



Probing the Factors Impacting Food Security



Policy Recommendations

Responding to Lack of "Accessibility" in Food Security

Pakistan as a Reliable Global Supplier in the Long Run

- Pakistan must develop a strategic plan to leverage economic gains in exporting essential food commodities amid export restrictions of leading global suppliers and strategically increase production of goods having global demand.

Combating Food Cartels

- Enforcement of stringent timelines for penalty hearings conducted by the CCP, and incorporating the clause of CPP in the NFSP should be ensured.

Addressing the Deficiency of "Availability" in Food Security

Improving Wheat Storage Management

- Properly evaluate the domestic wheat requirement by examining consumption patterns and periodic surveys.
- In the short run, build a storage capacity to address the provincial level's lack of capacity and wastage issue.
- Invest in building domestic capacity for producing the high-yield climate-resilient wheat varieties.

R&D and Collaboration

- Foster collaboration for climate-resilient hybrid seeds through public-private partnerships and credit incentives for seed R&D.

Targeted SDGs



Targeted SDGs



Managing the Efficiency of "Utilization" in the Food Security

Food Safety for Food Security

- Align national standards of food quality and safety with international benchmarks. Ensure consistent enforcement of food safety regulations and standardized guidelines provincially.
- Establish food testing and certification systems. Create a network of food testing laboratories, develop a globally recognized domestic certification system, and partner with international organizations for its establishment.

Clean Water Availability

- Warrant effective implementation and allocate financial resources for National Water Policy, 2018.
- Engage development partners in addressing the need for adequate financial resources, and introduce technologies for improving the access to safe drinking water.

Targeted SDGs



Approaching Absence of "Stability" in the Food Security

Water Conservation

Drip Irrigation

- Cost-sharing programs like PIPIP and SIAPEP should be scaled up and launched in other provinces.
- Develop discounted loan packages in collaboration with microfinance institutions and ZTBL to promote drip irrigation.
- Set up cluster-level demonstration plots and share cost-benefit analyses for drip irrigation practices with potential farmers.
- Mandate technology providers to offer technical support when contracting with funding agencies for drip irrigation so farmers can absorb the technology and production dynamics.
- Foster local manufacturing of drip/sprinkler components from existing pipe/plastic materials for technology indigenization.

Land Laser Leveling

- Promote the adoption of a Land Laser Leveling Rental model to enhance water conservation efforts.
- Facilitate the availability of loans and lease agreements with favorable terms for service providers.
- Collaborate with NGOs with expertise in the field as potential service providers in this endeavor.

Targeted SDGs



1. Introduction

Pakistan traditionally focused on achieving self-sufficiency, particularly in the domestic production of staple foods. However, in recent years, there has been a decline in food availability and self-sufficiency within the country. Consequently, Pakistan has faced a significant fiscal burden, amounting to around Rs. 110 billion in food-related subsidies for FY25, as it strives to ensure domestic food availability and address the rising need for imports. These subsidy allocations include Rs. 12 billion for the Pakistan Agricultural Storage & Services Corporation Ltd (PASSCO), Rs. 15.9 billion for wheat subsidies in Gilgit-Baltistan, Rs. 13 billion for fertilizer plants and imports, Rs. 5 billion for Farm Mechanization/ Kissan Package, and a substantial Rs. 65 billion designated for the Utility Stores Corporation (USC), which primarily covers food products.

Figure 1: Food Security Index of Asia



2. Food Security Dimensions and Pakistan's Challenges

The term food security has been defined by the World Food Summit in the year 1996 as **"the physical availability of sufficient, safe, and nutritious food that meets the dietary requirements of all people at all times, enabling them to lead healthy and active lives."** This definition highlights the need for a continuous and reliable supply of food that is not only abundant but also safe to consume and nutritionally apt to support the well-being of individuals. Food security covers four primary dimensions.

Figure 2: Four Dimensions of Food Security



2.1. Food Availability

Food availability is crucial for food security, influencing all its aspects. As per FAO estimates, Pakistan's average dietary energy supply adequacy consistently exceeds 110%, ensuring the recommended energy intake is met. The protein supply in Pakistan has gradually increased from around 65.7 to 67 grams per capita per day, though it remains below the global average of 82.5-82.9 grams. The supply of animal-based protein in Pakistan has grown to 29.3 grams, reflecting changing dietary patterns, but it still falls short of the global average of 32.5-32.8 grams. While staple foods like cereals, roots, and tubers dominate energy intake in Pakistan, the percentage of dietary energy from these sources is around 50%, slightly lower than the global average of 51%. Pakistan's food availability, while better than that of LDCs, still lags behind peer countries. This disparity contributes directly to the nation's overall food insecurity situation. Comparatively, Pakistan's food supply falls short of global averages, highlighting a critical area of concern that needs to be addressed to ensure adequate food availability.

