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The Spillover Effects of Gulf Conflict on Global Food Production: A Sustainability Analysis of Fertilizer Supply Chain Disruptions

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Abstract

The ongoing conflict of the US-Israel war with Iran and the resulting disruption of shipping through the Strait of Hormuz represent a critical threat to global food production systems. While much attention has focused on energy markets, the strategic importance of the Gulf region as a global hub for fertilizer production—accounting for nearly one-third of key agricultural inputs—creates a transmission mechanism through which regional instability can cascade into worldwide food shortages.

This paper examines the spillover effects on global agriculture, analysing the immediate disruptions to fertilizer supply chains, the medium-term impacts on crop yields and planting decisions, and the differentiated vulnerabilities across importing regions. Drawing on data from international organizations and expert analysis, the paper quantifies the potential human cost, including projections that nearly 45 million additional people could face acute food insecurity if the conflict persists (UN, 2026). The analysis concludes by considering the structural vulnerabilities exposed by the crisis and implications for global food system resilience.

This paper contributes to the growing literature on food system resilience by demonstrating how geographically concentrated input production creates systemic vulnerability in global food supply chains. The analysis reveals that the Gulf's dual role as both fertilizer exporter and food importer creates a 'sustainability trap'—where regional instability simultaneously threatens global food production and local food security. We conclude by proposing a multi-level governance framework for enhancing food system resilience through supply chain diversification, strategic reserve coordination, and climate-smart agricultural transitions.

Keywords: Food System Resilience; Fertilizer Supply Chains; Strait of Hormuz; US-Israel-Iran War, Gulf Cooperation Council (GCC); Global Food Security; Supply Chain Disruption; Virtual Water Trade; Climate-Smart Agriculture

1.0 Introduction

1.1 Theoretical Positioning: Food System Resilience in Geopolitical Context

This paper contributes to three intersecting theoretical domains within sustainability scholarship. First, it extends resilience theory (Folke et al., 2010) by demonstrating how geographically concentrated production of critical agricultural inputs creates systemic vulnerability—a "single point of failure" in global food systems. Unlike climate or ecological shocks, geopolitical disruptions to concentrated production centers are characterized by sudden onset, political rather than natural drivers, and potential for strategic manipulation by state actors.

Second, the analysis contributes to global value chain (GVC) governance literature (Gereffi et al., 2005) by examining how input supply concentration in politically volatile regions creates distinct governance challenges. The Gulf's dominance in fertilizer production represents a "captive" value chain structure where importing countries lack bargaining power despite critical dependence.

Third, the paper integrates behavioural economics perspectives on crisis response (Kahneman & Tversky, 1979; Buheji, 2026b) to explain how threat perception amplifies supply chain disruptions through panic purchasing, hoarding, and defensive trade policies—mechanisms often overlooked in traditional supply chain analysis.

1.2 The Humanitarian Importance of the Strait of Hormuz

The Strait of Hormuz, a narrow waterway connecting the Persian Gulf to the wider Indian Ocean, handles approximately one-fifth of the world's liquefied natural gas, significant volumes of crude oil, and—critically for global agriculture—a substantial share of internationally traded fertilizers (Jain & Mante, 2026). As the conflict between US-Israel forces and Iran escalates in 2026, this strategic chokepoint has become a focal point of disruption, with shipping traffic severely curtailed and major port facilities sustaining attacks. Buheji (2026a); El Safty & El Dahan (2026).

While instability in the region is causing immediate humanitarian consequences that are visible and pressing within the Gulf region, the indirect effects on global food production systems may ultimately prove more far-reaching, Buheji (2026a). Unlike the Russia-Ukraine war, which directly disrupted a major grain-exporting region, the current conflict threatens global food production through a different mechanism: the supply of essential agricultural inputs, particularly fertilizers, and the energy required to produce and transport food (Cakirtekin, 2026).

This paper argues that the spillover effects of the Hormuz disruption will transmit through three interconnected channels: direct fertilizer shortages that reduce crop yields, energy price increases that raise production and logistics costs throughout food supply chains, and secondary impacts on planting decisions and agricultural investment. The convergence of these factors threatens to recreate the conditions of the 2022 global food crisis, potentially pushing tens of millions into acute food insecurity (Donmez, 2026).

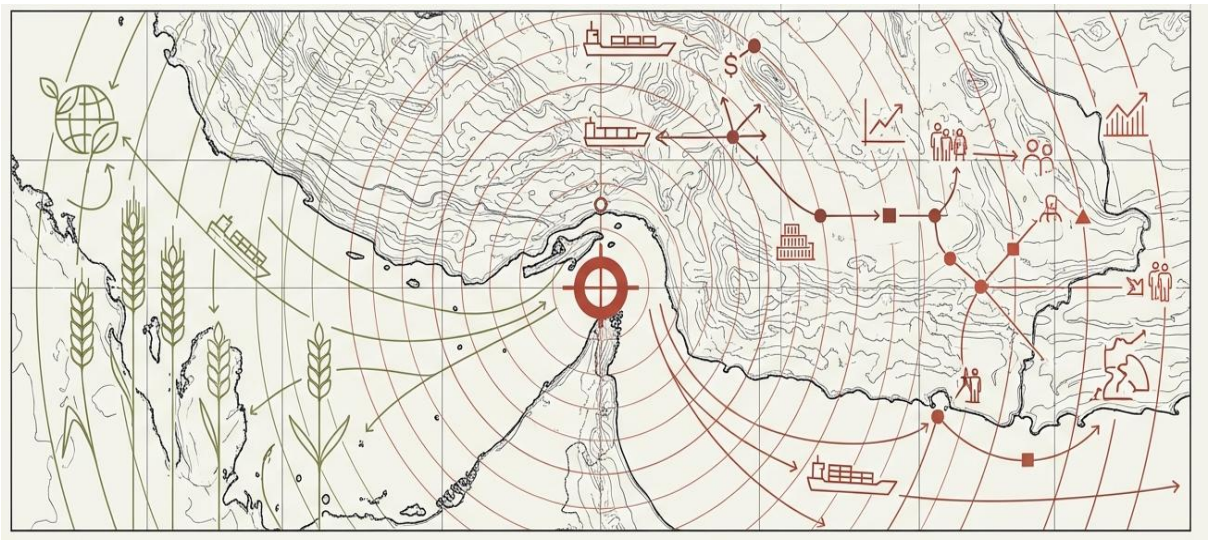
1.3 Dissecting the Global Food Insecurity Crisis

