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GLOBAL FOOD SECURITY AND SOVEREIGNTY IMPACTED BY COVID-19 PANDEMIC

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ABSTRACT

The current health crisis due to the coronavirus SARS-CoV-2 is challenging several of the assumptions of a globalized world. There are severe consequences over food security and sovereignty, especially among the poorest and most vulnerable populations. Particularly, since any infectious disease outbreak is directly correlated to an increase in hunger and malnutrition. In the context of the COVID-19 pandemic crisis, this manuscript is set to analyze the impacts of the sanitary crisis on food security and sovereignty in the international context, and highlight how governments are acting to reduce consequences, through the use of an exploratory and analytical methodology. Hereon, some international government interactions: although the U.S. faced with confidence the health crisis at the beginning, the food crisis has overtaken, as a result of the growing unemployment. In Latin America, the pandemic is exacerbating food access and economic situation. The sanitary crisis has aggravated food shortages in Africa already going on, especially in rural areas. Asia suffered the most significant impact in food security. The new food security policy in the European Union aims to hold food security. Food insecurity and malnutrition are not just about agriculture production; they are also about food access limitations. In consequence, this health crisis cannot be allowed to become also a food crisis.

Keywords: COVID-19 pandemic, food security, food sovereignty, food system, socio-economic impacts.

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INTRODUCCIÓN

The COVID-19 pandemic is a global crisis (Sohrabi *et al.*, 2020). The severe consequences of this crisis have impacted the world population, especially the poorest and most vulnerable (Sumner *et al.*, 2020). The pandemic-induced economic slowdown has had a significant impact on employment, especially in developing countries. Around 80 % of the labor force was affected totally or partially by workplace closings (Kim *et al.*, 2020). Due to its impact on the food and agriculture sectors, it is essential to safeguard the continuousness of the food supply chains at national and international levels. The global food system is now tested, since it has been under pressure in the past year and perhaps the following years (FAO, 2020a). Agriculture is important in human development and is close related to food security (Poudel *et al.*, 2020).

Any infectious disease outbreak is directly correlated to an increase in hunger and malnutrition (Headey *et al.*, 2020).

According to the Food and Agriculture Organization (FAO), the world is confronting a difficult challenge in terms of transport logistics, since the countries cannot take food from one point to another due to mobility restrictions. Regarding farms and food industry workers, they might avoid engaging in agriculture tasks and food processing, causing labor shortages for the harvest and difficulties to bring food to the market (FAO, 2020b). As a result, it has been reduced the production of high-value foods, such as: fruits, vegetables and processed food (Swinnen and McDermott, 2020).

The closure of restaurants and the low purchase frequency in grocery stores reduce the demand for fresh and fishery products, affecting producers and suppliers (OECD, 2020a). The agriculture, fishing and aquaculture sectors are affected by tourism restrictions (FAO, 2020c), and the suspension of school activities (FAO, 2020a).

Although the vaccination is already available in most of the countries, the world is far from getting the level of immunity needed to be wholly safe. So that the outlook is not encouraging for both developing and undeveloped countries (Wouters *et al.*, 2021). Therefore, every country must generate strategies to allow food sovereignty, strengthen food production and its distribution system, while considering the most vulnerable population with higher relevance.

The hypothesis is that the sanitary crisis is affecting economic and social aspects around the world resulting in a food crisis, especially in vulnerable areas. Information analysis is required to identify the impacts of the sanitary crisis on food security and sovereignty in the international context. Hence, this research aims to contextualize how food security and sovereignty are being affected by the spread of the COVID-19 disease and what are doing some governments to reduce its impact.

MATERIALES Y MÉTODOS

Exploratory and analytical technics were used in three main steps: 1) Structure design, 2) Systematic literature search and information analysis, and 3) Review redaction.

In order to design the structure of this review, team members had a reunion to justify the need of the research and to formulate the principal questions and the objectives of the investigation; concluding that this pandemic, as have happened with other sanitary crisis, has exacerbated the risk to security and sovereignty of food, especially in vulnerable areas in the world.

The search was performed (January 2020 - February 2022) to process the information from the following databases: ScienceDirect, Elsevier, Springer and International Organization reports. Also, the information was constrained to a timeframe, the previous ten years.

The Systematic literature search and information analysis were carried out using the following search cycle (Figure 1).

The used method involved a regular investigation and tracking the source information in detail using a spreadsheet; the information was categorized by world

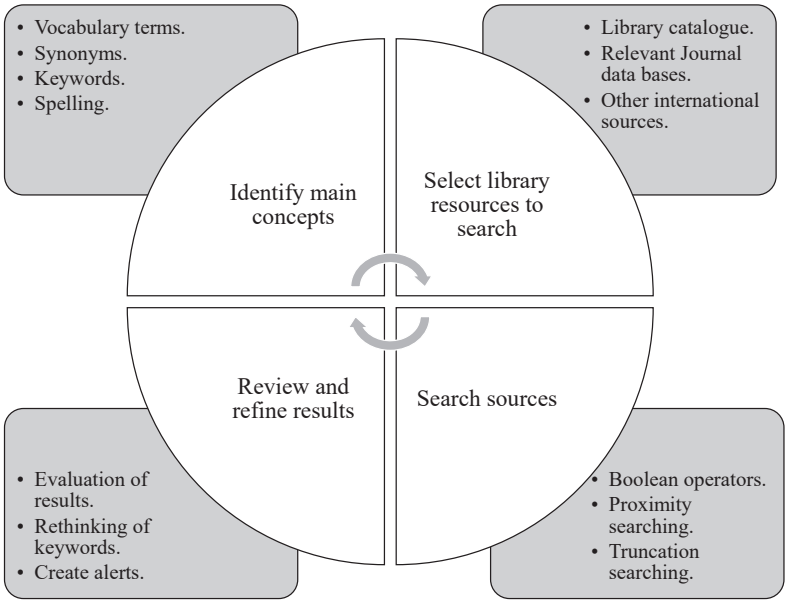

Figure 1. Search cycle (Charles Stuart University, 2018).

region, development status; socioeconomic, food security and sovereignty impacts; vaccination level and government actions. The information was organized this way to allow the analysis by region and the comparison between them following this search cycle.

