THE IMPACT OF COVID-19 ON SDG 2 – ZERO HUNGER: CHALLENGES TO BALANCE IP PROTECTION WITH FOOD SECURITY

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ABSTRACT

The COVID-19 pandemic was a multidimensional situation and an unprecedented global challenge that has far-reaching effects on food security. This article analyses the multipronged effects of COVID-19 on food security, the challenges it has posed, and the immediate responses initiated at the national as well as international level, along with lessons learnt during this unprecedented crisis. All four aspects of food security: physical access, availability, stability, and utilization have been hampered by the pandemic. The research study's objective is to evaluate how COVID-19 affects food security. The investigation was a global analysis but with a focus on food-insecure countries. This is accomplished by using facts from a range of sources, such as the Food and Agriculture Organization (FAO), the Global Report on Food Crises (GRFC) 2023, and the most recent report on the State of Food Security and Nutrition in the World 2023. According to this research, COVID-19 has significantly impacted food supply chains, hunger, global food trade, food prices, nutrient-dense food, and the shortage of agricultural labour. Developing nations are disproportionately affected by the food security issues caused by COVID-19 due to their strong reliance on protecting their food supplies. The outbreak has also highlighted the significance of global collaboration and the necessity of addressing basic problems in global food systems in times of disaster.

Key Words: Food security, Economy, Supply chain, Sustainability, Economy, COVID-19 pandemic

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INTRODUCTION

The occurrence of the COVID-19 pandemic in late 2019 initiated an unparalleled global disaster. Due to its immediate health effects, the epidemic had a significant impact on economies, societies, and everyday life in other parts of the world. Food security, a crucial pillar of human well-being, is one life-threatening issue that has been significantly impacted by the pandemic. In 2022, 122 million more people worldwide were starving than prior to the COVID-19 pandemic, according to the most recent report from The State of Food Security and Nutrition in the World, 2023. The study also predicted that by 2030, almost 600 million individuals would suffer from chronic malnutrition. According to the most recent Global GRFC report 2023, the number of people who are facing acute food insecurity and who require immediate food and livelihood support is rising. Additionally, the GRFC research reveals that the COVID-19 epidemic and the crisis in Ukraine are causing acute food insecurity and hunger for more than a quarter of a billion people. Food security, a complex idea centred on everyone's access to, availability of, use of, and stability of wholesome food, rose to the top of international worries as the pandemic progressed.

The food security disruption caused by the pandemic, ranging from supply chain interruptions to upheaval, raised pressing questions about the adaptability and resilience of food arrangements worldwide. The primary objective of this research is to investigate the various ways in which food security has been affected by the COVID-19 pandemic. In order to safeguard food security in the face of future challenges, the study examines the responsibilities encountered, the national and international responses, and the lessons learnt. Food security is greatly impacted by the interaction of public health, the environment, and the economy, as we navigate the turbulent waters of the pandemic's aftermath. This research study considers the opportunities and vulnerabilities that affect global food systems by examining this link and assessing the effects of pandemics on food security and upcoming disruptions.

To what extent did the pandemic affect the nutritional quality and diversity of food? How has COVID-19 affected the agriculture industry? How does COVID-19 affect hunger, malnutrition, and food prices? What are workable plans and regulations to handle shocks to food security in the event of a pandemic in the future? What effects does intellectual property protection have on SDG 2 and food security? What policy room

do WTO member states have to strike a compromise between food security and intellectual property protection?

How COVID-19 Influenced Food Security

Food security is defined in a variety of ways. Food security is defined by the FAO) as all people have the right to appropriate physical, economic, and safe access to meet their nutritional needs at all times, as well as to choose their own dietary preferences to live an active and healthy lifestyle (Ahn and Nowood, 2021; Reynolds et al., 2019). The FAO acknowledges economic and physical access to food at the household, national, and international levels, along with the four conventional aspects of food security: the physical availability of food, sufficient energy or food utilization, nutrient intake for maintaining good nutritional status, and the stability of these three dimensions Over time, the idea of food security has changed to incorporate the significance of additional components like agency and sustainability. The Committee on World Food Security (CFS) has suggested these two further elements of food security: agency and sustainability (FAO et al., 2023). Agency in food management denotes to a person's or an organization's capacity to choose what food they produce, consume, or how that is prepared, processed, and delivered.

Furthermore, sustainability is the capability of food systems to provide food security and nutrition over an extended period of time (Liverpool-Tasie et al., 2019). In contrast, a food crisis arises when severe food insecurity and malnutrition levels grow dramatically on a local or national scale, necessitating emergency food assistance.According to the GRFC (2023), people who already suffer from long-term hunger and food uncertainty are more vulnerable to food crises.