The Strait of Hormuz transcends its role as merely a vital artery for energy flows; it represents a "critical node" in the architecture of global food security. Any disruption to this passage does not merely trigger a price shock

but rather performs a deep dissection of the vulnerabilities embedded in cross-continental supply chains. See Figure (1)

For policymakers, it must be recognized that the food insecurity resulting from this disruption is not simply a supply crisis, but a leading indicator of state failure. Food gaps rapidly translate into existential risks for net food-importing countries, catalysing waves of civil unrest and cross-border mass migration. This crisis does not follow a linear path; rather, it branches into three parallel vectors that simultaneously assault the global system, demanding an unconventional strategic response.

Figure (1) Illustration of the Importance of the GCC Region and Strait of Hormuz to Global Food Security



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1.4 Relevance to Sustainable Development Goals

This analysis directly engages with multiple Sustainable Development Goals. SDG 2 (Zero Hunger) is centrally implicated through the threat to global food availability and affordability.

SDG 12 (Responsible Consumption and Production) is relevant through the fertilizer supply chain vulnerabilities exposed. SDG 14 (Life Below Water) and SDG 15 (Life on Land) connect through the environmental impacts of fertilizer production and the "virtual water" dimensions of food trade. SDG 17 (Partnerships for the Goals) is implicated in the regional and global coordination mechanisms required for an effective response. By examining how geopolitical instability threatens progress toward these goals, the paper contributes to understanding the fragility of sustainability achievements in interconnected global systems.

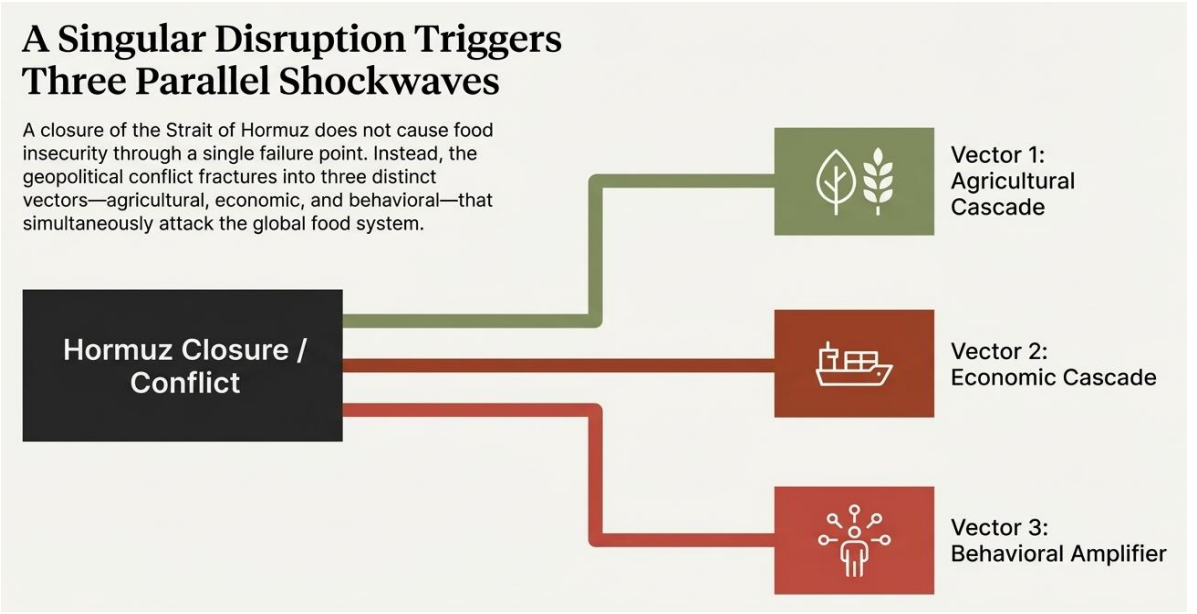
1.5 Structural Framework: Three Parallel Shock Waves from Passage Disruption

When a geopolitical conflict or closure of the Strait occurs, global food security unravels through three collision paths. It must be emphasized that these paths are multiplicative, not merely additive; their interplay acts as a "force multiplier," making it difficult to contain the crisis with traditional economic tools. Figure (2) shows the agricultural cascade path, which is a physical vector that shows the biological capacity for production by

cutting off essential input supplies. The economic cascade path, which is the financial vector, imposes constraints on market access through cost inflation resulting from energy price spikes.