Food security and sovereignty in the world

According to the FAO, "Food Security exists when all people, at any time, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 2020d). This concept is multidimensional, since it includes: the stability over time of food availability, its economic access and its biological uses. While, the term "Food Sovereignty" is defined as: "the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their food and agriculture systems" (Gordillo and Jeronimo, 2017). This term puts the aspirations and needs of those who produce, distribute and consume food at the heart of food systems and policies rather than the demands of markets and corporations.

Thus, the fundamental difference between "Food Security" and "Food Sovereignty" consists in the definition of the mechanisms through which the food supply must be ensured. While food security privileges productivism and international trade for food availability, food sovereignty proposes agroecological practices; short production and distribution circuits; as well as respect for cultural, genetic and ecosystem diversity.

Therefore, governmental and non-governmental worldwide organizations should have both, food security and sovereignty, as main objectives, especially in poorest countries and areas threatened by war or climate change. As data shows, the COVID-19 pandemic has put at risk both of them, food security and sovereignty, all over the world, especially in those areas under critical conditions. Hence, food equity must be ensured, through efficient systems of production and distribution from the reserves and international markets (UN-WFP, 2020a).

World trade restrictions have triggered shortages and elevate the prices of food items; similarly, travel limitations, interrupted flight operations, frontier closures and labor shortages have disrupted the food supply chains, which are essential to ensure stability in the supply (FAO, 2021).

Due to closures of workplaces, schools and restaurants, the demand of some daily products, such as perishable food, has been reduced, causing scarcity in some regions and food waste in others. Consequently, there is a gap to bridge between food waste and hunger.

The COVID-19 pandemic resulted in mass unemployment. Given the close relationship of poverty and food security, social protection measures must be prioritized to protect the vulnerable, especially the informal economy. A report from the U.S. Bureau of Labor Statistics shows that in march 2021, the economy added 916,000 jobs in the U.S. However, a large number of workers continue to file for unemployment compensation. The same situation occurs in other countries, so that the global economy recovery is uncertain, especially due to recent virus outbreaks in many regions.

Prior to the current pandemic, there were 820 million persons with no access to food; 2 billion individuals malnourished, and 700 million people lived under the poverty line (IFAD *et al.*, 2019). Projections are that 100 million people could need humanitarian assistance in the following years, and this number can rise if multilateral actions are not taken (UN-WFP, 2020a).

North America facing COVID 19 pandemic

Agri-food chains in North America, especially in the United States and Canada, have been distinguished for being highly efficient. Nevertheless, the first year of the pandemic exposed a surprising food chain vulnerability due to the near-total temporary loss of the foodservice distribution channel due to workforce outbreaks by COVID-19, which shows that special attention should be paid to how an unexpected crisis can cause harsh effects on food security. However, this continent region managed to quickly overcome the effects of the pandemic with prices and production levels similar to those typically observed in years prior to the pandemic (Weersink *et al.*, 2021).

Furthermore, the demand shifted away from foodservice to food retail, but the systems that have evolved to deliver food at the lowest cost to these end-users could not adapt quickly enough to such significant shock. Other structural changes will be felt through input markets, most notably labor, as the tendency to greater automation will continue to accelerate as a response of not having healthy and productive workers. Also, the

economic fallout induces changes in consumer food-buying behavior, ranging from online shopping and increasing purchases from local suppliers (Weersink *et al.*, 2021).

United States is already facing the COVID-19 impact

Early March 2020, when the pandemic effects were developing, the United States Government pronounced self-confidence on food security, based on three main input sources: domestic production, imports and storage (USDA, 2020).

In accordance with a forecast of the U.S. Dept. of Agriculture (USDA), the domestic production of agricultural commodities would be sufficient, since red meat production for 2020 was about 56.7 billion pounds, 3 % higher than 2019, while production of poultry meat was 51.6 billion pounds, 2 % more than 2019. Production of eggs and milk was also higher in 2020 compared with 2019. In addition, an USDA report on commodities in cold storage showed that at the end of February, total red meat in freezers was 5 % higher and chicken was 6 % more than the previous year. About cereals, wheat production in 2019/2020 was a little more than 2 % from last harvest season. Wheat supplies, particularly for bread wheats, was plentiful.

Regarding food importation, USDA reported that the forecast suggested that even countries heavily affected by COVID-19 spread would continue shipping food products and that there would be no immediate risks of massive disruptions in the global supply chain. There were food importations that accounted higher shares, such as fruits, nuts and some meat cuts, importations (USDA, 2020)

However, the economic downturn caused by the COVID-19 pandemic has already led to devastating consequences, since the current information shows that the U.S. are having a recession not seen since the Great Recession of 2007. Tens of millions of people have lost their jobs or reduced their hours worked, increasing poverty (Wolfson and Leung, 2020). Feeding America, the largest domestic hunger-relief organization, studied the impact of COVID-19 on food security, and they projected that 1 of 9 persons will experience food insecurity in the following years. This study also projected that 21 % of black individuals (1 out of 5) may experience food insecurity all 2021, compared to 11 % of white individuals. In response to this problem, the administration of the current president and the U.S. Department of Agriculture (USDA) have proposed several actions that will be carried out to ensure nutritious food.