Food is specifically stated in Article 25 of the Universal Declaration of Human Rights (1948) as a component of the right to a standard of living (suitability of food to protect the health of the family and individual). Since 1948, international sessions and conferences have focused on the right to food. All states, with the exception of the US and Australia, agreed in the Rome Declaration on Global Food Security (1996) that food is a fundamental human right (Chilton and Rose, 2009). The SDGs 17 and 169 represent an ambitious agenda that strikes a balance between the social, economic, and ecological aspects of maintainable growth.

By 2030, the overall objective is to end hunger and poverty worldwide, address inequalities within and between countries, create inclusive, peaceful, and equitable societies, respect human rights, advance gender

equality, empower women of all ages, and guarantee the sustainable preservation of the planet and its natural assets (Resolution, 2015). The private sector will need to work with governments, parliaments, multistakeholder partnerships, and the UN to achieve the SDGs (UN Global Impact, 2016). The effort has been constant. Thus far, the COVID-19 epidemic has forecasted the whole global food supply chain, from production to consumption (Fleetwood, 2020). Lockdowns, boundary closings, and transport restrictions brought on by COVID-19 upset supply chains and caused delays in the flow of food and agricultural goods. In certain nations, this disruption had an impact on food accessibility and availability, leading to shortages and exorbitant costs.

Disruption of Food Supply Chains

Lockdowns, border closures, and transportation restrictions brought on by COVID-19 upset supply chains and caused delays in the flow of food and agricultural goods. In certain nations, this disruption had an impact on food accessibility and availability, leading to shortages and exorbitant costs.

Agricultural production, processing, postharvest management, distribution services, and consumption are the five phases that make up the food supply chain. The food supply chain usually employs two strategies for food safety and quality. The first is predicated on voluntary norms set by international organizations or market regulations.

The second is predicated on laws and rules that work legally binding principles that are examined by state agencies (Aday and Aday, 2020). In contrast to diseases like listeria, foot and mouth disease, Escherichia coli, or bird flu, the COVID-19 plague has no direct impact on food production because it does not spread through livestock or agricultural products (FAO, 2020). Apart from labor migration, however, the transportation of products by land, air, and sea was severely restricted by governments everywhere. Several studies state that with the pandemic limitations, the proportion of trucks employed for food transport in France dropped to 60% (FAO, 2020). An appeal was made to the jobless in France to work in the fields because border regulations prevented many skilled harvest workers from entering other nations. Additionally, hiring 70,000 Britons to work in the fields and during harvest was the aim of the Pick for Britain campaign (Plants, 2020).

Numerous accounts exist of farmers being compelled by transportation restrictions to destroy their dairy and agricultural products by either burning them or letting them spoil. Dairy farmers in America cooperative

estimate that during the pandemic, 14 million litres of milk were discarded daily as a result of the disrupted supply chain. The chair of dairy farmers stated that in a single week, about 5 million litres of milk in England were in danger. It was also reported that logistical difficulties caused tea plants to be lost in India (BBC News, 2020). For the food industry, maintaining logistical efficiency is essential, particularly during international emergencies. The two primary issues in the food supply chain are getting raw materials from suppliers and keeping food moving from producers to consumers (Alonso et al., 2007).

In the USA, the pandemic affected at least 257 food processing facilities and 462 meat packaging and production facilities. As a result of COVID-19, at least 232 workers died, including 14 farm workers, 34 food processing workers, and 184 meat packaging workers. Out of a total of 54,036 workers, 8,343 were food processing workers, 3905 were meat packaging workers, and 5,788 were farmers (The Fern, 2020). According to the State of Food Security and Nutrition in the World report 2023, billions of people lack access to inexpensive, healthful food due to the pandemic's persisting effects on people's poor earning, general inflation, and the rising expense of a good diet. Hunger in the world today still far exceeds that of the COVID-19 pandemic. A. This analysis indicated that between 690 and 783 million people were hungry globally in 2022. More than 122 million more people than before to the pandemic. But there's no reason to be complacent while hunger is still rising in Western Asia, the Caribbean, and Africa. The Sustainable Development Goal of ending hunger by 2030 is still an unmet goal in these conditions (FAO, 2023).