The third spillover (shock waves) is the behavioural amplifier, which is the psychological and political vector. It acts as a catalyst for non-linear escalation, where panic and sovereign policies transform a physical crisis into a comprehensive collapse of confidence. This destructive synergy means that addressing only one path without the others will not halt the collapse; rather, it will exacerbate the total impact on global stability. See Figure (2)

Figure (2) illustrates the Spillover of the Disruption of Production in GCC and specifically the Strait of Hormuz Closure



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2.0 The Gulf's Strategic Position in Global Fertilizer Markets

2.1 Production and Export Concentration

The Gulf Cooperation Council (GCC) states, together with Iran, constitute one of the world's most concentrated centres of fertilizer production. According to International Fertilizer Association data, GCC states accounted for 23% of global ammonia trade (up from 19% in 2019) and 34% of global urea trade. The wider Middle East region contributed nearly 30% of global export supplies for major fertilizers, including nitrogen, phosphate, and potash. Shan (2026), Jain & Mante (2026).

This concentration reflects the region's comparative advantage in natural gas, which serves as the primary feedstock for nitrogen-based fertilizers. As Joseph Glauber of the International Food Policy Research Institute (IFPRI) notes, the Gulf's importance extends beyond direct fertilizer exports to encompass the LNG that

underpins global fertilizer production capacity (cited in Cakirtekin, 2026).

2.2 The Hormuz Bottleneck

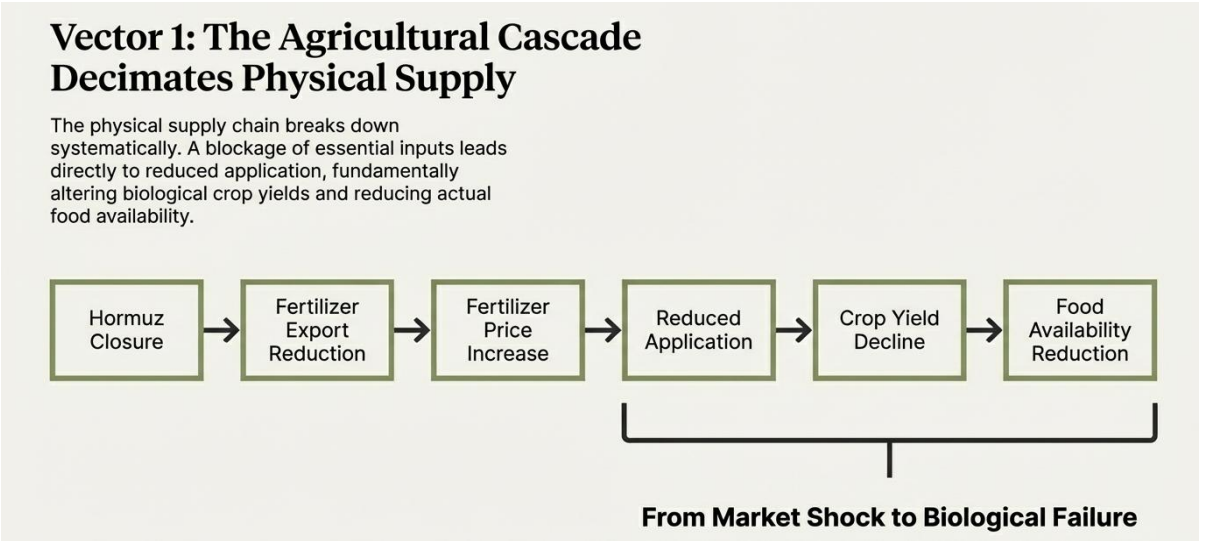
The strategic danger of the Strait of Hormuz lies in its role as the primary passage for fertilizers and their inputs. Disruption of this passage places the agricultural system in a "temporal trap." While maritime routes can be cleared in weeks, the loss of an entire growing season due to fertilizer shortages creates a supply vacuum lasting 12 to 18 months.

Critically, virtually all of this production must transit the Strait of Hormuz to reach international markets. Pre-conflict traffic averaged approximately 100 vessels daily, but current disruptions have reduced this to a fraction of normal volumes (El Safty & El Dahan, 2026). The International Fertilizer Association estimates that a prolonged closure could tighten global fertilizer supply chains by 33%, with urea supplies falling by 30% and sulfur—a key input for phosphate fertilizers—by 44% (Shan, 2026).

According to UNCTAD data, approximately 13% of global chemicals trade, including fertilizers, and 2.4% of dry bulk, including grains, passes through the Strait (Cakirtekin, 2026). While these percentages may appear modest, the strategic nature of fertilizer supplies—essential for maintaining crop yields—amplifies their significance.

Figure (3) shows how the chain of physical collapse: Strait Closure → Decline in Fertilizer Exports → Fertilizer Price Spike → Reduced Application Rates → Decline in Crop Yields → Shortage of Food Availability. This "biological failure" cannot be overcome by injecting financial liquidity; land that loses its fertility due to input shortages does not respond immediately to the reopening of maritime routes, making this path the longest in impact and the most difficult to recover from.

Figure (3) Illustrates the Importance of Global Resilience to Fertilizer Export Constraints Due to Geopolitical Conflicts – Taking the Strait of Hormuz as an Example



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2.3 Food System Resilience in Geopolitical Context

Recent scholarship on food system resilience has emphasized the importance of diversity, connectivity, and adaptive capacity (Tendall et al., 2015). However, much of this literature focuses on climate shocks or market volatility, with less attention to geopolitical disruption of input supply chains. The Gulf crisis provides a critical case for examining how resilience principles apply when shocks originate in politically strategic production centres rather than ecologically vulnerable areas. Building on Buheji's (2018, 2026b) work on empathetic supply chain design and navigating VUCA conditions, this analysis demonstrates that resilience in such contexts requires not only supply chain diversification but also strategic coordination mechanisms that transcend traditional market responses.

