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Economic impact of poultry supply chain disruptions on food security: Evidence from Post-Pandemic Market Volatility in West Africa

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Abstract

The COVID-19 pandemic underscored the fragility of global and regional food systems, with poultry supply chains in West Africa particularly exposed to unprecedented disruptions. Poultry, as a vital source of affordable protein, plays a central role in regional nutrition security and rural livelihoods. However, pandemic-induced restrictions on movement, rising input costs, and interruptions in cross-border trade destabilized supply chains, creating ripple effects across production, distribution, and consumption. These shocks not only affected market prices and availability but also deepened inequalities between smallholder farmers and industrial producers, while threatening the food security of low-income households. This study investigates the economic impact of poultry supply chain disruptions on food security in post-pandemic West Africa, employing a mixed-methods approach combining market price analysis, household survey data, and simulation modeling. Results reveal persistent volatility in feed and live-bird markets, with price spikes disproportionately affecting consumers in urban centers. Smallholder farmers reported income losses due to limited access to veterinary services and reduced demand during critical lockdown periods, whereas larger firms demonstrated greater resilience by leveraging integrated supply networks. The findings highlight a dual vulnerability: while consumers face declining purchasing power amid volatile markets, producers contend with uncertain recovery trajectories. Policy simulations suggest that targeted interventions such as strategic grain reserves for feed, regional coordination of veterinary services, and emergency financial support for smallholders can stabilize the poultry sector and safeguard food security. In conclusion, strengthening resilience within poultry supply chains is essential to mitigating future systemic shocks, ensuring that West Africa's most accessible protein source remains affordable, available, and sustainable.

Keywords: Poultry Supply Chains; Food Security; Market Volatility; Post-Pandemic Economy; West Africa; Livelihood Resilience

1. Introduction

1.1. Background and Context

Poultry plays a central role in food systems across West Africa, serving as a critical source of affordable protein for both rural and urban households. Beyond nutrition, the sector underpins livelihoods for millions of smallholder farmers, traders, and processors, creating employment across production and marketing chains [3]. Its accessibility, short production cycles, and cultural acceptance make poultry unique compared to other livestock systems. In many households, eggs and chicken meat are among the most frequently consumed animal-source foods, ensuring poultry's importance to both dietary diversity and food security [1].

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The COVID-19 pandemic, however, exposed structural vulnerabilities in food systems worldwide, and West Africa's poultry sector was no exception. Movement restrictions disrupted transport of inputs such as feed, while border closures curtailed informal cross-border trade in live birds and day-old chicks [7]. At the same time, demand fluctuated sharply as urban consumers experienced income shocks, and producers faced price volatility in local markets [5]. These disruptions highlighted the interdependence of supply chain segments and the fragility of systems heavily reliant on imports of maize, soybean, and veterinary supplies.

Understanding poultry supply chains in this context is critical for assessing food system resilience. Unlike staple crops, poultry is more sensitive to input price changes, market shocks, and disease risks [8]. The pandemic thus served as a stress test, demonstrating how quickly disruptions could cascade from producers to consumers. Framing poultry supply chains as central to food security provides a vital entry point for exploring broader questions of resilience and equity in West Africa [2].

1.2. Research Problem and Rationale

The pandemic introduced unprecedented volatility into poultry markets, with feed costs soaring and production systems strained by input scarcity. Price fluctuations in maize and soybean the backbone of poultry feed exposed farmers to cost shocks that many could not absorb [6]. For smallholders, who often operate with minimal reserves, such instability translated into rapid production declines and, in some cases, complete farm closures [1].

Disruptions extended beyond the farm. Transport bottlenecks limited access to urban markets, while reduced demand in some areas forced producers to sell at significant losses [4]. These breakdowns had direct consequences for food security, particularly among low-income consumers for whom poultry is the most affordable source of animal protein [3]. Rising prices, declining availability, and reduced dietary diversity combined to worsen vulnerabilities in both rural and urban populations.

West Africa presents a unique case due to its hybrid poultry system. The region relies heavily on smallholder and backyard producers, yet increasingly imports feed ingredients and parent stock from international suppliers [7]. This dual structure magnifies exposure to global shocks while constraining adaptive capacity at the local level. Examining this context provides an opportunity to understand how systemic weaknesses intersect with external crises to shape food security outcomes [5].

1.3. Structure of the Article

This article is structured to provide a comprehensive and logical examination of poultry supply chain disruptions and their implications for food security in West Africa. Following this introduction, Section 2 discusses the role of poultry in regional diets and livelihoods, as well as pre-pandemic vulnerabilities. Section 3 analyzes the effects of post-pandemic market volatility on input availability, trade restrictions, and consumer demand. Section 4 shifts focus to the economic impacts across producers, intermediaries, and national economies, supported by comparative analysis.

Section 5 examines how disruptions translate into food security outcomes across the four dimensions of availability, access, utilization, and stability. Section 6 evaluates policy responses and institutional interventions, while Section 7 outlines forward-looking strategies for building resilient poultry systems. The article concludes in Section 8 with a synthesis of findings and implications for policy and practice [8]. This structured approach ensures a seamless progression from context to problem, analysis, and solutions [2].