Table 1: Dimension of Food Availability

Indicators	Unit	Area	2016-2018	2017-2019	2018-2020	2019-2021	2020-2022
Average dietary energy supply adequacy	%	LDC	106	107	108	108	108
		Pakistan	112	111	111	111	112
		World	122	123	123	124	124
Average protein supply	g/capita/day	LDC	59.1	59.4	59.7	-	-
		Pakistan	65.7	66.3	67	-	-
		World	81.8	82.5	82.9	-	-
Average supply of protein of animal origin	g/capita/day	LDC	12.4	12.4	12.5	-	-
		Pakistan	27.7	28.7	29.3	-	-
		World	32	32.5	32.8	-	-
Share of dietary energy supply derived from cereals, roots and tubers	(kcal/cap/day)	LDC	67	67	67	-	-
		Pakistan	51	50	50	-	-
		World	51	51	51	-	-

Data Source: FAO Stats

2.2. Food Accessibility

Food access is crucial for households to secure enough food regularly. Pakistan faces challenges in ensuring food access due to limited infrastructure, high inflation, and sociocultural barriers. FAO data from 2016 to 2022 shows that Pakistan's GDP per capita remained relatively stable until 2019, dipped in 2020, and slightly rebounded in 2021, yet consistently lagged behind LDC and global averages. This GDP per capita does not fully reflect purchasing power due to significant income inequality. Pakistan's moderate to severe food insecurity has risen, particularly among women, highlighting gender disparities in food access. Women consistently face higher food insecurity than men, exacerbating the issue compared to LDC and global rates. Moreover, the prevalence of undernourishment in Pakistan has increased after a brief decline, consistently exceeding LDC and global averages.

Table 2: Dimension of Food Accessibility

Indicators	Unit	Area	2016-2018	2017-2019	2018-2020	2019-2021	2020-2022
Gross domestic product per capita, PPP	Constant 2017 (international \$)	LDC	3050.7	3140.9	3102.2	3152.4	-
		Pakistan	5294.2	5317.8	5144.3	5350.1	-
		World	16738.4	17036.5	16321.4	17156.1	-
Prevalence of moderate or severe food insecurity in the female adult population	Percent (3-year average)	LDC	51.6	52	53.3	55.8	57.9
		Pakistan	14.9	15.8	25.8	35.9	49.2
		World	22.3	23.1	24.9	26.8	28.1
Prevalence of moderate or severe food insecurity in the male adult population	Percent (3-year average)	LDC	51.1	51.7	52.6	54.4	56.7
		Pakistan	10.8	12.6	22.8	29.3	35.4
		World	21	21.7	23.3	24.1	25.2
Prevalence of moderate or severe food insecurity in the total population	Percent (3-year average)	LDC	53	53.6	54.7	57	59.3
		Pakistan	12.8	14.2	24.3	32.6	42.3
		World	23.9	24.7	26.6	28.1	29.5
Prevalence of undernourishment	Percent (3-year average)	LDC	20.2	20.2	20.7	21.4	21.8
		Pakistan	10.8	11	13.1	16	18.5
		World	7.7	7.7	8.2	8.7	9.2

Data Source: FAO Stats

2.3. Food Utilization

Food utilization is vital for food security, involving selecting safe, nutritious food, proper conservation, and preparation to ensure nutrient absorption. It also requires access to clean water, sanitation, and healthcare. According to FAO estimates, Pakistan faces persistent challenges in child malnutrition, with stunting in children under five only decreasing slightly from 39.4% in 2017 to 34.9% in 2021. While access to essential drinking water improved from 89.7% to 90.1% and basic sanitation services from 62.9% to 68.4%, Pakistan still lags behind global benchmarks. Additionally, the rate of safely managed drinking water services stagnated at around 35.8%, below both LDC and global averages. The prevalence of anaemia among women of reproductive age in Pakistan remains concerning at around 41.3%, higher than the LDC average of 39.4% and the global average of 29.9%.