3.0 Methodology

This study employs a mixed-methods approach combining quantitative data analysis with qualitative policy synthesis.

3.1 Data Sources

Primary quantitative data were drawn from:

- International Fertilizer Association trade statistics (2022-2026)
- UNCTAD maritime transport database
- World Food Programme food security projections (March 2026)
- FAO price monitoring systems

3.2 Analytical Framework

Analysis follows a three-stage framework:

1. **Supply chain mapping**: Identifying critical nodes in global fertilizer supply chains transiting the Strait of Hormuz
2. **Impact transmission analysis**: Tracing mechanisms through which disruption propagates to food production
3. **Vulnerability assessment**: Differentiating impacts across importing regions based on exposure, sensitivity, and adaptive capacity

3.3 Limitations

Data limitations include: (a) the conflict is ongoing, with rapidly evolving conditions; (b) complete trade data for 2026 are unavailable at the time of writing; and (c) secondary impacts on planting decisions will only become observable in subsequent harvest seasons.

4.0 Transmission Mechanisms to Global Food Production

4.1 Direct Fertilizer Supply Disruptions

The most immediate agricultural impact of the Hormuz closure is reduced availability of fertilizers in importing countries. This effect is already visible in price movements: urea prices have risen from approximately $487 per ton before the conflict to $700 per ton in mid-March 2026 (Shan, 2026).

The agricultural consequences of fertilizer shortages are severe and well-documented. As the CEO of Yara International, one of the world's largest fertilizer companies, has warned, certain crops can experience yield reductions of up to 50% without adequate fertilizer application (Cakirtekin, 2026). This relationship between input availability and agricultural output creates a direct transmission mechanism from Hormuz disruption to global food supply.

4.2 Energy Price Pass-Through

Beyond direct fertilizer effects, the conflict has driven significant increases in energy prices, with oil trading above $100 per barrel (Donmez, 2026). Energy costs permeate food systems through multiple channels. It would raise, for example, the farm production costs where fuel for irrigation pumps, farm machinery, and transport are affected.

The cost of fertilizers production would raise sharply specially after the sharp rise of natural gas due to the bombing of Ras Lifan of Qatar Gas. Natural Gas typically constitutes 70-80% of nitrogen fertilizer production costs. Besides, fuel costs for shipping, trucking, and distribution would impact the whole supply chain.

As Richard Volpe, agricultural economics expert at California Polytechnic State University, explains: "As we go down the food supply chain, go downstream towards consumers, those higher energy costs are going to be compounded" (cited in Cakirtekin, 2026). This "multiplier effect" means that energy price increases disproportionately impact final food prices.

4.3 Timing and Agricultural Cycles

The impact of fertilizer shortages depends critically on timing relative to planting seasons. For the current crop cycle, many farmers had already purchased inputs before the conflict escalated, providing a temporary buffer (Shan, 2026). However, the disruption coincides with preparation for key planting periods in multiple regions such as in the Sub-Saharan Africa where planting season for major cereal crops, in South Asia where it is a period for rice and wheat cultivation, and in North America where it is a period for pre-planting fertilizer procurement for corn and soybeans. (WFP, 2026)

5.0 Regional Vulnerability and Impact Assessment

5.1 Asia: The Most Exposed Continent

Asia faces the steepest projected increase in food insecurity as a result of the crisis. WFP projections indicate a 24% increase in acute food insecurity (IPC Phase 3 or above) across Asian countries relative to pre-conflict

baselines. More people could fall into acute food insecurity across Asian countries, representing approximately 9.1 million additional individuals, WFP (2026). This vulnerability reflects several factors as in fertilizer import dependence: India, the world's largest importer of urea and DAP, relies heavily on Gulf supplies and is already seeking alternative sources from Indonesia, Belarus, Russia, and China (Jain & Mante, 2026).

Many Asian countries also import substantial portions of their energy needs, exposing them to oil price increases. The region's substantially smallholder farmer populations are particularly sensitive to input cost increases

5.2 Sub-Saharan Africa: Compounding Vulnerabilities

Sub-Saharan Africa faces the second-highest risk, with projected increases of 17-21% in food-insecure populations across different sub-regions (WFP, 2026). The region's vulnerability stems from several structural factors. More than 90% of fertilizer used in sub-Saharan Africa is imported (Cakirtekin, 2026). African households typically spend 40-60% of their income on food, making them acutely sensitive to price increases, while governments in this region have constrained resources for subsidies or social protection expansions.

The countries in this Sub-Saharan region is already experiencing humanitarian crises and face compounded risks. Sudan, which imports approximately 80% of its wheat, and drought-affected Somalia have both reported sharp price increases for essential commodities since the conflict began (WFP, 2026).

5.3 Latin America: Agricultural Export Exposure

Brazil, the world's largest exporter of soybeans, corn, and coffee, imports approximately 85% of its fertilizer requirements (Cakirtekin, 2026). Disruptions to fertilizer supplies therefore, threaten not only Brazilian domestic food security but global supplies of key commodities. Higher production costs in Brazil could translate into reduced global availability and higher prices for staple crops (Shan, 2026).

Beyond fertilizer effects, oil price increases impact Brazil's ethanol-sugar complex, potentially diverting cane toward sugar production and affecting global sweetener markets.

5.4 The Middle East and North Africa

The MENA region faces a projected 14% increase in food-insecure populations, or approximately 5.2 million people, including the strip of Gaza, Hassoun et al. (2025). This reflects the region's extreme dependence on food imports—GCC states are 80-90% dependent on imported food, with over 70% historically transiting the Strait of Hormuz. (WFP, 2026)

Countries without alternative port access face particular challenges. As analysts note, "Qatar, Kuwait, Bahrain and Iraq effectively become landlocked and will depend on overland routes through Saudi Arabia," creating costly congestion and logistical challenges (El Safty & El Dahan, 2026).