Due to restrictions, access to food is also an element that has been impacted. Another strategy to address this will be implemented to improve the access to online purchasing, increasing the food access. Currently, USDA expands the SNAP Online Purchasing Pilot beyond the original 8 states. More than 1.5 million households in 46 states and D.C are using their SNAP benefits to purchase. Additionally, it is contemplated an increased support to U.S. territories, such as Samoa and Puerto Rico.

In addition, the nutritional supports that were already given in the schools to the students were maintained and increased. A health and nutrition program for young mothers and their children is also being supported, as well as nutritional support for students with difficulties and populations of young people living on the streets that were not previously contemplated (USDA, 2021).

Central America and Mexico

Central America and Mexico include the subtropical and tropical regions of the North American continent and comprise Mexico, Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica and Panama. The region has some of the largest, most productive, and technical agricultural systems, livestock feeding operations, intensive horticultural production systems for domestic consumption and export, and some highly marginalized, resource-limited subsistence agri-food systems. Nevertheless, some regions of these countries are among the poorest in the world (Lopez-Ridaura *et al.*, 2021).

The international trade agreements in the region and the non-traditional agricultural production have led to the migration of young people to urban areas and the United States; at the same time, they have created a massive inflow of remittances to rural areas. However, the incidence of rural poverty has not changed, especially among indigenous populations, nor the unequal distribution of land. Costa Rica stands out with the most equitable land distribution compared to Guatemala, the unequal country land (Lopez-Ridaura *et al.*, 2021).

However, the COVID-19 pandemic has affected the agri-food sector in the region, principally due to high infection rates, reduced mobility, decreased labor availability, disruption of the financial services, packaging-distributions facilities disrupted, contraction of national/international markets, delays in imports and exports.

Agri-food system inputs, such as: fertilizers, seeds, veterinary medicines and animal feed, became scarce and expensive when available in the region. Farmers in Southern Mexico reported that reduced mobility made it difficult to reach input shops. In Guatemala, producers of basic grains and vegetables saw an increase in the costs of agricultural inputs. In Honduras, producers stated that the retention of inputs in customs had created difficulties in maintaining their production, to mention just a few examples (Lopez-Ridaura *et al.*, 2021).

COVID-19 disrupts economies and food systems everywhere, but the poor suffer the most significant risk of food crisis. As can be seen in the North American continent, the risk of increased food insecurity depends on economic development. As employment and income opportunities fall for the poor, the gap between rich and poor grows.

Latin America and the Caribbean from a weaker position

Prior to the current pandemic, the Economic Commission for Latin America and the Caribbean (ECLAC), expected a 1.3 % of GDP grow in 2020. However, the health crisis has led to a GDP drop of at least 1.8 %. Further pandemic effects are forecasted as a reduction of more than 3 %.

The CEPAL (2020) stated that sanitary crisis affects the region through five main external channels: First, decline in the economic activity of its main trading partners, since the region dependent on several exports, the volume and value of which will be reduced by the global recession.

Second, price decay in primary products, due to the global demand contraction, particularly from China, the largest consumer and importer of primary products, will affect the exporters countries principally.

Third, interruption of global value chains, starting with Chinese suppliers and then European and American (USA) production, mainly affecting Mexico and Brazil, whose manufacturing sectors are the largest in the region.

Fourth, lower demand for tourism services due to travel restrictions. The tourism activity in the Caribbean has contracted more than 25 % in this area. The most affected countries are those island countries which economy depends on tourism, such as: Antigua and Barbuda, Belize, Barbados, Dominica, Guyana, Grenada, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago (UNECLAC, 2020).

Fifth, is the increased risk aversion and worsening global financial conditions. Current lower demand for the financial assets of the region and significant depreciation of the currencies.

These social and economic effects of the pandemic in Latin America and the Caribbean are a threat to achieve food security. Besides, in recent years, food security in the region has been deteriorated, now on the sanitary crisis worsens the situation (FAO, 2020d).

In South America, the prevalence of hunger in 2020 was 7.8 %. Between 2014 and 2020, hunger rose from 3.8 % to 7.8 % in South America, with an increase of 4 % over six years. It is important to mention that half of this increase occurred during the last year, in the context of the COVID-19 pandemic, taking the prevalence of undernourishment in South America to its highest level since 2007 (IFAD *et al.*, 2019; FAO *et al.*, 2021).

The pandemic impact over food systems and food security in the CELAC countries has varied, depending on the health policies and strategies established, the productive and commercial structures, the degree of income inequity and external factors related to energy and credit markets, or exchange rates (Figure 2), (FAO, 2020d).

Regarding the food demand, the pandemic is impacting the economic access of families. The economic decrease in the region has led to an increase in the unemployment rate from 8.1 % to 11.5 %, affecting the population whose income is necessary to acquire basic goods and elementary services (FAO, 2020d). The sector most exposed to unemployment represents 64 % of formal employment, which means an increase in informal employment, job instability and insecurity. This population does not have social security or savings to face the economic impact of a health emergency (OECD, 2020b).

In addition, social protection does not cover around 40 % of the population in rural areas where the situation is even more precarious. Before the end of 2020, the poverty in the region increased. CELAC estimated that the number of poor people in the region would grow from 186 to 214 million people, and the individuals in extreme poverty would rise from 67.5 to 83.4 million in 2020. Poverty and inequality restrict access to primordial goods and services, such as health services and food. In this regard, it is expected that a decrease in food consumption and quality will occur, mainly in countries with a high degree of inequality (FAO, 2020d).

