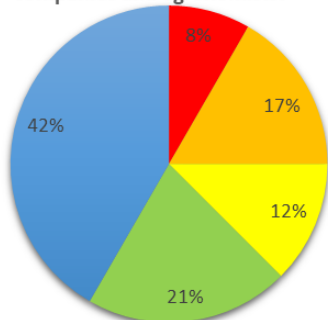


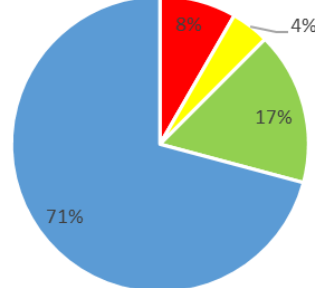
Figure 3. Questionnaire charts (part I).

During the period of lockdown did you get via physical presence advisory for your crops from agricultural companies and agronomists?



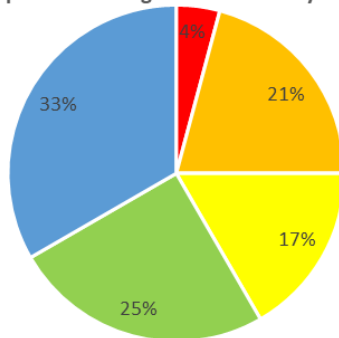
■ Not at all ■ Minimum ■ Moderate ■ Enough ■ Very much

During the period of lockdown were there any delays at your payments from buyers (wholesale & retail) from sales of your products, in addition to the usual delays that may have noticed in previous periods?



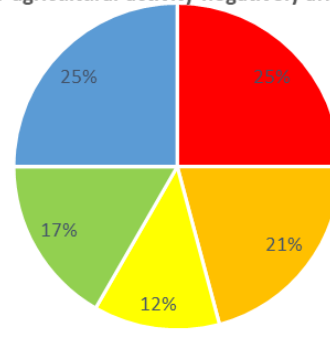
■ Not at all ■ Moderate ■ Enough ■ Very much

During the period of the lockdown was the degree of exercise of your professional agricultural activity affected?



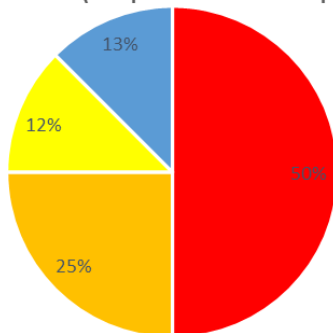
■ Not at all ■ Minimum ■ Moderate ■ Enough ■ Very much

During the period of lockdown was your access to the area of your agricultural activity negatively affected?



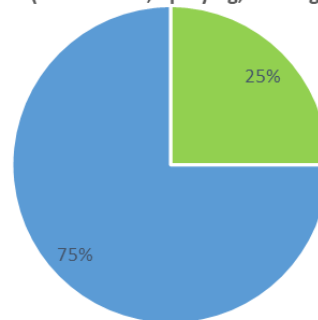
■ Not at all ■ Minimum ■ Moderate ■ Enough ■ Very much

During the period of lockdown your agricultural production was decreased? (Compared to 2019 same period)



■ Not at all ■ Minimum ■ Moderate ■ Very much

During the period of lockdown did you carry out cultivation works? (Fertilization, Spraying, Pruning e.t.c.)



■ Enough ■ Very much

Figure 4. Questionnaire charts (part II).



Figure 5. Questionnaire charts (part III).

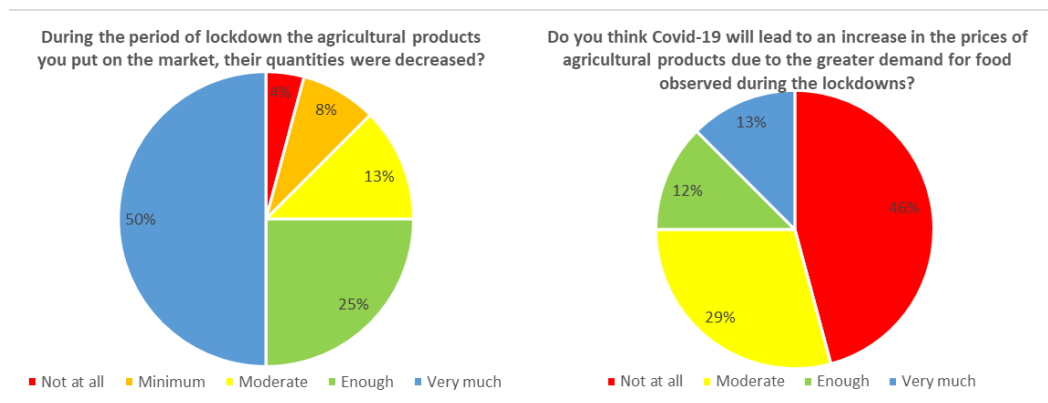


Figure 6. Questionnaire charts (part IV).

- Questions concerning exclusively production quantities and selling prices of agricultural products

In response to a query regarding the impact of the imposed lockdown on exercising their professional agricultural activity, only 8% reported that it was not affected, while 25% and 33% responded enough and very much, respectively. The individuals once again were equally divided in terms of which levels the imposed lockdown negatively affected their access to their agricultural holdings and the areas of their professional activity. A significant point from this study, is the fact that almost all participants (75%) during the period of the lockdown, carried out their cultivation program works such as fertilisation, spraying etc. with no disruption. COVID-19, as was highly expected hit the country's agricultural supply chains. More than 85% of the respondents reported significant difficulties to distribute their crops to markets. Regarding the economic indexes, only 8% noticed an increase in agricultural chemical prices and 17% reported moderate fluctuations.