Table 3: Dimension of Food Utilization

Indicators	Unit	Areas	2017	2018	2019	2020	2021
Percentage of children under 5 years of age who are stunted	%	LDC	35.2	34.6	34	33.4	32.8
		Pakistan	39.4	38.3	37.1	36	34.9
		World	23.7	23.3	23	22.7	22.5
Percentage of the population using at least basic drinking water services	%	LDC	64.5	65.3	66.1	66.8	-
		Pakistan	89.7	89.9	90	90.1	-
		World	89	89.4	89.8	90.1	-
Percentage of the population using at least basic sanitation services	%	LDC	34.9	35.6	36.3	36.9	-
		Pakistan	62.9	64.8	66.6	68.4	-
		World	75.1	76.2	77.3	78.3	-
Percentage of the population using safely managed drinking water services	%	LDC	35	35.7	36.5	37.1	-
		Pakistan	35.9	35.7	35.8	35.8	-
		World	72	72.8	73.7	74.3	-
Prevalence of anaemia among women of reproductive age (15-49 years)	%	LDC	39.1	39.2	39.4	-	-
		Pakistan	41.6	41.4	41.3	-	-
		World	29.3	29.6	29.9	-	-

Data Source: FAO Stats

2.4. Food Stability

Stability is the fourth dimension of food security, ensuring that food access, availability and utilization persist sustainably over time. FAO data shows Pakistan's per capita food production variability has improved, decreasing from 17.6% to 6%, indicating steadier food output. However, per capita food supply variability fluctuates between 15 and 26 kcal/capita/day, reflecting supply-side inefficiencies. Despite increased wheat production, limited storage leads to wastage. Similarly, 35-40% of fruit and vegetable production is lost pre- and post-harvest. These inefficiencies have increased Pakistan's dependence on food imports, with the value of food imports in total merchandise exports rising from 27% to 28% recently.

Table 4: Dimension of Food Stability

Indicator	Unit	Area	2015-2017	2016-2018	2017-2019	2018-2020	2019-2021
Per capita food production variability	Constant 2014-2016 1000 I\$ per capita)	LDC	4	4.1	3.3	1.4	-
		Pakistan	17.6	13.7	6.8	6	-
		World	3.5	2	2.1	2.6	-
Per capita food supply variability	kcal/capita/day	LDC	21	18	15	13	13
		Pakistan	21	26	15	23	22
		World	6	5	5	3	3
Value of food imports in total merchandise exports	% (3-year average)	LDC	-	24	22	23	24
		Pakistan	-	27	25	26	28
		World	-	7	7	7	7

Data Source: FAO Stats

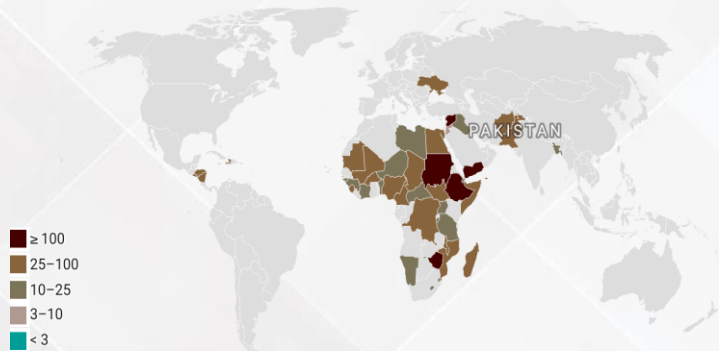
3. Factors Influencing Food Security in Pakistan

Pakistan is among 45 nations facing a severe food crisis. The Global Report on Food Crises notes a 41% surge in essential food prices in Pakistan between April and June 2022, compared to the previous five-year average. Pakistan ranks 14th in limited food access due to these soaring prices, a trend affecting many regions globally. Farmers brawl with declining incomes as intermediary commission rates and the costs of fertilizers and agricultural inputs rise faster than farm output prices. Also, rising international food and energy prices contribute to domestic inflation, with domestic food prices not aligning with recent declines in global prices.

Figure 3: Cost of Basic Food Basket

Rise in cost of basic food basket in 45 food crisis countries

% change in cost of food basket (Apr-Jun 2022 vs 5-year average for that period)

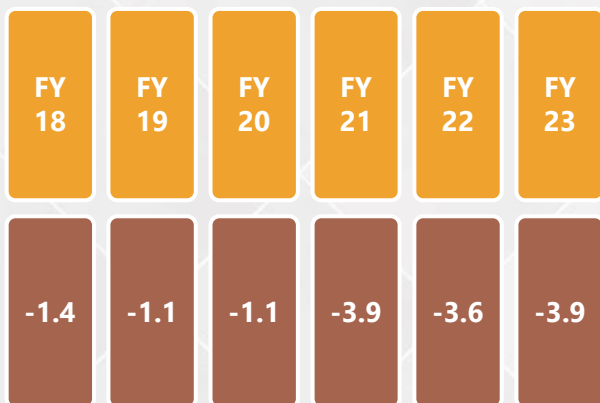


1. The price of a typical food basket is based on meeting a population's energy and nutrition requirements. Its size and composition vary according to local preferences, demographic profiles, activity levels, climatic conditions, etc. 2. Data for Bangladesh refer to Cox's Bazar.