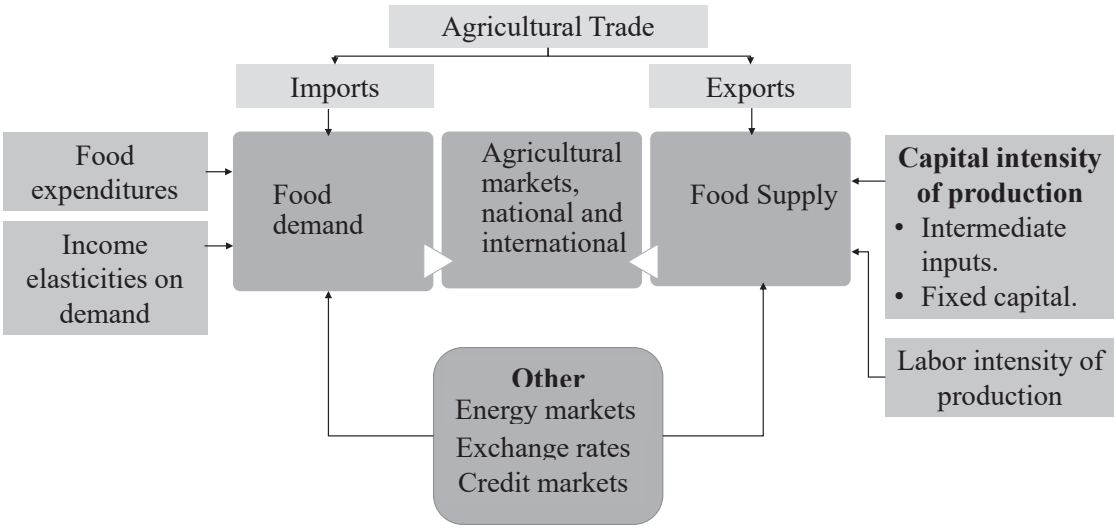

Figure 2. Main transmission channels of the impacts of the COVID-19 pandemic on food and agriculture.

For the food supply element, all indications for mobility restriction and social isolation have impacted all the way along the supply chain (ILO, 2020). A worldwide food price reduction was observed between February and March 2020, which resulted from a 4.3 % fall in the prices of major food groups (vegetable, cereals, oils, sugar, dairy and meat) motivated by reductions in demand as a consequence of COVID-19. Despite these price movements, the CELAC countries have shown no movements or general volatility in domestic food (FAO, 2020d). An analysis of the most critical effects of COVID-19 on the agri-food sector and the energy sector is included (Table 1).

Food shortages in Africa exacerbated by COVID-19

In Africa, the effect of COVID-19 is reflected in a considerable reduction in the production, distribution and storage of food (UN-WFP, 2020b). The measures that were taken to prevent contagion, such as social distancing and border closures, have led to a disruption in supply chains (FAO, 2020e). The food security is also affected by the climate change, growth population, low productivity, the economic turbulence and the social conflict, is currently worsened by the sanitary crisis and the arrival of pests (AAI and GCA, 2020).

Natural disasters and climate change in the region have reduced agricultural production, impacting the most vulnerable population, with probable long lasting and widespread consequences (FAO, 2020e). Rising temperatures and changed precipitation pattern affect the crop productivity and influence the agricultural pests and diseases. For example, cereal yields in Africa are in average about 1.5 tons per hectare, only half of those in South Asia. Africa is having natural disasters, such as:

Table 1. Analysis of COVID-19 effects, separated based on the trade balances of the agri-food sector and the energy sector (Schmidhuber *et al.*, 2020).

	Net food exporter	Net food importer
Net energy exporter	Bolivia, Colombia, Ecuador and Paraguay: Affected by lower export prices of both energy and agricultural products. An increase in the flow of food exports affects the supply and domestic prices of food, which provides incentives to establish export barriers to satisfy the domestic demand for food. Reductions in international prices and exports contribute to reduce the collection of tax revenues.	The Grenadines and Saint Vincent, Venezuela and Trinidad and Tobago: Benefit from lower agricultural import prices. However, lower international energy prices adversely affect them by reducing their energy export earnings, thereby undermining their ability to import enough food into international markets. Also, substantial depreciation in their currencies lead to increases in domestic prices of imported food.
Net energy importer	Argentina, Belice, Brasil, Chile, Costa Rica, Guatemala, Guyana, Honduras, México, Nicaragua, Perú and Uruguay: Affected by low international prices in the agricultural sector. Decrease in the inflow of foreign currency due to the drop in exports, putting pressure on the exchange rate, leading to an increase in the competitiveness of its agricultural products. Although the economy has become more dynamic, there is a risk of an internal shortage of products that are more frequently destined for export.	Antigua and Barbuda, Bahamas, Barbados, Cuba, Dominica, El Salvador, Granada, Haiti, Jamaica, Panama, the Dominican Republic, Saint Kitts and Nevis, Suriname and Saint Lucia: Benefit from lower international prices for energy and agricultural products. However, they are subject to possible affectations in the commercial flow due to interruptions in exports from surplus countries in these products or affectations in the transport chain of external or internal merchandise.

Schmidhuber *et al.* (2020).

infestation by locust swarms, which has wiped out entire crops in Sudan and floods in Yemen (IFPRI, 2020; IFPRI, 2021).

The social effects of the pandemic disturb directly or indirectly the food security, since the tourism is affected due to travel restrictions, which signified a loss of more than 14 million dollars. Remittances are essential for household consumption and monetary systems, such as those in: Zimbabwe, Lesotho, Mozambique, and Malawi, Egypt, Jordan and Sudan. However, the increased unemployment has reduced the currency inflows and household ability to purchase food (IFPRI, 2021). Many southern African countries are dependent on commodity exports to China; where the pandemic promoted recession and a prolonged reduction of the economy. This African area has weak sovereignty, high debt burdens, and volatile currencies (UN-WFP, 2020b).