6.0 Secondary and Cascading Effects

6.1 The Domino Effect Across Agricultural Seasons

The agricultural impacts of input shortages are not confined to a single growing season. Reduced fertilizer application in one season can deplete soil nutrients, affecting subsequent crops even if supplies normalize. As Richard Volpe warns, weak harvests can create a "domino effect" that persists "for an extended period of time" (cited in Cakirtekin, 2026).

6.2 Virtual Water Trade and Water Security

The conflict also threatens food production through its impact on water security, both directly and indirectly. GCC states rely on desalination for up to 90% of their freshwater needs, and recent attacks on desalination facilities in Bahrain and Iran highlight the vulnerability of this critical infrastructure (Hadchity, 2026). As Elsayed and Al-Ghamdi (2024) document, desalination plants in the Gulf represent concentrated infrastructure nodes with limited redundancy, making them strategic targets during conflict. The loss or reduction of desalination capacity would create immediate water scarcity that cascades into food production constraints, particularly for high-value agriculture that depends on irrigated cultivation.

The virtual water, i.e. the amount of water that is "embedded" or used in the production of a good, commodity, or service—particularly agricultural products—that is then traded to the GCC region, is considered very high. Beyond direct water infrastructure, the region depends on "virtual water" imports—water-intensive products like meat and cereals from water-abundant nations, Allan (1998). For the GCC, virtual water imports effectively substitute for domestic water resources that are naturally scarce. Hoekstra and Mekonnen (2012) estimated that the Middle East region imports approximately 200 billion cubic meters of virtual water annually through food and agricultural products—equivalent to the flow of two Nile rivers.

If conflict disrupts these imports, the Gulf effectively loses a substantial portion of its water budget. This would affect both food and water self-sufficiency, potentially repeating the Gaza pattern of compounded water and food scarcity, though on a different scale. Al-Muhannadi and Buheji (2024) documented how intentional food and water scarcity create cascading humanitarian crises, with water shortages directly constraining food preparation, hygiene, and agricultural production. Table (1) shows that the GCC region is highly dependent on virtual water since it cannot grow most of its own food.

Table (1) illustrates why the GCC Region Cannot Grow Its Own Food

Agricultural Reality	**Implication**
Minimal rainfall	Cannot rely on rain-fed agriculture
Depleted aquifers	Groundwater extraction is unsustainable
High desalination cost	Producing water for agriculture is prohibitively expensive

The MENA region's food systems are already water-stressed under normal conditions; conflict-induced

disruptions to virtual water flows would exacerbate existing vulnerabilities.

Virtual water flows are the invisible yet critical water imports that sustain water-scarce regions like the GCC. When conflict disrupts food trade, it simultaneously disrupts virtual water flows, creating compounded water and food insecurity.

The UNESCO (2024) World Water Development Report emphasizes that water security is intrinsically linked to food security, and that conflict zones face compounded risks where water infrastructure becomes both target and weapon. In the Gulf context, this means that attacks on desalination facilities and disruption of virtual water imports together create a dual vulnerability that could rapidly transform a food supply crisis into a comprehensive water and food insecurity emergency.

As Al-Muhannadi and Buheji (2024) documented in Gaza, when both physical water infrastructure and food imports are simultaneously compromised, the result is a compounded humanitarian crisis where water scarcity directly constrains food preparation, hygiene, and survival.

Table (2) Illustrates the Vulnerability Scenarios Under Conflict

Scenario	**Consequence**
Shipping disrupted	Physical food imports stop → virtual water inflow stops
No virtual water	GCC loses 80-90% of its water budget for food
Desalination attacked	Cannot produce local water to grow alternative food
Result	Combined food + water crisis

6.3 Remittance Flows and Household Food Security

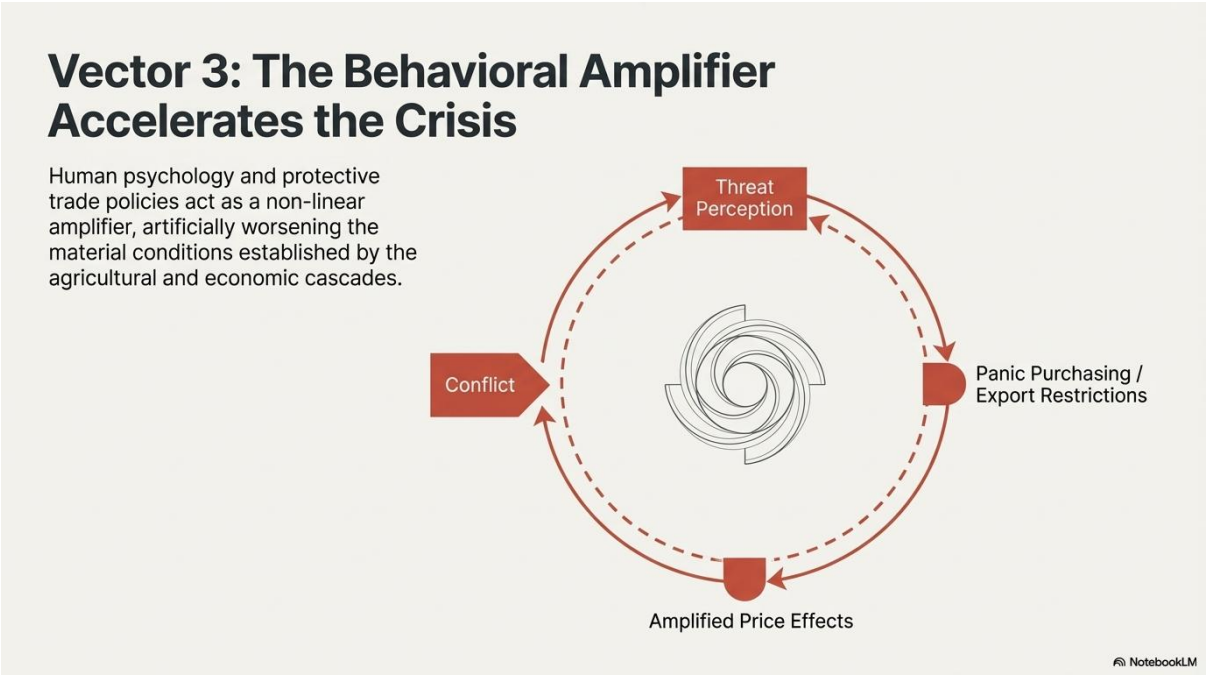
An often-overlooked transmission channel operates through remittance flows. The Gulf hosts millions of migrant workers from India, Bangladesh, Pakistan, Egypt, Yemen, and Sudan—countries where remittances constitute 3.4% to 15% of national GDP (Jain & Mante, 2026). Economic disruption in the Gulf reduces migrant earnings and remittance flows, directly impacting household food purchasing power in some of the world's most food-insecure regions.