The COVID-19 Impact on SDG 2 - Zero Hunger

According to estimates by the United Nations, millions of people were forced into food crises and situations of hunger during the pandemic, marking a record high for "the number of people experiencing acute food insecurity". A hunger pandemic might swiftly follow the COVID-19 pandemic, doubling acute food insecurity, according to World Bank estimates that 40 to 60 million people will be living in life-threatening poverty by the end of 2020 (Pangestu, 2020). Acute hunger affected 258 million people in 58 countries in 2022, up from 193 million in 2021 and 155 million in 2020, according to the 2023 Global Report on Food Crises.

Currency devaluations, African swine fever, and pests like locust infestation have all contributed to the detrimental effects of the COVID-

19 drought (Klare, 2020). Additionally, the pandemic's lasting effects on people's disposable income, the rising cost of a healthy diet, and the general increase in inflation meant that billions of people remained without access to affordable nutritious food. The world hunger is measured by the prevalence of undernourishment remained comparatively unchanged from 2021 to 2022, but it is still far above pre-COVID-19 pandemic levels, affecting around 9.2% of the global population in 2022 compared with 7.9% in 2019. Between 691 and 783 million people globally experienced hunger in 2022, according to the State and Nutrients and Food Security report released in 2023. In Africa, Undernourishment rose from 19.4% in 2021 to 19.7% in 2022, primarily in Southern and Northern Africa. The number of hungry individuals in Africa has increased by 11 million since 2021 and by about 57 million since the COVID-19 pandemic (FAO, 2023).

	2017	**2018**	**2019**	**2020**	**2021**	**2022**
World	**7.5**	**7.6**	**7.9**	**8.9**	**9.3**	**9.2**
Africa	**16.5**	**16.6**	**17.0**	**18.7**	**19.4**	**19.7**
Northern Africa	6.0	6.0	5.8	6.0	6.9	7.5
Sub-Saharan Africa	18.9	19.1	19.5	21.6	22.2	22.5
Eastern Africa	26.2	26.0	26.7	28.1	28.4	28.5
Middle Africa	23.7	24.4	24.8	27.6	28.5	29.1

Southern Africa	7.8	7.7	8.3	9.5	10.0	11.1
Wester Africa	10.6	11.1	11.0	13.7	14.5	14.6
Asia	**7.0**	**7.1**	**7.4**	**8.5**	**8.8**	**8.5**
Central Asia	3.5	3.1	2.8	3.3	3.2	3.0
Eastern Asia	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
South-eastern Asia	5.8	5.5	5.3	5.3	5.3	5.0
Southern Asia	12.2	12.3	13.3	15.6	16.4	15.6
Western Asia	9.8	10.3	10.3	10.5	10.2	10.8
Western Asia and Northern Africa	8.1	8.3	8.2	8.4	8.7	9.2
Latin America& the Caribbean	**5.8**	**5.9**	**5.6**	**6.5**	**7.0**	**6.5**

Caribbean	13.2	14.0	14.2	15.2	14.7	16.3
Latin America	5.2	5.3	4.9	5.9	6.4	5.8
Central America	6.1	6.1	5.1	4.8	5.0	5.1
South America	4.9	5.0	4.9	6.3	7.0	6.1
OCEANNIA	**6.1**	**6.4**	**6.4**	**6.0**	**6.6**	**7.0**
NORTHAN AMERICA AND EUROPE	**<2.5**	**<2.5**	**<2.5**	**<2.5**	**<2.5**	**<2.5**

FAO, IFAD, UNICEF, WFP, and WHO are the sources (2023). Protecting against economic downturns and slowdowns, FAO, Rome, "The state of food security and nutrition in the World 2023," p. 9.

Impact on Agricultural Labour Shortages

The food sector and agriculture are exceedingly integrated into the global economy and trade (Ahn and Steinbach, 2023). The measures to contain the virus, such as lockdowns and social distancing, hindered the availability of agricultural labour, particularly in labour-intensive sectors like harvesting. This, in turn, impacted harvesting schedules and crop production.

The COVID-19 pandemic affected global relations as well as the labour strength in the agriculture and food sector. This includes assertions of export limitations in multiple nations that restrict market entry and international trade in agri-food (Laborde, 2021). Globally, the agri-food industry is very interconnected. Due to widespread "supply chain disruptions caused by the COVID-19 pandemic, international ports" were scaled back or closed, commercial flights carrying agricultural products had significantly reduced consignment capacity, and critical access to agricultural inputs and markets was restricted (Ivanov, 2020).