Source: WFP Global Market Monitor, August 2022; and FSIN, Global Report on Food Crises 2022 (mid-year update) - Created with Datawrapper

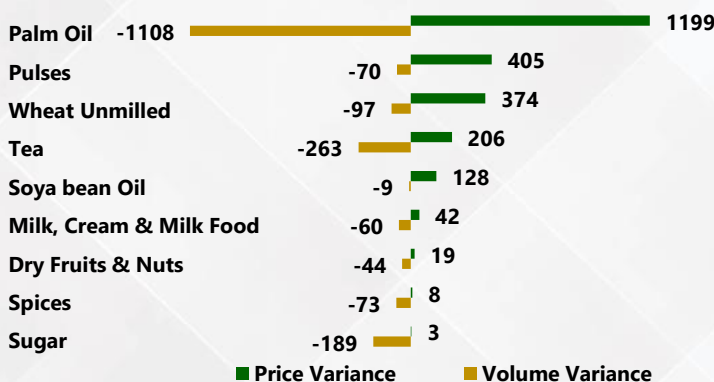
Pakistan faces severe inflationary pressures, with a large portion of consumer income spent on basic needs, particularly food. Various crises have weakened the country's ability to protect vulnerable populations. Since 2020, reduced fiscal space and foreign exchange reserves, due to slow export growth and declining global competitiveness, have widened fiscal and balance-of-payment gaps. This has increased external debt and servicing costs, limiting Pakistan's capacity to implement fiscal measures or import essential goods to combat rising prices. According to PBS data, Pakistan's food trade deficit reached US\$ 3.9 billion in FY23, surpassing the previous year's US\$ 3.6 billion. During FY23, selected food products saw a price-driven increase of about US\$ 2.4 billion, while import volumes decreased by US\$ 1.9 billion. Moreover, climate-related hazards and supply chain disruptions from the Russia-Ukraine conflict have weakened the Pakistani rupee, further driving up domestic prices.

Figure 4: Food Trade Deficit of Pakistan in US\$ Billion



Data Source: PBS

Figure 5: Breakup for Change in Food Group Imports (FY23) in US\$ Million



Domestic and International Threatening Factors

3.1. Food Production and Yield Issues

Global disruptions in food supply chains have spurred countries to enhance food production and consider alternative crops like millet for their nutritional value, climate resilience, and economic viability. Pakistan, historically a significant producer — ranking 9th in wheat, 11th in rice, 16th in maize and 15th in millet (FAO Stats, 2022) — has seen its crop yields fall behind nations like China, India, and Bangladesh. Factors such as extreme temperatures, untimely rainfall, crop susceptibility to climate changes, water scarcity, high input costs, and lack of certified seeds contribute to this disparity. According to Planning & Research Department, ZTBL (2020), Pakistan's actual yields for wheat (3.11 tonnes/ha), rice (2.46 tonnes/ha), and maize (6.38 tonnes/ha) in 2022-23 are well below their potential yields of 6.68, 9.26, and 7.18 tonnes/ha, respectively. This significant yield gap has led to increased reliance on imports, straining consumer purchasing power and depleting foreign reserves, particularly for staple crops like wheat.

Figure 6: Demand and Supply Gap

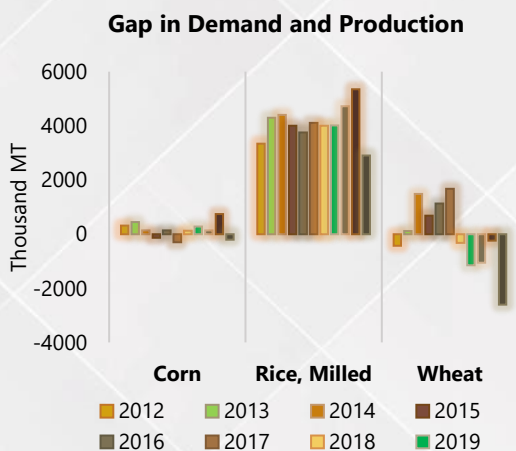
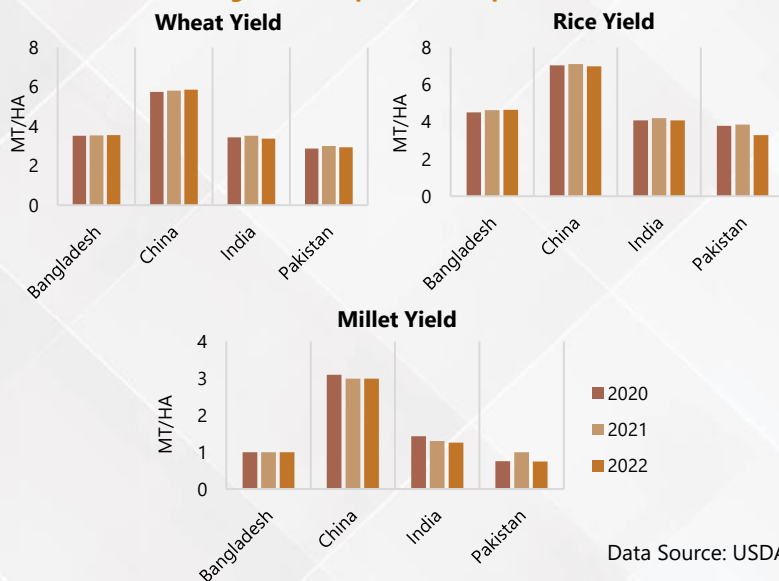