2. Poultry and food security in west AFRICA

2.1. Importance of Poultry in Nutrition and Livelihoods

Poultry plays a pivotal role in addressing nutritional gaps across West Africa, where per capita consumption of animal-source protein remains below global averages [9]. Chicken meat and eggs offer an affordable, accessible, and culturally acceptable source of protein, vital for low-income households that often cannot afford beef or fish. In both urban and rural contexts, poultry consumption directly supports dietary diversity, providing essential amino acids and micronutrients critical for child development and maternal health [11].

The poultry sector also supports millions of livelihoods, particularly among smallholder farmers. Backyard poultry systems, often managed by women, contribute both cash income and food security at the household level [13]. Women's involvement ensures that poultry is not only a nutritional resource but also a pathway to economic empowerment, as income generated is often reinvested in household welfare and children's education [7]. Youth participation has been

increasing as poultry farming is seen as a relatively low-barrier entry point compared to more capital-intensive livestock enterprises. The sector provides opportunities across production, processing, and retailing, creating a diverse employment landscape [10].

Beyond households, poultry value chains stimulate local economies by generating demand for feed, veterinary inputs, and marketing services. Poultry-related enterprises frequently act as stepping stones for micro-entrepreneurs, further embedding the sector in community development [12]. The affordability and versatility of poultry position it as a cornerstone for both nutrition security and livelihood resilience in West Africa, highlighting why supply chain disruptions carry disproportionate consequences [8].

2.2. Poultry Value Chain Structure

The poultry value chain in West Africa is highly diverse, encompassing smallholder backyard systems, medium-scale semi-commercial farms, and large commercial enterprises [7]. Smallholders dominate numerically, particularly in rural settings, where flocks of 10–50 birds provide subsistence and occasional income [11]. These systems rely heavily on scavenging, with limited access to commercial feed or veterinary services, making them low-input but also low-output. By contrast, large-scale commercial operations though fewer in number supply a significant proportion of urban markets, supported by vertically integrated structures that cover feed milling, hatcheries, and processing facilities [9].

Key inputs include feed, hatcheries, and veterinary services, each of which underpins the sector's performance. Feed constitutes the single largest production cost, often exceeding 70 percent of total expenses, and is dependent on maize and soybean markets [13]. Hatcheries are critical for providing day-old chicks, though reliance on imported parent stock creates exposure to external shocks. Veterinary inputs, particularly vaccines and antibiotics, are essential for disease management but remain inaccessible for many smallholders due to cost or availability [10].

Distribution networks connect producers to consumers, with live bird markets forming the backbone of urban supply systems [8]. These markets not only facilitate trade but also reflect consumer preferences for freshly slaughtered poultry. Informal traders and transporters play central roles in moving birds from farms to urban centers, while modern retail outlets, though growing, remain a small fraction of overall distribution. The coexistence of informal and formal channels characterizes the value chain, ensuring wide accessibility but also embedding vulnerabilities [12].

2.3. Vulnerabilities Pre-Pandemic

Before the pandemic, West Africa's poultry sector already faced structural weaknesses that undermined its resilience. Infrastructure limitations, particularly poor road networks and inadequate cold storage facilities, constrained efficient distribution and heightened post-harvest losses [13]. These deficiencies not only raised transaction costs but also limited producers' ability to scale and meet rising urban demand [9].

Disease outbreaks represented another recurring vulnerability. Avian influenza, which struck several West African countries in the 2000s and mid-2010s, caused devastating losses, forcing widespread culling and undermining farmer confidence [7]. Inadequate veterinary coverage and weak biosecurity practices exacerbated the impact, especially among smallholders unable to access vaccines or professional advice [11]. The recurrence of such outbreaks revealed systemic weaknesses in disease surveillance and control, leaving the sector chronically exposed.

Import dependence also heightened fragility. The majority of feed ingredients particularly soybean meal and most veterinary medicines were imported, tying local production to global commodity prices and supply chains [8]. Currency fluctuations further intensified cost variability, making production planning difficult. Even hatchery operations often relied on imported parent stock, creating risks of supply bottlenecks when trade routes were disrupted [12].

Taken together, these vulnerabilities illustrate that the poultry sector entered the pandemic already compromised by infrastructural, biological, and trade-related challenges [10]. The health crisis merely amplified pre-existing weaknesses, pushing systems closer to breaking points. Recognizing these structural constraints is essential for contextualizing the scale and severity of pandemic-induced disruptions. Without acknowledging these prior risks, assessments of food security impacts may underestimate the true fragility of West Africa's poultry supply chains [13].

3. Post-pandemic market volatility

3.1. Feed Supply Disruptions and Price Inflation

Feed availability and affordability form the backbone of poultry production in West Africa, where feed costs often account for over 70 percent of total production expenses [13]. During the pandemic, global shocks to maize and soybean supply chains sharply raised local feed prices, creating immediate strain for producers across scales. Lockdowns disrupted transport of grains from rural production zones to urban feed mills, while border restrictions curtailed regional trade in soy products, particularly from Nigeria and Côte d'Ivoire [14]. The reliance on imported premixes further compounded volatility, as international shipping delays and currency depreciation inflated costs.