To stop the virus from spreading, nations all over the world put in place a number of preventive measures, such as closing shopping centres, enforcing quarantines, and placing limitations on places to travel, stay, and eat. Additionally, by outlawing floor trading, the markets took things a step further and affected the ability to swap supplies (Nicola et al., 2020). Pandemic put the agricultural sector's resilience to the test. Along with restrictions on consumers and buyers as well as a shift in traders' behaviour away from farmers, food producers also experienced significant losses on perishable and nutritious food. The Agriculture Commodity Price Index was observed at its highest level since 2013, and as of June 15, 2022, it was approximately 33% higher than in 2020. This is a fact that the impact of COVID-19 on agriculture was different in developing countries as compared to developed countries. Developed nations rely heavily on technology, which mitigates the pandemic's effects on agriculture by increasing production and reducing the need for human labour. In contrast, developing nations are more susceptible to the pandemic's negative effects because agriculture in these nations employs a large amount of human labour (Mouloudj et al., 2020). Due to quarantine regulations, workforce reductions brought on by COVID-19 deaths and severe illnesses, and other factors, labour was restricted in a number of countries. Significant limitations have been placed on labour movements and programs for foreign workers, which are essential to the production of agricultural products in certain industries (Stephens et al., 2020).

Trade Restrictions and Changes in Food Prices

Rising food costs in some nations were caused by increased demand and supply chain disruptions for specific essential items. People found it increasingly difficult to afford wholesome diets as a result. In the month after the COVID-19 virus first appeared in the United States, export,

import, consumer, and producer prices were more erratic due to supply chain interruptions and demand shocks. The pandemic's erratic economy had a particularly negative impact on dairy, fish, eggs, and meat (Mead et al., 2020). Some nations restricted the export of necessary food items during the pandemic in order to protect their domestic supply. Strict export laws disrupted the global supply chain and affected the availability of food in overseas markets (Marlow, 2020). Farmers suffered from a lack of agricultural inputs as a result of the disruption of international trade. One of the major producers and exporters of fertiliser worldwide is China. For example, during the Kharif season, India requires approximately 26 million quintals of agricultural seed (Torero, 2020). As a result of the pandemic conditions, crops like spring maize, wheat, canola, barely, and open-field vegetables cannot be sown.

Due to the COVID-19 epidemic impacts, consumers have changed their foodstuff purchasing patterns as a result of high prices of the commodities. There are several indications that the COVID-19 pandemic will have a significant impact on agriculture and the food supply chain, particularly upsetting food demand and, eventually, food security and severely harming the most vulnerable group (Siche, 2020). The supply of certain fresh items and staples has been scarce in grocery stores, and many farmers who sell directly to consumers have seen their marketplaces closed during this time, while demand for other products has increased (Schmidt et al., 2020).

Meat import prices dropped by 2.3% in January 2020 (Haley and Gale, 2020). The COVID-19 pandemic in 2020 caused China to leave the Australian beef market in large part, increasing the amount of beef available on the global market (Condon and Nason, 2020). Prices for imported meat continued to fall, down 8 percent from 2020, due to weak Asian demand. The decline in US export meat prices was a result of the reduction in global meat demand, especially from Asia. From March to May of 2020, the percentage of US dollar exports of meat products and meat packing foodstuffs fell by 22.5% (Bureau, 2023). The COVID-19-related decline in demand and supply chain disruption surprised both import and export prices for fish and shellfish. Lobster prices fell as a result of a general “decline in demand from restaurants and the cruise industry, which effectively shut down the market” (New Year Times, 2020).

Effect of COVID-19 on Nutritional Foodstuff

Malnutrition can result from food instability, both over nutrition and undernutrition, as people may resort to low-priced, less nutritious food options. The State of Nutrition and Food Security in the World report from 2023 defines nutritious food as safe foods that contribute essential nutrients, such as vitamins and minerals, fiber, and other components to healthy diets that are beneficial for growth, health and development while preventing malnutrition. In addition, the report offers updates on five of the six diet objectives that were first approved by the World Health Assembly (WHA) in 2012 and were expected to be accomplished by 2025. The WHO and the UNICEF have since recommended extended 2030 targets for these targets. Diets and nutrition have been adversely affected by the COVID-19 pandemic (Husain et al., 2022). The pandemic's negative impacts on diets arose in various ways: mobility restrictions lessened food access (Margolies et al., 2022); reduced household incomes required lowering food expenses; residents faced increased food prices or decreased food availability; and the epidemic affected behaviours and approaches toward foods. In addition to having a detrimental impact on mental health, low incomes and social distancing practices can also raise stress and anxiety levels and alter or even worsen relationships within households (Ragasa et al., 2023). Diet adequacy for women was particularly low in Uganda, Rwanda, and Nigeria. Changes in food access brought on by COVID-19 are especially concerning in these situations in these countries because there were already problems with food security before the epidemic began (FAO, 2023). Achieving