Figure 7: Crop Yield Comparison

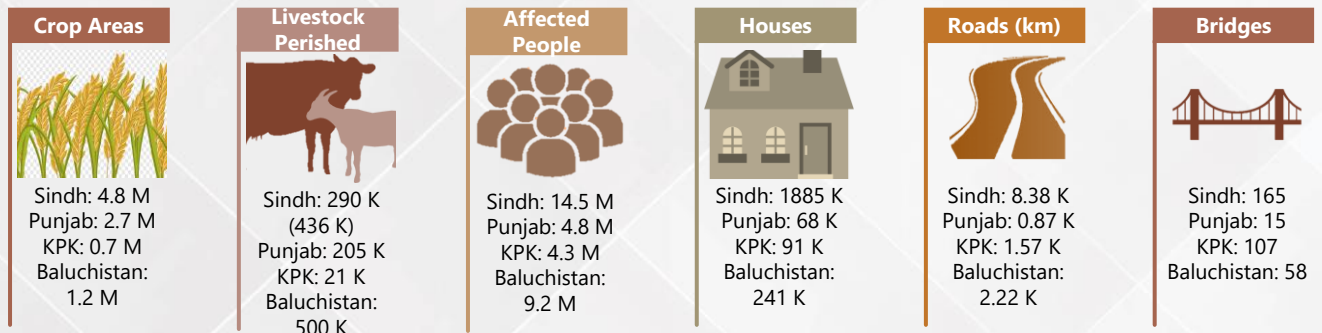


Data Source: USDA

3.2. Flooding and Climate Adaptation Needs

Climate change is revealed through heat waves, erratic precipitation, rising sea levels, and frequent floods. In Pakistan, floods have been particularly devastating. In 2022, unprecedented rainfall caused extensive flooding, resulting in over US\$ 14.9 billion in damages. The NDMC and FAO report that floods affected 4.8 million acres of crops in Sindh, 2.7 million in Punjab, 1.2 million in Baluchistan, and 0.7 million in KPK. Livestock losses were also severe, with around 500,000 animals lost in Baluchistan, 290,000 in Sindh, 205,000 in Punjab, and 21,000 in KPK. The country also faced infrastructural damage, highlighting the urgent need for effective climate change adaptation and disaster management strategies.