6.4 State of Uncertainty - Behavioural Amplifier and Non-Linear Escalation of Crisis

The crisis may trigger defensive trade policies reminiscent of the 2007-2008 and 2022 food price crises. When prices spike, exporting countries often restrict shipments to protect domestic consumers, while importers engage in panic purchasing. Such behavior amplifies price increases and can create a cascading series of export restrictions. The FAO has proposed a Food Import Financing Facility (FIFF) to provide balance-of-payment support for eligible food-import-dependent countries, allowing them to continue importing through normal commercial channels during crises (Donmez, 2026).

Figure (4) shows the third vector of this Hermuz closure disruption, where psychological and political reactions amplify the crisis beyond its physical reality. Once a threat is perceived, markets enter a destructive feedback loop. The loop starts with threat perception, where the conflict generates a state of uncertainty. Then, the panic buying and protectionist restrictions loop starts. Here, nations resort to "sovereign panic" triggered by imposing export bans to secure their national stockpiles. This leads to amplification of price effects that is managed by behaviours that drive price increase that may reach up to five times the actual physical supply deficit. Protectionist policies shatter the confidence of the global trading system, transforming a supply disruption into a comprehensive systemic crisis from which it is difficult to retreat—even after the direct geopolitical cause has subsided.

Figure (4) Illustrates the Human Psychological Role in the GCC-Hermuz Crisis



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7.0 Quantitative Estimates of Global Impact

7.1 Projected Increases in Food Insecurity

The World Food Programme has developed rigorous estimates of the conflict's potential human impact. Using pre-crisis baseline numbers of people unable to afford an energy-sufficient diet (2,100 kcal/day), WFP modelled a sustained oil price shock at $100 per barrel, accounting for each country's dependence on imported energy and food (WFP, 2026).

The projections indicate that approximately 45 million additional people could fall into acute food insecurity (IPC3+) if the conflict continues through mid-2026 (UN, 2026; WFP, 2026). This would bring global acute food

insecurity to approximately 363 million people—surpassing the 349 million recorded during the 2022 Ukraine war-induced crisis (Donmez, 2026).

Table (3) illustrates the projected increases by World Regions (WFP, 2026)

Region	Projected Increase	Additional Food-Insecure Population
Asia	24%	9.1 million
West and Central Africa	21%	10.4 million
East and Southern Africa	17.7%	17.7 million
Latin America and Caribbean	16%	2.2 million
Middle East and North Africa	14%	5.2 million
Total		44.6 million

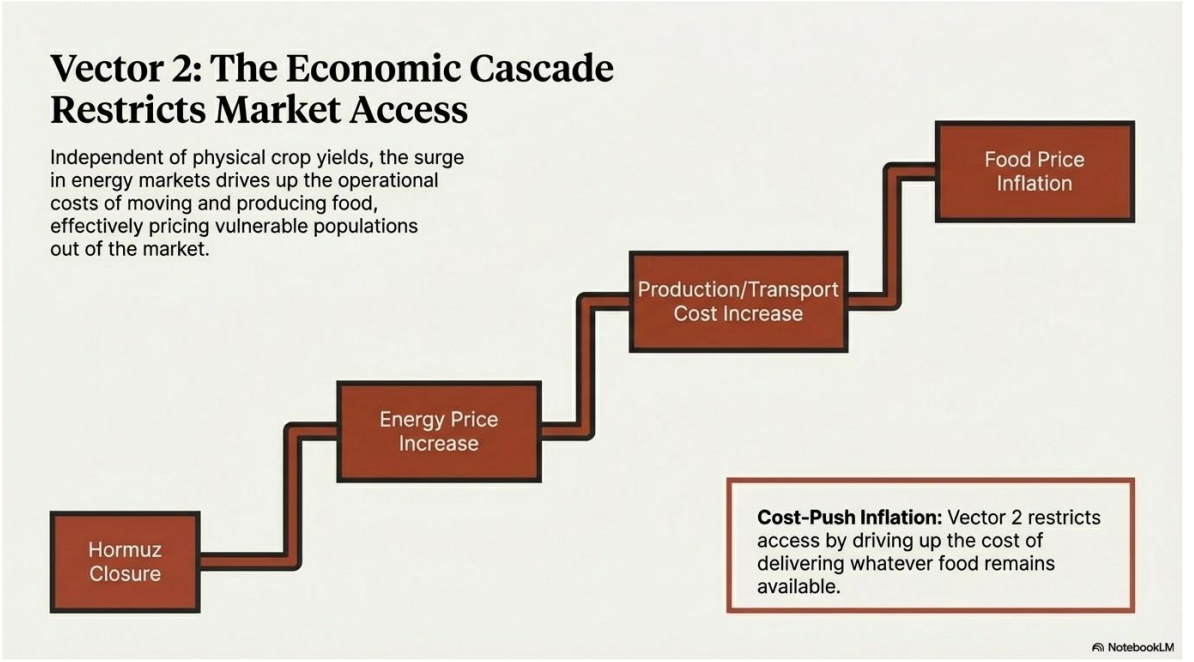
7.3 Economic Impact Projections- Cost Inflation and Market Access Constraints