	Severe food insecurity prevalence (%)		Moderate or severe food insecurity prevalence (%)	
	MEN	**WOMEN**	**MEN**	**WOMEN**
WORLD	**9.5%**	**10.6%**	**25.4%**	**27.8%**
AFRICA	**22.9%**	**23.4%**	**58.7%**	**59.9%**
Northern Africa	11.3%	12.3%	30.9%	32.8%
Africa (Sub-Saharan)	26%	26.3%	66%	66.8%
Africa (Eastern)	27.1%	27.7%	68.1%	70%
Africa (Middle)	39.6%	38.4%	78%	78.4%
Southern Africa	12.2%	12.4%	26%	25.1%
Africa	21.5	22%	66%	66.4%

(Western)	%			
Asia	**8.5%**	**9.9%**	**21.1 %**	**24%**
Asia (Central)	4.4%	4.6%	17.3 %	17.4%
Eastern Asia	1%	.9%	6.8%	5.6%
Asia (South-eastern)	2.4%	2.7%	16%	16.5%
Asia (Southern)	17.8 %	21%	37.3 %	42.7%
Asia (Western)	8.6%	11.5%	30.8 %	38.4%
Asia (Western) & Northern Africa	9.8%	11.9%	30.9 %	35.8%
Amrica (Latin)&	**11.%**	**13.8%**	**32.7 %**	**41.8%**

the Caribbean				
Caribbean	26.7%	29.8%	58.9%	62.8%
America (Latin)	10%	12.7%	30.8%	40.3%
America (South)	11%	14%	29.5%	38.7%
OCEANIA	**3.4%**	**3.4%**	**31.3%**	**40.9%**
America (Northern) &Europe	**1.4%**	**1.7%**	**12.5%**	**13.3%**
European Countries	1.8%	2%	6.9%	9.2%
Eastern Europe	1.8%	6.9%	7.2%	9.2%
Northern	1.8%	2.1%	9.4%	12.5%

Europe				
Southern Europe	n.a.	n.a.	n.a.	n.a.
Western Europe	1.5%	1.7%	7.2%	7.6%
Northern America	1.7%	1.9%	5%	6.4%
SOURCES: FAOSTAT: Suite of Food Security Indicators, FAO 2023. In: FAO. P,179.				

the 2030 global nutrition targets are threatened by rising food prices, climate change, and the COVID-19 pandemic's lingering effects. To eradicate malnutrition, countries must coordinate their efforts (FAO et al., 2023). The foundations of organic agriculture are based on the principles of equity, health, ecology, and caring (IFOAM, 2023). Depending on the commodity and the country as a whole, COVID-19's effects on the organic industry will vary; in certain, retail sales have increased. For example, in Germany, retail sales of organic products rose by 25% in the first quarter of 2020 over the same period the previous year. Later, buying organic feed, especially for non-ruminants became more challenging for organic farmers in a number of Member States, including Belgium, Sweden, the United Kingdom, and Italy. These issues are mostly the result of COVID-19-related disruptions in the supply chain from important suppliers of organic food, such as China and India. The cost of organic feed has increased by more than 25% in certain nations and areas (Smuleac et al., 2020). The COVID-19 epidemic underscored the susceptibility of the food structure to external shocks, including climate change and pandemics. This has encouraged debates about building more resilient food systems.

Adult Men and Women's Prevalence of Moderate or Severe Food Insecurity and Severe Food Insecurity Only in 2022. The COVID-19

epidemic has drawn attention to the significance of food security and the necessity of strong regulations to deal with food system disruption. To guarantee that food security is a top priority on the international agenda, the corporate sector, civic society, governments, and international organisations must work together to implement these policies. For improvement in relation to food security in the face of future crises, several strategies and policies can be considered:

1. The Governments, in cooperation with the international organizations and the private sector, may develop and implement strategies to improve the rigidity of food supply chains, including improved logistics, diversification of sources, and contingency planning for disruptions. Increased emphasis should be placed on godowns and storage, as well as the efficient operation of post-harvest operations, retail and wholesale marketing, production, storage, and transportation. Should travel restrictions be increased, home delivery and online shopping ought to be encouraged. Countries need to have resilience. Resilience helps people, communities, countries, and global institutions prevent, anticipate, prepare for, manage with, and get well from surprises. It entails not just returning to our pre-shock state but also improving upon it. Dr. Fan Shenggen, a former director general of IFPRI, stated this in a global webinar (ILSI Asia, 2023). To achieve this, food management would need to be more inclusive of all parties involved, including consumers, institutions, and smallholder farmers.