Figure 8: 2022 Flood Impact

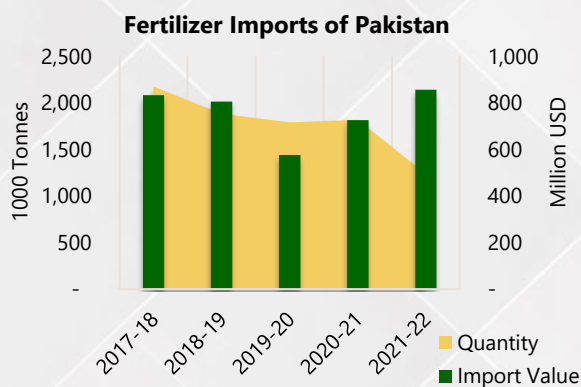


Data Source: FAO

3.3. Impact of Soaring Input Prices

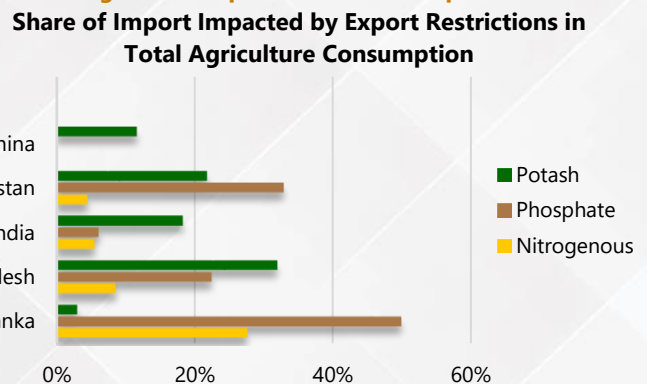
Pakistan must make strategic choices to effectively address food security challenges, including expanding cultivated areas, improving yields per acre, and increasing cropping intensity. However, these initiatives require greater input consumption. Unfortunately, Pakistan has seen a significant surge in input prices, with fertilizers, diesel, electricity, seeds, and pesticides increasing by 200-250% over the past four years. For example, the cost of DAP fertilizer escalated from Rs. 6,300 per bag in August 2021 to Rs. 14,800 in August 2022 due to global price hikes and the massive depreciation of the Pakistani rupee. From 2017-18 to 2021-22, Pakistan's fertilizer imports decreased from 2,176 thousand tonnes (US\$ 833 million) to 1,238 thousand tonnes (US\$ 855 million), viewing the impact of rising international prices. Two significant factors contributing to the rising fertilizer prices are the increasing global demand and disruptions in the fertilizer supply chain due to export restrictions. The graph showcases the impact of export restrictions on fertilizer imports and consumption. It can be observed that countries including Pakistan, China, India, Sri Lanka, and Bangladesh, face a relatively high proportion of imported fertilizers affected by export restrictions concerning their total agriculture consumption.

Figure 9: Trend of Fertilizer Imports



Data Source: ITC, Trade Map and IFPRI

Figure 10: Impact of Fertilizer Export



3.4. Export Restrictions and Food Supply Volatility

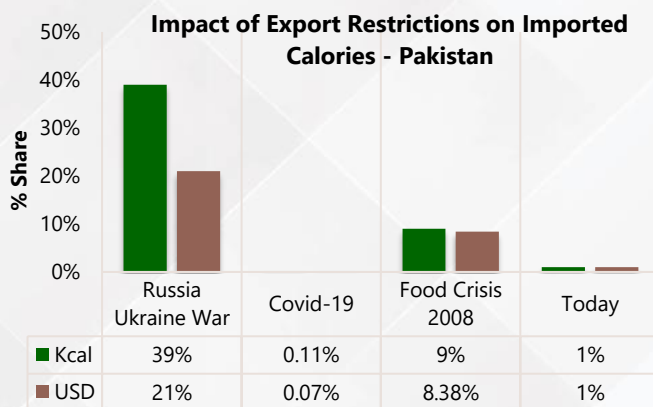
Global supply volatility has heightened, exerting inflationary pressure on food supplies. Consequently, food prices have surged, prompting economies to enhance productivity and impose export restrictions to control food outflow. These restrictions have made low-income countries, with higher current account

deficits, more vulnerable to food crises. The graph illustrates the impact of export restrictions on Pakistan's import calories. During the Russia-Ukraine war, export restrictions accounted for 39% of Pakistan's imported calories, compared to 0.11% during COVID-19 and 9% during the 2008 food crisis. These statistics underscore Pakistan's growing vulnerability to global export restrictions, which pointedly drive up both domestic and international food prices.

The table below outlines the export restrictions implemented by selected countries. In 2022, India imposed an export ban, controlled licensing, and a tax on broken rice, sugar, and wheat to mitigate inflationary pressure on essential food items.

Russia implemented similar restrictions for sugar, wheat, rye, sunflower oil, meal and seeds, maize, and barley. Ukraine adopted various measures, including an export ban and licensing for wheat, oats, millet, sugar, poultry, eggs, sunflower oil, bovine meat, rye, and maize. In Pakistan, a ban on sugar exports was enforced to control rising domestic sugar prices.