Fertilizer price increases are already evident, with urea rising approximately 44% since the conflict began (Shan, 2026). These increases will transmit to food prices with a lag, as higher production costs work through agricultural systems. The IFPRI notes that "higher energy and input costs risk reigniting global food inflation just as retail food prices had returned to more historical levels in many countries" (Cakirtekin, 2026).

Separate from physical productivity, this path operates through the mechanism of cost-push inflation as illustrated in Figure (5). The immediate spike in global energy prices resulting from the Strait closure directly impacts transportation and logistics costs, leading to the "pricing out" of the most vulnerable populations and groups.

This path creates a dual-track world: wealthy nations capable of subsidizing costs and securing their needs, and emerging markets facing complete exclusion from the international market. This disparity is not merely an economic issue but rather the fuse for new geopolitical conflicts arising from inequality in access to essential resources—even in regions with sufficient local production but unable to afford the energy costs required for distribution.

Figure (5) Illustrate the Economic Cascade that creates the Cost-Push Inflation



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7.4 Temporal Dynamics of Impact Transmission

Understanding the temporal dimensions of food system disruption is critical for policy response. The analysis identifies three distinct temporal phases:

Phase 1 (Immediate, 0-3 months): Fertilizer price spikes and panic purchasing dominate, with food price impacts beginning but planting decisions largely locked in for the current season.

Phase 2 (Medium-term, 3-12 months): Reduced fertilizer application in major planting seasons translates to observable yield declines, with food price inflation peaking as reduced harvests reach markets.

Phase 3 (Long-term, 12+ months): Soil nutrient depletion from reduced application affects subsequent seasons; trade policy adjustments and supply chain reconfiguration may partially offset shortages, but at sustained higher cost levels.

8.0 Adaptation Capacity and Resilience

8.1 Market Adjustment Mechanisms

Global agricultural markets possess some capacity to adapt to the disruption. As Kenneth Medlock of Rice University notes, "none of the Persian GCC states ranks in the top 20 countries for global agricultural commodity exports, so the global system has the capacity to manage what is going on, albeit at higher prices" (Cakirtekin, 2026).

Alternative fertilizer suppliers—including Russia, China, Indonesia, and Belarus—may increase output, though this depends on their spare capacity and willingness to expand production (Jain & Mante, 2026). Similarly, alternative shipping routes, including the Cape of Good Hope, can partially substitute for Hormuz transit, though at significantly higher costs and longer transit times. In the meantime, the region can increase its empathetic supply within the GCC partners, where essential self-sufficiency products can be shared effectively based on previous experiences. Buheji (2018)

8.2 GCC Strategic Reserves

GCC states have developed substantial strategic reserves following the 2008 food crisis. Most have constructed modern grain silos capable of storing hundreds of thousands of tons of strategic grains, providing buffers for staples that can be stored for months. The UAE's Fujairah grain silos, strategically located on the Indian Ocean coast outside the Strait of Hormuz, have approximately 300,000 metric tons of capacity and were specifically designed to bypass Hormuz (El Safty & El Dahan, 2026).

However, these reserves are finite—generally sufficient for 4-6 months of consumption (El Safty & El Dahan, 2026). Regional cooperation among GCC members will be critical to managing complex logistics and ensuring all states maintain access, but the bloc has historically struggled with coordination.

8.3 Limitations of Adaptation

Despite these adaptive capacities, significant constraints exist. Ports outside the Strait have limited handling capacity. Khorfakkan can handle 5 million TEUs and Fujairah less than 1 million—far below the capacity of Dubai's Jebel Ali port, which serves approximately 50 million people (El Safty & El Dahan, 2026)

Overland transport through Saudi Arabia provides an alternative but creates costly congestion and depends on infrastructure that may be inadequate for full trade diversion (El Safty & El Dahan, 2026). Air freight capacity has dropped by 22%, and flying perishable goods dramatically increases costs. Many affected countries lack the fiscal space to subsidize food or expand social protection (Donmez, 2026)

9.0 Long-Term Implications and Policy Recommendations

9.1 Effective Diagnosis of GCC-Hermuz Closure Structural Vulnerabilities

The Hormuz crisis exposes several structural vulnerabilities in the global food system. The concentration of fertilizer production in a single geopolitically volatile region creates systemic risk (Jain & Mante, 2026). The

tight coupling of energy and food systems means energy disruptions rapidly transmit to food availability and affordability (Cakirtekin, 2026).

Figure (6) shows that the reliance on the critical maritime corridor of the Strait of Hormuz creates single points of failure in global supply chains. Regions with extreme import dependence and insufficient supplier diversification are expected to face acute vulnerability (El Safty & El Dahan, 2026).