2. Countries should promote local and sustainable food production to reduce dependence on global supply chains. As COVID-19 increased THE risk of transport disruption and trade among the different countries, in these circumstances, countries should explore the pathways to improving the productivity of their crop production.

For instance, in the event of an emergency, rice shipment is likely to be significantly delayed because it is mostly transported by sea rather than by land or air. When other commodities like soybeans, wheat, and corn are imported from outside the region, they must travel greater distances (Caballero et al., 2020). Additionally, they must put policies and programs in place to lessen food waste at every stage of the food supply chain, from production to consumption. The governments should encourage urban and pre-urban agriculture to enhance local food availability, and especially support small-scale farmers for good agricultural production.

3. To track trends in food security and spot weaknesses, governments and international research organisations should fund studies on the subject and make investments in data collection and analysis.

4. To increase crop yields and lessen their susceptibility to climate-related disruptions, low-income and developing nations should invest more in agricultural technologies like precision farming and climate-smart agriculture. To mitigate the impact of climate change on food production, countries may also develop climate-resilient agricultural policies and practices.
6. Farmers need to have consistent and appropriate access to the market, which necessitates a balance between procurement from the public and private markets. Since small-scale farmers frequently face challenges like inadequate storage and having to sell their products for less money, the government should help and support them, especially those who produce perishable goods.
7. To assurance that vulnerable groups have the right of entry to wholesome food during crises like pandemics, governments should fortify societal security nets and nutrition initiatives. To ensure that children are fed even when schools are closed, school feeding programs should be expanded.

8. The developing countries and low-income countries should strengthen international cooperation and governance mechanisms for global food security, with a focus on addressing trade restrictions and disparities in access to food. According to the FAO's definition, "food security has to meet dietary needs and food preferences; there is no common, static food secure state". Nations must acknowledge this new reality in food security (Caballero et al., 2020). Countries must make sure that trade remains robust in order to meet the demands and preferences of their people.

Intellectual Property and Food Security

Traditionally, given the communal nature of farming practices, genetic materials resulting from farming practices were not protected under intellectual property (IP) laws (Chidi, 2006). Plants or plant varieties were excluded from the application of patent laws in the West. Plant genetic resources (PGRs) were brought within the ambit of IP protection because sui-generis IP regimes for plant breeders' rights (PBRs) were inspired by judicial, legislative, and policy developments in the U.S (Chidi, 2006). In 1961, the International Union for the Protection of Plant Varieties (UPOV) provided a multilateral framework for the protection of PGRs. There were subsequent revisions of the UPOV in 1978 and 1991.
The Agreement on Trade-Related Aspects of Intellectual Property Rights

(TRIPS Agreement, 1994) extended the scope of IP protection to all fields of technology. Article 27(3)(b) of the TRIPS Agreement (1994) states that "members shall provide for the protection of plant varieties one or the other by [utility] patents or by an effective sui generis system or combination thereof …". The mandatory IP protection for PGRs has ramifications for food security, biodiversity, and SDG 2. In most parts of the South, access to food has emerged as a major concern (Cullet, 2004). The IP framework grants control over knowledge and resources for private good instead of valuing the sharing of knowledge and resources for public good. It facilitates control of agri-businesses over plant varieties and related knowledge, making it hard for resource-poor populations in the South to fulfil their basic food needs.

The IP framework is overly protective of the benefits of moneymaking breeders at the payment of social and environmental objectives. It is not balanced in its approach because several important factors have not been given due consideration. These factors include farmers' rights and interests; the right to food; access to genetic resources; the distribution of benefits of exploiting genetic resources; and the sustainable use of genetic and biological means (Cullet, 2004). More importantly, contributions of farmers to innovations in PGRs are not even properly recognized let alone rewarded under the reward mechanism for incentivising innovation in PGRs (Chidi, 2006).

Indigenous agricultural practices by local communities play a crucial role in enriching plant genetic diversity. As noted by Tobin:

Effective management and ongoing access to plant and animal genetic variety are essential to both global food security and the livelihood of hundreds of millions of people. Local livestock and farming practices are essential to the world's food security.

Locally developed seed varieties, for instance, provide 60-90 per cent of seed planted in developing countries and are vital for local food security (Lawson and Sanderson, 2013).