Figure 11: Export Restrictions Influence on Pakistan's Calories



Data Source: IFPRI

Table 5: Comparison of Export Restrictions by Selected Countries

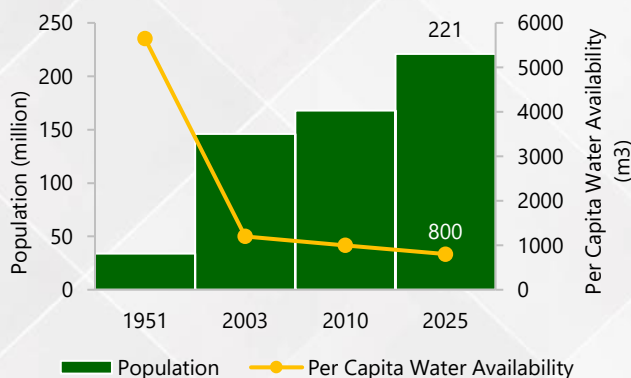
Countries	Export Restriction	Product	Description/ Reasons	Starting Date	Ending Date
India	Export Ban	Broken Rice	Ban on broken rice and 20% tax on other categories of rice (to augment supplies and calm local prices after below-average monsoon rainfall curtailed planting)	09/08/2022	12/31/22
		Sugar	Amid the huge rise in inflation, the Government banned Sugar Exports	06/01/2022	10/31/22
		Wheat	A day after its data showed annual Consumer Price Inflation hitting a near eight-year-high of 7.79% in April, and retail food inflation surging even higher to 8.38%	05/13/2022	12/31/22
		Wheat Flour, Semolina, Maida	To curtail high price export ban	08/25/2022	12/31/22
	Export Licensing	Wheat Flour	India has tweaked its export policy for wheat flour and asked traders to secure permission before exporting the commodity	07/12/2022	12/31/22
	Export Tax	Rice	India has levied a tax on some rice exports as the nation seeks to secure domestic supplies of food grain after planting shrank due to lack of adequate rains	09/09/2022	12/31/22
Pakistan	Export Ban	Sugar	The Federal Government has announced a ban on sugar export, saying the ban would drop sugar prices and relieve the people.	04/15/2022	12/31/22
	Export Restriction	Wheat	Net Importer	-	-
Russia	Export Ban	Sugar	Russia will temporarily ban cereal and sugar exports due to international sanctions and to protect the internal market	03/14/2022	08/31/22
		Wheat, Meslin, Rye, Barley, Maize, Sugar		03/14/2022	06/30/22
		Sunflower Seeds	Russia will ban exports of sunflower seeds from Friday until the end of August and impose an export quota on sunflower oil to avoid shortages and ease pressure on domestic prices.	04/01/2022	08/31/22
	Export Licensing	Sunflower Oil	Russia will ban exports of sunflower seeds and impose an export quota on sunflower oil to avoid shortages and ease pressure on domestic prices	04/15/2022	08/31/22
	Export Tax	Sunflower Oil, Sunflower Meal	Russian May duty on sunflower oil added 19% to a maximum of \$372.20/mt.	04/15/2022	12/31/22
		Wheat, Barley, Corn	Russia has hiked up the tax on wheat exports to \$101.4 per from April 13 to 19	04/13/2022	12/31/22
Ukraine	Export Ban	Wheat, Oats, Millet, Sugar	Ukraine's Government has banned the export of wheat, oats and other staples that are crucial for global food supplies as authorities try to ensure they can feed people during Russia's intensifying war	03/09/2022	05/10/22
	Export Licensing	Poultry, Eggs, Sunflower Oil, Bovine Meat, Rye, Maize		03/06/2022	05/10/22

Data Source: IFPRI & FAO

3.5. Agricultural Challenges Amid Water Scarcity

To meet the food demands of a rising population, Pakistan’s agriculture, which depends on the Indus River Basin for 90% of its output and accounts for 22% of GDP, needs increased water resources and efficient use. As the population grows, the demand for water to sustain this sector intensifies. However, climate change poses a significant risk by reducing water availability, which could lead to a 20% decrease in crop yields in Southern Pakistan and a 30% reduction in livestock production, as noted by Mirza (2021). Additionally, Punjab and Sindh face the potential loss of 20–25% of their arable land due to water shortages. Compounded by a rapid annual population growth and urbanization rate of around 2%, these factors are pushing Pakistan toward acute water scarcity. Currently, with a per capita water availability of 1000 cubic meters—significantly lower than India’s 1600 cubic meters—Pakistan is approaching the threshold of critical water scarcity. Projections suggest that without intervention, Pakistan could reach a state of absolute water scarcity by 2025, presenting a grave threat to its sustainability and economic stability.