The "perfect storm" occurs when the three paths converge, combining physical availability deficits with cost inflation and behavioural panic to produce an acute state of global food insecurity.

Figure (6) illustrates the Diagnostic Matrix of Pathways

Diagnostic Matrix: Comparing the Threat Pathways

Understanding the mechanical differences between the supply, cost, and behavioral drivers is critical for targeted policy intervention.

	Vector 1 (Agricultural)	Vector 2 (Economic)	Vector 3 (Behavioral)
Primary Catalyst	Hormuz Closure	Hormuz Closure	Geopolitical Conflict
Core Mechanism	Physical input disruption	Cost-push operational inflation	Market panic & protectionism
Immediate Output	Crop Yield Decline	Production/Transport Cost Increase	Panic Purchasing/Export Restrictions
Market Impact	Reduced Physical Availability	Baseline Price Inflation	Amplified Price Effects

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9.2 Policy Responses

The crisis underscores several policy priorities for strengthening global food system resilience. At the global level, WTO disciplines need to be more emphasised on export restrictions to prevent cascading trade policy responses; the FAO's Food Import Financing Facility to support vulnerable import-dependent countries needs to be effective too (Donmez, 2026). Cakirtekin (2026) recommend enhancing commodity market transparency and risk management tools.

At the regional level, we need to develop multi-origin procurement systems for grains, edible oils, and pulses (El Safty & El Dahan, 2026). More investment is needed in regional storage and distribution infrastructure. Besides, coordination mechanisms among GCC states and with neighbouring regions need to be strengthened on the ground (El Safty & El Dahan, 2026).

At the national level, diversifying fertilizer sourcing and developing domestic production capacity where feasible (Jain & Mante, 2026). More investment in last-mile inland distribution systems and dedicated food

corridors. Climate-smart agriculture practices, including nutrient management, regenerative farming, and bio-fertilizers can be promoted to reduce dependence on chemical fertilizers (Cakirtekin, 2026)

9.3 Opportunity for Regional Empathetic Supply Chain Design

Building on Buheji's (2018) framework for empathetic supply chain design in the Middle East, the crisis underscores the importance of designing food systems with explicit attention to vulnerability patterns. Empathetic supply chain design—structuring procurement, storage, and distribution to anticipate and protect the most vulnerable populations—would include: (a) geographic diversification of strategic reserves to avoid single chokepoint dependence; (b) pre-positioning of humanitarian supplies in locations accessible even under conflict conditions; and (c) integration of household-level resilience strategies (such as home food production) into national food security planning.

9.4 Proposed Multi-Level Governance Framework for Food System Resilience

As shown in Table (4) the crisis reveals that food system resilience requires coordinated action across governance levels.

Table (4) Presents a Multi-level Framework Synthesizing the Policy Recommendations

Governance Level	Immediate Actions (0-6 months)	Structural Reforms (6-24 months)
Global	Operationalize FAO Food Import Financing Facility; enhance WTO monitoring of export restrictions	Strengthen WTO disciplines on export restrictions; establish strategic fertilizer reserves
Regional (GCC)	Activate coordinated reserve sharing; establish joint procurement mechanisms	Develop regional fertilizer production capacity; integrate food security into GCC security coordination
National	Implement visible reserve displays; deploy social norm messaging	Diversify fertilizer sourcing; invest in climate-smart agriculture

9.5 Call for Strategic Action

To bring positive solution and as illustrated in Figure ( ) the international mediators, including UN led organisations need to contain the collapse of the global food production. This requires intervention in each of the following vectors independently and simultaneously. The agricultural vector requires building strategic reserves of production inputs (fertilizers) outside geopolitical chokepoints.

The economic vector works on decoupling energy prices from transport costs in essential food chains through targeted subsidy mechanisms. While the behavioral vector needs to be mitigated by activating diplomatic transparency and international agreements to prevent protectionist reactions that break the balance of the

global market. Failure to address these paths as an integrated system means accepting the collapse of global food security as an inevitability resulting from any conflict in the Strait of Hormuz.

Figure (7) Illustrates How the GCC-Hemuz Crisis and US-Israeli-Iran War would lead to Global Food Insecurity

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10.0 Conclusion

The conflict with Iran and the resulting disruption of shipping through the Strait of Hormuz represent a systemic shock to global food production systems. Through the critical mechanism of fertilizer supply disruption—amplified by energy price increases and logistics challenges—regional instability in the Gulf threatens to cascade into worldwide food shortages affecting tens of millions of people.

The World Food Programme's projection that nearly 45 million additional people could face acute food insecurity if the conflict persists underscores the magnitude of the risk (UN Office at Geneva, 2026; WFP, 2026). While adaptation mechanisms exist—including alternative suppliers, strategic reserves, and rerouted trade—these come at high cost and cannot fully insulate vulnerable populations from the shock.

The crisis serves as a stark reminder of the interconnectedness of global food systems and the vulnerability created by geographic concentration of critical inputs and logistics chokepoints. As with the 2007-2008 food crisis and the 2022 Ukraine war-induced shock, the current disruption will likely accelerate efforts to build greater resilience into global and national food systems. However, for the millions facing reduced access to food in the coming months, these long-term adaptations will come too late.

The moral imperative identified by WTO Trade Dialogues on Food—that "trade in food is a moral obligation"—has rarely been clearer. Preventing the collapse of global food supplies requires coordinated international action to maintain trade flows, support vulnerable import-dependent countries, and ensure that the burden of adjustment does not fall most heavily on those least able to bear it.

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