A health crisis impacts agricultural production, with a repercussion in trade and marketing, rising food prices (AAI and GCA, 2020). In 2014, when Ebola spread in Guinea, Liberia and Sierra Leone, domestic rice prices increased by over 30 %, while cassava, a major staple in Liberia, shot up by 150 %. The rising food prices result in a dismissal of the rate of the Minimum Acceptable Diet (MAD) indicator, leading to increased malnutrition and hunger (UN-WFP, 2020b).

According to the Minimum Acceptable Diet (MAD) indicator, in Southern Africa, the MAD values fluctuated from 8 % in Zimbabwe to 23 % in Eswatini, in contrast to the international target of 70 %. The expectation with the COVID-19 crisis is a higher

reduction of the indicator for the following years, if governments do not take actions, since food prices often mirror urban-rural divisions as well. The affordability of a nutritious diet is higher in urban areas, even if it is more expensive because incomes are higher. However, rural areas are strongly impacted by seasonality since food prices rise higher in the lean season as compared to urban areas (UNICEF, 2020).

In principle, high food prices may represent a smallholder farmer´s opportunity for production increase. However, the incentives to produce more are affected by a lack of capital and increased input costs. For example, fertilizers have price risen much faster than finish good prices, as predicted by Rabobank (Diwakar, 2020).

Whether urban or rural, the poorest spend the largest income share on food and who have no asset access, such as land. Hence, COVID-19 could deepen food insecurity, malnutrition in Africa (WHO, 2020). Up to 73 million people in Africa live in acute food insecurity. Without urgent action, countries like: Burkina Faso, Nigeria, South Sudan and Yemen, will face famine in the following years (UN-WFP, 2020a).

Macro-level policies mitigate the socioeconomic impacts. A notable expansion of social protection programs has been implemented to support disadvantaged groups, but the high cost may lead to fiscal instability. COVID-19 is just one among multiple shocks that have hit the continent in recent years, and the risk of disease outbreaks and natural disasters are likely increasing. Building resilience will require food systems that promote inclusive investments (IFPRI, 2020; IFPRI, 2021).

Asia and the Pacific confronted the most significant effect

The COVID-19 pandemic has heightened food security risks in Asia and the Pacific. Due to major travel restriction, disruptions of domestic and international food supply chains have undermined food availability and accessibility (Kim *et al.*, 2020). At the beginning of 2019, the Republic of China followed a strict lockdown for two months, these lockdowns caused immediate and largescale impacts on entire stages of food supply chains, since China underpins the economies of many important countries on the continent, a slowdown in China results a disproportionate impact on trading partners (Swinnen and McDermott, 2020).

From the food supply, access to farm inputs became a challenge. Capital investments in the agriculture sector were postponed or even canceled due to weakening economic prospects. About 90 % of global goods trade is made via maritime, disrupted port facilities prevented the food import. Also, additional time and costs were imposed to handle cargo. In several developing economies in the region, the prices of rice and wheat had risen, partially due to adverse weather conditions in major Southeast Asia producer countries, but more broadly driven due to the pandemic disruptions to production and distribution, combined with panic buying (IFPRI, 2020; IFPRI, 2021).

For the food demand, the impact of the pandemic has varied. Prices of certain staple foods drove up due to panic buying and hoarding. Short value chain, such as for staple crops, may benefit from steady demand. In contrast, the medium value chains, such as perishable crops, could face lower demand due to income losses of the

consumers and food service industry closure. Agriculture supply chain disruptions had disproportionately affected vulnerable households that had lost their jobs.

The nutrition status of the most exposed and vulnerable to the COVID-19 crisis is a particular concern (IFPRI, 2020; IFPRI, 2021). As the incomes and livelihoods of the poor and vulnerable were threatened, their access to safe, diverse and healthy food was challenged since most micronutrient-rich foods are highly perishable and highly vulnerable to disruptions in food supply chains, therefore, to price hikes (Swinnen and McDermott, 2020).

The greatest impact on the global workforce was suffered in Asia and the Pacific at the first quarter, 115 million jobs or a 6.5 % decline, and a second quarter decline of 10 %. The informal sector in the region is at particular risk given their social protection limited access and low wages, requiring to perform multiple jobs to sustain incomes. Informal employment shows the highest share in South Asia (89 %), followed by Southeast Asia (76 %) and Central Asia (70 %). The countries with the highest risk of impoverishment because of the crisis are Bangladesh, India and Nepal, since 9 out of 10 workers are informal (Kim *et al.*, 2020).

Job losses are at higher risk if agriculture supply chains remain disrupted, since this sector is the largest in the region, accounting for 266 million workers, 37 % of total employment. The World Bank has projected a 20 % decline in migrant worker remittance inflows to low- and middle-income countries in 2020 due to the COVID-19 pandemic, with a more severe decline expected in Central Asia and South Asia. Since half of the remittances are spent on agriculture-related expenses in rural communities, domestic food production is already hurt as a result (Ponsot *et al.*, 2017).

Support for food security short-term

The Asian Development Bank (ADB) has acted to support consumers of its developing member countries, increasing coverage, relaxing trade conditions and enhancing the benefits of social protection programs. Many governments have provided financial relief and liquidity support to farmers, agrobusinesses and food processors, by extending and relaxing credit conditions. ADB has a role to play supporting and strengthening a regional food reserve or establishing a special food security fund (Kim *et al.*, 2020).

Support for food security medium and long-term

The movement towards agricultural technology is a long-term response to food insecurity, accounting for the impact of climate change, environmental degradation and shrinking natural resources, such as water and arable land. A change towards mechanization and digital agriculture may as well accelerate and make the sector more competitive.