Traditional farming, in the absence of IP protection, contributed significantly to improving plant varieties and preserving agrobiodiversity (Correa et al., 2015). Now, because of IP protections for plant varieties, local farm crops and traditional farming practices are being displaced by a biotechnology-driven agricultural regime and food system which is based on monoculture and lack of diversity because of no involvement of indigenous communities or local practices (Chidi, 2006). As noted by Baker, Jayadev and Stiglitz (2017), farmers have lost control over community activities that have been the backbone of agriculture for thousands of years. Biodiversity is undermined because the UPOV

Convention favours genetic uniformity in plant varieties. IP rights reward homogeneity and standardization, not agrobiodiversity. Biodiverse innovation is undermined because commercial breeders are encouraged to eliminate genetic variation within plant varieties.

If a new plant variety satisfies the requirements of originality, distinctiveness, uniformity, and stability, it may be protected under the UPOV convention paradigm. Commercial plant breeders can secure monopolies by meeting these criteria. However, it is hard for farmers to benefit from the UPOV Convention as potential owners of PVP because their breeding practices are not aimed at achieving uniformity and stability (Forsyth and Farran, 2013). Plant varieties of farmers are unlikely to meet the uniformity and stability criteria because they involve a diversity of genotypes (Correa et al., 2015). Farmers' varieties are unlikely to qualify for protection and prone to the exclusion from the benefits of a PVP regime based on the UPOV Convention. Moreover, natural processes and breeding practices for specific conditions, such as stress-prone environments, are undermined due to strict applicability of the UPOV criteria for protection (Ugwu, 2020).

The United Nations Convention on Biological Diversity (CBD) (1992) aims at conserving biodiversity and provides a framework for fair and equitable benefit sharing of PGRs. IP rights hinder the implementation of the CBD. The legal obligations under the CBD conflict with the UPOV Convention. Let alone promoting and conserving biodiversity by traditional practices, farmers are constrained from adapting protected plant varieties to local conditions (Correa et al., 2015). Local growing conditions differ and variations in plant varieties are helpful in responding to varied conditions. A sustainable and resilient agriculture depends on farmers' ability to make necessary adaptations. If biodiversity is lost, it becomes harder to cultivate crops which are resilient to diseases and pests (Forsyth and Farran, 2013).

By interfering with farmers' traditional rights to preserve, trade, and reuse seed, the exclusive PVP rights provided to plant breeders impede conventional farming operations (Ugwu, 2020). Article 9(3) of the ITPGRFA, 2001 states that nothing in this article should be taken to restrict farmers' ability to store, utilize, trade, and sell seed that they have conserved. Article 8j of the CBD (1992) acknowledges farmers' "traditional knowledge in relation to plant genetic resources without specifying how to protect traditional knowledge held by farmers".

The notion of farmers' rights is underdeveloped. The ITPGRFA did not provide a definition of farmers' rights because of the lack of consensus at the international level (Cullet, 2004). The language used in Article 9(2)

of ITPGRFA does not create binding obligations in relation to farmers' rights. In contrast to Article 2 of the 1991 UPOV Convention which usages the word "shall" to create binding obligations to protect breeders' rights, article 9 (2) of ITPGRFA stipulates that farmers' rights "should" be adopted (Ugwu, 2020). A weak regime for the protection of farmers' rights does not favour food security. Unlike farmers in developed countries, who rely heavily on seeds supplied by commercial breeders, resource-poor farmers in developing countries are reliant on informal channels such as farm-saved seeds and exchange of seeds among farmers (Correa et al., 2015). In some African countries, fulfilment of more than 80% seed requirements depends on farm-saved seeds (Correa et al., 2015).

The prices of seeds and genetic resources are determined by commercial breeders who own IP. Small-scale farmers with limited purchasing power are priced out. The suitability of the UPOV Convention for resource-poor countries, where a vast majority of farmers are reliant on informal channels for their seed needs, is questionable. Western countries developed the UPOV model keeping in view their own interests and realities. The latest version of UPOV favours commercial plant breeders and undermines farmers' rights (Forsyth and Farran, 2013). Farmers must have the freedom to save and utilise their own plant varieties. Farmers must be allowed to continue the traditional practices of exchanging seeds. Without these freedoms, it will be hard to accomplish the goals of ecological agriculture, conservation of plant diversity, and food security.

A number of human rights documents outline the human right to food. Everyone has the right to a standard of living sufficient for their own and their family's health and well-being, including food, according to Article 25 of the 1948 Universal Declaration of Human Rights (UDHR). Article 11f of 1966, ICESCR recognised the fundamental right of everyone to be free from hunger. Every man, woman, and child has the inalienable right to be free from hunger and malnutrition to develop fully and maintain their physical and mental faculties, according to the 1974 Universal Declaration on the Eradication of Hunger and Malnutrition.