- Questions concerning exclusively production quantities and selling prices of agricultural products.

Significant data were obtained regarding the quantity of local crops distributed at the markets during the lockdown period, as the 75% of participants declared the relevant quantity was highly decreased. To further extend, among those quantities that finally reached the markets, 79% of the respondents, calculate a minimum or zero increase in selling prices offered to final consumers. Finally, almost half of the participants (46%), expect the pandemic to lead to a sharp and sudden increase in selling prices of agricultural products due to the greater demand for food observed generally during lockdowns.

4. Discussion

COVID-19 threatens the stability of food chains, showing the magnitude of the existing fragility and gaps, under a burst of unexpected events such as pandemics. Food and Agriculture Organization reports that "livestock health represents the weakest part of the global health chain" [41]. The current pandemic among others reveals animal agriculture's vulnerability. The need to respond is urgent, otherwise new pandemics will rise in the future. To the same extent, the existing types of factory farms and the way that they currently operate are "the most likely epicentre of the next pandemic" [42]. The COVID-19 crisis has severely inflicted an economic global shock, as more than 170 countries, according to IMF soon or in near future will record a negative GDP [43]. Among the multispectral effects of the pandemic stand the rising unemployment, and the severe damage to foreign retail and wholesale trade, thus the direct negative impacts on construction, education, art, industry, and agriculture sectors [33].

The agricultural sector in Cyprus was drastically hit by the pandemic in several aspects. One of the dominant impacts concerns the non-availability of manpower to execute agricultural works, due to strict restrictions on movement during the general lockdown. The pandemic added an overwhelming burden on the normal fluxes in local food chains, as the majority of the questionnaire participants reported difficulties and gaps to offer their crops in the local markets and individual final consumers. In terms of economic aspects, potato producers across the country faced long delays in their payment transactions from the sales of their crops during the period of the lockdown and compared to the same period in 2019. Finally, the sudden disruption caused in potato cultivation procedures, resulted in a significant decrease in quantities distributed to the local agricultural markets.

Two key issues emerged during the Corona pandemic. The necessity of safeguarding biodiversity and the need to redesign the existing food production systems, thus, employ new ways to feed the society. In 2017, Professor Kwok-Yung Yuen—one of the co-discoverers of the SARS coronavirus—alerted that to avert another burst of SARS-like zoonosis "mankind should not interfere and disturb wildlife ecosystems and never put wild animals into markets" [44]. In the middle of April 2021, the WHO called for global alignment on halting the selling of living wild animals in traditional food markets [45].

Humans represent 36% of the mammals' biomass globally [46], and we interact with almost all ecosystems around the world [47]. The increasing global need for expansion of the agricultural sector, worsen this interaction. The need for local, sustainable, and regional food systems that will disrupt existing supply chain processes for the benefit of the local society is immense. Large scale supply chain organisations will have to accept that businesses are growing now also locally, and their markets should be regional [48], since absolute trust to supply chain partners as before the outbreak of COVID-19 has been deceived [49].

Minimising food waste as well could also contribute to this direction, since minimized food waste could guarantee products supply without interruptions even during future outbreaks [50]. Government allocated land for growing regional agricultural products is another solution to safeguard the viability of local markets [51].

The second key issue addresses the urgent need to rebuild a new way to feed the world. Our global food systems being highly stressed by the pandemic require a transition towards a more ecologically resilient and spatially localised food network [52]. Global existing current food systems are not sustainable, as one-third of food produced—almost 1.3 billion metric tonnes/year—is wasted [53]. Our current food supply systems need also to address the fact, that highly densely populated cities are highly dependent on exterior resources for energy, water, food, and materials [54]. Accepting the scenario that the population living in urban areas, by 2050 will grow up to 6.3 billion [16,55], these fluxes are estimated to get worsen even further [56].

5. Conclusions

The need to make society flexible and more adaptable in the events of future pandemics, and climate change, is as urgent as never before. The study showed that the labour force was confined because of the lockdowns, the dispersion of crops to markets was disturbed, there were long delays for new deals, and financial vulnerability was observed. The outcome of this work revealed that a global move towards establishing local markets is needed. The need for alternative solutions—again on a local level—appeared. Towards this direction, results from studies and reviews conclude that smart-innovative agriculture may result in the production of up to 140 kg/m²/year [57], via the selection of vertical farming methods, such as aquaponics, hydroponics, and aeroponics [58]. Among other key axes are the encouragement of family farming and the adoption of agriculture techniques that are able to increase soil health and fertility, which may guide policymakers and national legislations to stimulate urban production of vegetables, fruits, and some other animal products near urban populations.

6. Future Research

Fisayo and Tsukagoshi [53], categorized the pandemic effects into:

- First-order impacts: These are the immediate impacts of the infection, and our study did not focus on those
- Second-order impacts: These are indirect impacts, such as the impacts caused by the lockdown and measures executed to control the widespread, such as generally wellbeing, mental wellbeing impacts etc., where this study did focus on the consequences of the lockdown in a specific sector and not the impact on people's health.
- Third-order impacts: These are longer-term, roundabout impacts mainly related to social impact on linked directly on economy, businesses and, in specific, the agricultural sector.

Future research could be focused on measuring both the second and third-order impacts in the sector. A detailed analysis of the future impacts will shed light on one of the sectors that contributes the most to the Cypriot economy.

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