Policy reforms should promote market transparency, fair labor, digitized land use planning and food quality control. Direct marketing through online platforms helps to facilitate trading, avoid food waste and mitigate the profit loss of the farmers by reducing multiple layers of intermediaries. An enhanced price risk management system, with information records of crop land use for production combined with

weather predictions, market arrival, traded stocks and delivery schedules, can facilitate collaborative planning among agricultural value chain actors (Kim *et al.*, 2020). For example, some Indian farmer groups exchanged information using online platforms, arranged their own transportation of goods and directly sold their produce at markets not affected by lockdown (Mishra, 2020).

New food security policy in the European Union

Italy was the first European country hit by COVID-19. Soon after, many other European countries were impacted by the pandemic.

Throughout Europe, although scarcity of food was not a real threat, a concern about food systems' resilience has grown in face of the current COVID-19 crisis (Vittuari *et al.*, 2021), the crisis increased consciousness on Food Sovereignty, especially in the potential exposure of food systems to new crises, in terms of food access, consumer conduct, small-scale productions, and alternative food networks (Vittuari *et al.*, 2021). The lockdown put the region under strain and increases the threat of longer-term food insecurity. The region identifies two threats to food security: food shortage, triggering price rises, and an inequitable distribution of the available food. After march 2019, 80 % of European countries reported an increase of people seeking food assistance. More than 25 % of the food production depends on seasonal workers from abroad. Border closures and halt in the movement of people slowed food production (Toffolutti *et al.*, 2020).

A mark on the European Union (EU) has been left by the COVID-19 global crisis, since the new food policy Farm to Fork strategy (F2F) was presented in May 2020, and it has demonstrated a renewed interest to guarantee during any nature pandemic the food security and sustainability, putting them at the central structure of the whole F2F. The Commission has recognized that the current COVID-19 pandemic can place both food security and livelihoods at risk. To mitigate food system risks and better safeguard Europe from similar disturbances in the future, it is essential to reflect on the overall resilience of the European tactical value chains. This F2F strategy presents a new approach to just how the EU can guarantee food security in the upcoming whereas sustainably producing and treating food. The F2F was built to give farmers the support they need to guarantee food security all across the EU (Fortuna, 2020).

The EU executives also put forward another proposal to increase the long-term sustainability of food systems: An EU Food Security Observatory, to oversee and report on the capacity of the EU to guarantee the accessibility of food supplies, as well as food affordability (European Commission, 2020).

Furthermore, prompted by the supply chain disruptions determined by the coronavirus pandemic, the European Commission has recently unveiled the Action Plan on Critical Raw Materials to lead the green and digital transition envisioned under the European Green Deal. This Action Plan on Critical Raw Materials is aimed to: Develop strong supply chains in the face of difficulties in supplying the various industrial environments of the EU. Reduce raw material dependency through innovation and the creation of

sustainable products. Increase the supply of raw materials in the EU. Improve food diversity for the supply of third-world countries by avoiding international trade preferences towards other places of less need.

The principal observations EU have obtained with those strategies implemented since the beginning of the pandemic and so far in 2022 are: the related lockdown measures favored more formal and consolidated national and global supply chains; localized and sustainable food production and distribution practices had to face challenges, such as interruptions in the supply or demand chains due to the lockdown and the need to identify new distributions channels; then a policy that consider local needs and conditions and recognizes the benefits related with localized and sustainable food production and distribution practices becomes urgent, as the principal objective of Food Sovereignty (Vittuari *et al.*, 2021).

Global analysis

Most developed (D) and moderately developed (MD/ND) countries are mainly located in the regions that comprise Asia, North America and Europe. In contrast, the countries with less economic development are found in the regions that comprise Latin America and Africa (Table 2).

Due to the pandemic, similar measures had to be taken in all regions to combat the spread of the disease, such as social distancing, movement restrictions, total or partial closure of non-essential commercial activities, and in some places even essential activities (Table 3). Education and many work activities had to be carried out from home. The analysis of the impacts by region showed that the socioeconomic effects have not been the same.

The main pandemic social impacts are: firstly, the significant number of infections and deaths, mostly in the regions of America (north, center and south), Europe and Asia; in contrast to fewer infections and deaths in Africa and Oceania. These situations have been related to mobility and social contact, which are higher in regions of high economic development and globalization. Other critical social impacts are the border restrictions, the closure of schools, unemployment, racism, increase in hunger, malnutrition rise and the level of vaccination against the coronavirus; It can be seen that unemployment, hunger, malnutrition and the low level of vaccination occur mainly in those regions with less development, which demonstrates a global disparity and little social interest for those regions with greater poverty (Table 3).

Although the economic crisis derived from the pandemic has occurred in all regions, the recovery has been slower in the regions of Latin America, the Caribbean and Africa than in the regions of North America, Asia, the Pacific and Europe, where the economic recovery, at this date, is favorable, although it has not reach pre-pandemic rates (Table 3).

Food security and sovereignty have presented greater fragility in Latin America, the Caribbean, and especially in Africa. The imports, exports, income and economic support have been affected by the socioeconomic impacts of the pandemic. These

Table 2. Main countries by region and their economic development level.