The Convention on the Rights of the Child (1989) (CRC) stated that "States parties are necessary to take appropriate measures to combat disease and malnutrition, including through the provision of nutritious food and drinking water". The right to food conflicts with the IP rights of commercial breeders. As noted by a report of the UN Sub-Commission on Human Rights (2000), "actual or potential conflicts exist between the implementation of the TRIPS Agreement and the realisation of

economic, social and cultural rights in relation to … the enjoyment of the right to food".

The TRIPS Agreement provided a common responsibility to keep plant varieties without specifying the form of protection, the exclusive rights, the scope and duration of such rights, and other details about the criteria to grant plant variety protection (PVP) (Correa et al., 2015). In implementing this obligation at the national level, WTO Member States have a considerable latitude and policy space to align their PVP regime with their domestic conditions and sustainable development goals. They can avail themselves of the flexibility to define plant varieties and choose the level of protection by opting a form of sui generis protection that suits them, keeping in view the features of their agricultural and seed supply structures. The TRIPS Agreement does not mention the UPOV Convention and provides Member States with latitude to either adopt UPOV-style PVP legislation or design their own sui generis regime by using their legal imagination and creative thinking in terms of balancing the interests of IP owners with attaining food security, preservation of biological diversity, protection of farmers' rights, and achieving sustainable development.

The TRIPS Arrangement (1994) acknowledges the social objectives of granting IP rights. Article 8 acknowledges that Member States can promote public health and protect nutrition while implementing this treaty. Article 7 asserts that "safeguarding and upholding intellectual property rights should aid in fostering technological innovation and in the transfer and distribution of technology, benefiting both producers and users of technological knowledge, while promoting social and economic welfare, as well as a balance of rights and responsibilities (WTO TRIPS Agreement, 1994). Protecting the rights of plant breeders and facilitating cross-border trade in commercial seeds are not the only objectives of the WTO regime. Protection of IP rights is not an end in itself. It is rather a means to achieve economic as well as social objectives, such as public health and food security. Understandably, the TRIPS Agreement has provided policy space to Member States to balance competing policy objectives.

Generally, WTO Member States are not availing themselves of the flexibility to adopt a sui generis system that is aligned with their domestic needs. The majority of countries have adopted PVP laws based on the UPOV Convention's 1991 version (Blakeney, 2009). There are practical reasons why low- and middle-income countries should not be adopting the same PVP regimes as adopted by economically advanced

countries. The realities and practices of food production at national levels must be considered while developing domestic PVP laws and policies. The contributions of local cultivators and smallholder farmers to food security and traditional innovation practices in agriculture must be adequately recognised and rewarded. Farmers must be given control over their knowledge and resources, and their role in conserving biodiversity must be adequately incentivised. The TRIPS Agreement is not the only treaty. It is one of the several treaties, and it must be implemented concurrently with other treaties. An effective use of the flexibility to design tailor-made legal regimes may support Member States to comply with their other treaty obligations under the CBD, ITPGRFA, ICESCR, and CRC.

Conclusion

In conclusion, the COVID-19 epidemic has left unembellished the complexities and vulnerabilities of the global food security system. This study has investigated the multifaceted effects of the pandemic on food security, including its challenges, responses, and the invaluable lessons learned. The governments of the different countries and international organizations rallied to respond to the crisis, implementing a range of policy measures and food-backing programs. These responses offered a lifeline to many countries and also highlighted the need for alert, adaptable strategies that account for the unique circumstances of future crises.

The governments of the different countries must apply the knowledge and insights gained from the pandemic crisis to shape a more equitable and sustainable future, as the world continues to grapple with the ongoing repercussions of the pandemic. The lessons learned from the impact of COVID-19 on food security ought to be a call to action, inspiring us to fortify our food systems to achieve SDG 2 – Zero Hunger. Keeping in view the tension between IP protection for plant varieties and food security, it is critical for WTO member states, particularly low and middle income countries in the South, to fully utilize the flexibility provided by article 27(3) (b) of the TRIPS Agreement to design their own PVP regimes rather than adopting the UPOV Convention, which disproportionately benefits commercial breeders at the expense of farmers' rights, the right to food, and sustainable development. It will be hard to achieve SDG 2 if biodiversity, natural processes, and informal innovations are undermined, the role of small-scale farmers is overlooked, and traditional rights of farmers are not protected.