Figure 12: Trend of Water Availability



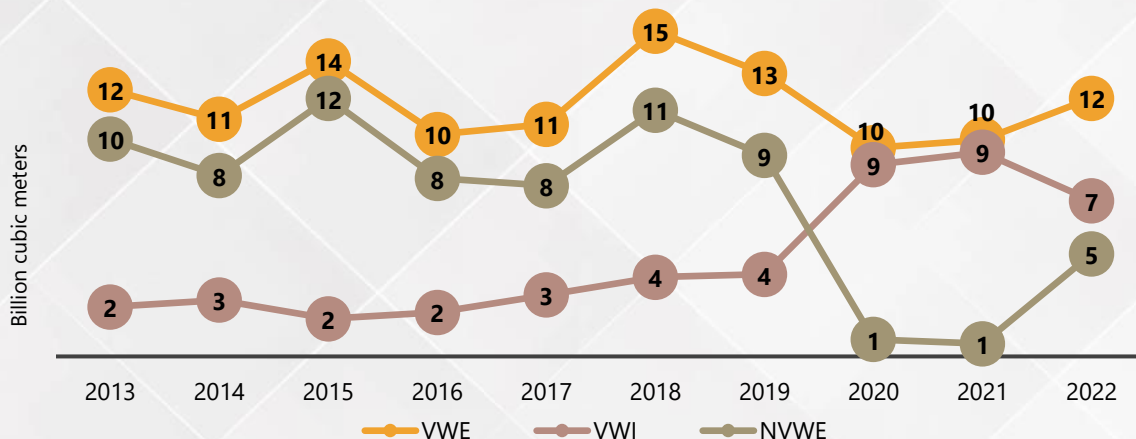
Data Source: Mirza, 2021

3.6. Pakistan’s Virtual Water Trade

Virtual Water Trade categorizes products’ water content into Green, Blue, and Gray Water. Blue water, used for irrigation, is costlier due to high infrastructure expenses, often borne by exporting countries without being reflected in export prices. Environmental and social costs of blue water are also overlooked in international trade discussions. From 2013–2022, Pakistan averaged a net export of 7 billion m³ of Blue Virtual Water for crops like maize, rice, wheat, sugar, cotton, oilseeds, and other cereals, peaking at 12 billion m³ in 2015 due to increased exports of rice, sugar, and maize. This trend pressures Pakistan’s depleting water resources. Although net blue water exports declined during COVID-19 and the economic crisis, the trend resumed in subsequent years, as shown in the graph.

Figure 13: Virtual Water Trade of Pakistan

Trade Statistics for Blue Virtual Water Content



Data Source: Author’s Estimation based on VWC calculation in Ali, T. et al. (2019)
VWE: Virtual Water Exports, VWI: Virtual Water Imports, NVWE: Net Virtual Water Exports

5. Conclusion

Pakistan's food security faces critical challenges due to a combination of domestic inefficiencies, economic constraints, and external volatilities. Despite having an adequate dietary energy supply, the country struggles with insufficient protein diversity, accessibility issues, and high rates of malnutrition. The reliance on imports to meet food demand, coupled with rising input costs and inadequate infrastructure, further worsens the situation. Addressing these issues requires comprehensive strategies, including improving agricultural productivity, investing in infrastructure, and implementing effective climate adaptation measures. The following key findings summarize the critical issues identified in this report:

- Pakistan's Global Food Security Index (GFSI) ranking has fallen by nine ranks, highlighting its struggle with food security and an increasing fiscal burden from food-related subsidies, totaling around Rs. 110 billion for FY25.
- Pakistan's dietary energy supply is adequate, but protein supply, especially animal-based protein, remains below global averages, necessitating improved protein diversity.
- High inflation, limited infrastructure, and sociocultural barriers hinder food access. Income inequality exacerbates moderate to severe food insecurity, particularly among women, who face higher rates of food insecurity compared to men.
- In Pakistan, undernourishment has risen, consistently surpassing LDC and global averages. Child malnutrition, including stunting, remains high, and the prevalence of anemia among women of reproductive age is concerningly higher than LDC and global averages.
- Despite improvements in per capita food production variability, significant food wastage (35-40% of fruit and vegetable production) and limited storage capabilities increase reliance on imports, adding pressure on foreign reserves.
- Extreme weather events, like the devastating 2022 floods, cause significant agricultural and infrastructural damage, highlighting the urgent need for climate adaptation and disaster management strategies.
- Sharp increases in the costs of fertilizers, seeds, diesel, and electricity (by 200-250% over the past four years) hinder efforts to expand cultivated areas and improve yields, further straining agricultural productivity.
- Export restrictions on essential food items during global crises like the Russia-Ukraine war heighten Pakistan's vulnerability to food supply volatility, driving up domestic and international food prices.
- The export of water-intensive crops contributes to depleting water resources. From 2013-2022, Pakistan averaged a net export of 7 billion m³ of Blue Virtual Water annually, peaking at 12 billion m³ in 2015, pressuring the country's water sustainability.
- Reliance on the Indus River Basin for agriculture, coupled with climate change and rapid population growth, threatens water availability, potentially reducing crop yields by 20% in Southern Pakistan and risking severe water scarcity by 2025.

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