Region	Countries
North America America	Canada (D), United States (D), Mexico (MD), Central American countries (MD/ND)
Latin America and Caribbean	Region encompasses 33 countries most of them are MD/ND: * The Southern Common Market consisting of five countries in southern Latin America: Argentina (D/MD), Brazil (D/MD), Paraguay, Uruguay (D/MD) and Venezuela. * The Caribbean Community consisting of 19 island groups: Antigua and Barbuda, the Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, St. Kitts and Nevis, Saint Lucia, St. Vincent and the Grenadines, Suriname, and Trinidad and Tobago. * The Andean Community consisting of four countries: Bolivia, Colombia, Ecuador and Peru.
Africa	Of the 54 African countries, most of them are MD/ND: * North Africa: Algeria (D), Egypt (D), Libya (D), Morocco (MD), Sudan, Tunisia (D), Western Sahara (MD). * West Africa: Benin (ND), Burkia Faso (ND), Cape Verde (MD), Côte d'Ivoire (ND), Gambia (ND), Guinea (ND), Guinea-Bissau (ND), Liberia (ND), Mali (ND), Mauritania (ND), Niger (ND), Nigeria (ND), Saint Helena (MD), Senegal (ND), Sierra Leone (ND), Togo (ND). * Middle Africa: Angola (ND), Cameroon (MD), Central African Republic (ND), Chad (ND), Congo dem. Rep. (ND), Congo Rep. (ND), Equatorial guinea (ND), Gabon (D), São Tomé & Príncipe (ND). * East Africa: Burundi (ND), Comoros (ND), Djibouti (ND), Eritrea (ND), Ethiopia (ND), Kenya, Madagascar (ND), Malawi (ND), Mauritius (D), Mozambique (ND), Reunion (France), Rwanda (ND), Seychelles (D), Somalia and Somaliland (ND), South Sudan (ND), Tanzania (ND), Uganda (ND), Zambia (ND), Zimbabwe (MD). * Southern Africa: Botswana (D), Lesotho (MD), Namibia (MD), South Africa (D), Swaziland (D).
Asia and Pacific	Afghanistan (ND); American Samoa; Armenia; Australia (D); Azerbaijan; Bangladesh (ND); Bhutan (ND); Brunei (D), Darussalam; Cambodia(ND); Cook Islands; Democratic People's Republic of Korea (MD/ND); Fiji; French Polynesia; Georgia; Guam; Hong Kong (D), China (D); India (MD/ND); Indonesia (MD/ND); Iran (Islamic Republic of); Japan (D); Kazakhstan; Kiribati (ND); Kyrgyzstan; Lao People's Democratic Republic; Macao (ND), Malaysia; Maldives; Marshall Islands; Micronesia (Federated States of); Mongolia; Myanmar (ND); Nauru; Nepal (ND); New Caledonia; New Zealand (D); Niue; Northern Mariana Islands; Pakistan; Palau; Papua New Guinea; Philippines (MD/ND); Republic of Korea (D); Russian Federation (D); Samoa; Singapore; Solomon Islands (ND); Sri Lanka; Tajikistan; Thailand (ND); Timor-Leste (ND); Tonga; Turkey; Turkmenistan; Tuvalu (ND); Uzbekistan; Vanuatu (ND); Viet Nam (ND)
Europe	There are 44 countries in Europe, most of them are D and MD countries.

Developed (D), Medium Developed or No Developed (MD/ND).

impacts have exacerbated hunger, malnutrition and social inequality; additionally, their food production has also been affected since their production largely depends on supplies that, due to business closures or high costs, have not been possible to acquire (Table 3), putting food sovereignty at risk, which allows survival in the local environment.

Finally, the most developed regions seem to be moderately or even highly prepared to face the socioeconomic impacts of this pandemic, since they have provided an immediate response to the needs of their population in terms of vaccination, once the approval was released, economic and food assistance programs, market diversification among other strategies (Table 4). On the other hand, few efforts have been made in

Table 3. Socio-economic pandemic impacts on food security and sovereignty worldwide.

Regio / average Vaccination %	Pandemic impacts		
	Social	Economic	Food Security and Sovereignty
North America: * 62 %	* Hunger has increased throughout the pandemic: 30 million adults and 12 million children impacted. *Black and Latins suffer more food insecurity. * Increased food demand due to consumer panic buying. * The demand shifted away from foodservice to food retail	* U.S. was forced into an economy crisis due to unemployment, and falling behind on housing payments. * Canada, Mexico and the rest of the North follow this trend.	* Agricultural markets remain regularly supplied and food was affordable. * U.S. struggled with food insecurity. * Food insecurity increased in prevalence from 54% to 64%. * Two Canadian studies reported prevalence of pandemic food insecurity of 14.8 %.
Latin America and Caribbean: * 60 %	* Rise in hunger and food insecurity levels were exacerbated. * most pronounced rise in relation to other world regions, the prevalence of moderate to severe food insecurity grew by 9 %. * Education has been interrupted across the region.	* The International Monetary Fund (IMF) reported a 7.0 % economic contraction for Latin America and the Caribbean in 2020. * Caribbean nations that depend on tourism had deep economic recessions, several with estimated economic declines over 15 % in 2020. * Several South American nations were hard-hit with economic contractions over 10 %. * Economic contraction in 2020 increased poverty and exacerbated income inequality. Latin America and the Caribbean report estimated 22 million people in Latin America moved into poverty in 2020, 3 % more than 2019.	* During 2020, in Latin America and the Caribbean, 60 million people more than in 2019 did not have physical or economic access to food in the quantity and quality required for their health and development. * In South America between 2014 and 2020, the prevalence of moderate or severe food insecurity increased by 20.5 %, while in Mesoamerica there was an increase of 7.3 % during the same period. * According to the FAO, Food Price Index also experienced a downward trend, with sugar and vegetable oil prices showing the strongest declines –14.3 % and 5.2 % respectively. * A decline in export volume by the slowdown in consumption and economic activity of the principal trading partners. * The agricultural export sector faced complications in its operations due to soaring prices and logistical restrictions.
Africa: * 12 %	* Social distancing and border closures. * Fewer flights to the region. * Tourism is affected due to travel restrictions. * Increase in malnutrition and hunger especially in all ND countries. * Increased food demand due to consumer panic buying.	* The rising debt levels have led to increased vulnerabilities. * Limited savings and access to public safety nets. * Increased unemployment * Increased in poverty. * Gross domestic product (GDP) slowdown. * Exports slowdown to China in South Africa.	* A lack of pesticides is also hampering efforts to contain pest outbreaks, including the current locust outbreak in East Africa. *Rise in fertilizer prices. * Reduction in the production, distribution and storage of food * Fishing activities have been reduced in different part of Africa. *Rise in food prices.

Continue Table 3

Table 3. Socio-economic pandemic impacts on food security and sovereignty worldwide.

Regio / average Vaccination %	Pandemic impacts		
	Social	Economic	Food Security and Sovereignty
Asia and Pacific: * 65 %	* Limited mobility, lockdowns and regulated travels. * Lost jobs and reduced work hours. * Closed Schools. * School meal programs were suspended affecting low-income children's access to healthy and balanced diets. * China slowdown resulted in a disproportionate impact in Asian and pacific partners.	* Capital investments in the agriculture sector are postponed or even canceled due to weakening economic prospects. * Additional time and costs in cargo handling.	* Border closures and lockdowns limiting the movement of goods and people. *Access to farm inputs—such as seeds, fertilizers, and crop protection products—became challenging. * Processing and packaging facilities closed due to quarantines. * Disruptions to production and distribution. * Affections in household food consumption due to low household income and reduced mobility to groceries, restaurants, and other retail food shops.
Europe: * 64 %	*Death and illness of workers. * Lockdowns. * Border closures and halt in the movement of people. * Shortages and movement restrictions.	* The value of the output of the agricultural industry declined by 1.4% in 2020 compared to 2019. * Farm incomes also declined compared to 2019 (-7.9% corresponding to 7.1 billion EUR). * Conversely, retail sales increased with online food sales.	* Food shortages. * Triggering price rises. * Inequitable distribution of the available food. * Low production.

the less developed regions to maintain their socio-economic security (Table 4). These regions have shown the lowest vaccination level and an increase in hunger and malnutrition. These situations had not been seen since the last crisis, which has led to a step back for those efforts to combat these long-lasting regional problems.

CONCLUSIONS

Malnutrition and food insecurity are about access and disruption of the food system, as a consequence of the fluctuations of the assets value and currency, as well as inflation, and all the opportunities of exchange in social, commercial, political and cultural aspects.

The widespread concern on nutrition being affected by food price increases is because of the large share of food expenditure household in developing countries. Food prices have an impact on the distribution of income in the population.

Enhanced regional mechanisms are required to appropriately distribute the food reserves in the international market and prepare for the positive crop forecasts, and to prevent food shortages and price spikes by ensuring free trade for food security. South-South and Triangular Cooperation are organizations to strength agriculture systems,

Table 4. Goverment action to pandemic impacts on food security and soveregnty.

Region	Main government actions	References
North America	* Guaranty struggling families could get the nutritious food.	* USDA, 2020. * USDA, 2021. * https://covidvax.live/
Latin America and Caribbean	* An important factor for the region's economic recovery is the availability and distribution of vaccines. * Many countries have implemented relief programs to help protect their economies and vulnerable populations, using increased external financing, such as: the IMF, Inter-American Development Bank, and World Bank.	* FAO *et al.*, 2021. CEPAL, 2020. * Sullivan & Meyer, 2021. * Van Teijlingen & Hogenboom, 2020. *Schmidhuber *et al.*, 2020 * https://covidvax.live/
Africa	* Social protection programs have been implemented, but not enough.	* FAO, 2020e. * Schmidhuber *et al.*, 2020. * UN-WFP, 2020b. *IFPRI, 2020. * IFPRI, 2021. * AAI and GCA, 2020.
Asia and Pacific	Immediate and short-term support: * Increasing coverage, relaxing conditionalities, and enhancing the benefits of social protection programs. * Immediate support to enhance smallholder farmers' access to markets. * Provide financial relief and liquidity support to farmers, agribusinesses, and food processors under financial stress. * Countries collaboration to avert food shortages and price spikes by ensuring free trade and strengthening regional mechanisms for food security. Medium- and long-term support for the agriculture supply chain: * Direct marketing through online platforms. * Enhanced price risk management system. * Movement toward agricultural technology. * Institutional and legislative reforms. * Targeted support to poor and smallholder farmers through agricultural reforms.	* Kim *et al.*, 2020. * Swinnen and McDermott, 2020. * IFPRI, 2020. * IFPRI, 2021.
Europe	* The EU response has been highly effective in preserving the integrity of the local markets. * The Commission of European Union (EU) introduced 'the green lanes' for vehicles carrying agri-food products to ensure free and fast movement on borders. * Free movement of agri-food and seasonal workers for enabling them to reach their workplace and exercise their activities. * The commission extended the farmers' application deadline to receive income support to support farmers and agri-food business to ensure liquidity. * Farm to Fork strategy (F2F) of 2020 demonstrated a renewed interest to guarantee the food security and sustainability.	* Vittuari *et al.*, 2021. * Toffolutti *et al.*, 2020. * European Commission, 2020. * Montanari *et al.*, 2021.

The references used for each region in this table also correspond to each region in Table 1 and Table 2.

in order to open market access improving technology and agricultural finance to key actors in food supply chains, such as family farmers and smallholders.

Lessons learned by this health crisis are used to develop long-sought agricultural reforms into the economies. The ultimate economic impact depends on the actions taken at the national, regional and global levels. Food security and nutrition require rapid response and longer-term planning. This pandemic is developing a food crisis, especially in vulnerable world areas.

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