Smallholders faced the brunt of these shocks. Operating with minimal reserves and low bargaining power, many could not afford to sustain feeding cycles, resulting in premature sales of flocks or complete farm exits [16]. By contrast, larger commercial farms—though affected—were able to leverage vertical integration, storage capacity, and credit facilities to buffer price fluctuations. Nonetheless, even these actors saw margins eroded as consumer purchasing power contracted, limiting their ability to transfer costs downstream [12].

Feed inflation not only squeezed profitability but also constrained expansion of production at a time when food security needs were heightened. Farmers resorted to alternative feed sources, including cassava peels and groundnut residues, but such substitutions often lowered productivity and compromised flock health [18]. The uneven capacity to adapt reinforced inequalities between commercial and smallholder actors, amplifying long-term risks to sectoral resilience.

The trajectory of poultry feed prices from 2018 to 2023 illustrates how pandemic-induced shocks intersected with global market volatility.

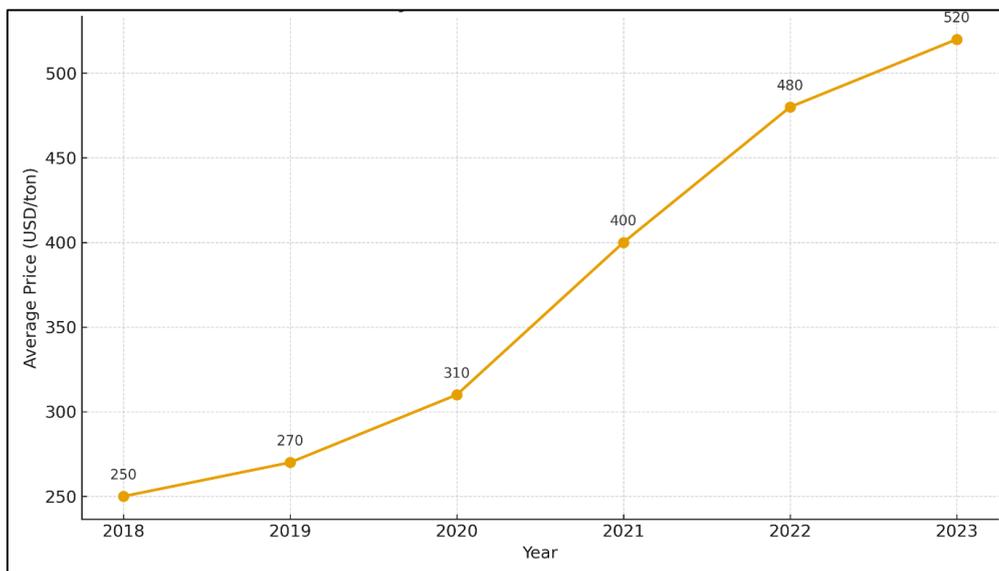


Figure 1 Trend of poultry feed prices in West Africa, 2018–2023 [6]

This trend underscores the dual vulnerability of West African poultry systems to both domestic restrictions and international commodity dynamics [15].

3.2. Input Scarcity and Veterinary Service Constraints

The pandemic also disrupted access to critical inputs beyond feed, including veterinary services, medicines, and vaccines. Movement restrictions limited mobility of extension officers and veterinarians, reducing the frequency of farm visits and weakening disease surveillance systems [12]. This created a paradoxical situation: while biosecurity concerns were heightened due to fears of avian influenza or Newcastle disease outbreaks, the capacity to deliver timely services was severely curtailed [17].

Hatcheries were similarly affected by delays in the importation of day-old chicks and parent stock. This led to reduced production cycles, inconsistent supply to farms, and heightened mortality risks when farmers attempted to raise chicks

under suboptimal conditions [16]. Informal veterinary drug sellers filled part of the gap, but reliance on unregulated products increased risks of antimicrobial misuse, raising longer-term concerns for food safety and zoonotic spillovers [14].

Smallholders were disproportionately disadvantaged. With limited access to private veterinary services even before the pandemic, many relied on government extension programs, which were scaled back or suspended during lockdowns [18]. Commercial farms, though better positioned, still experienced shortages of vaccines, creating risks of disease resurgence at industrial scales [15].

These constraints undermined sectoral resilience by elevating the probability of localized disease outbreaks cascading into systemic losses. The reduced delivery of preventive care illustrates how pandemic conditions exacerbated structural weaknesses, emphasizing the need for stronger decentralized veterinary networks in future crisis preparedness [13].

3.3. Market Access and Trade Restrictions

Border closures and transport restrictions disrupted poultry trade within and across West African countries, curtailing both formal and informal flows of birds, eggs, and inputs [18]. Informal cross-border trade, a key channel for smallholder farmers in regions such as northern Ghana and Benin, was particularly affected. Traders faced delays, harassment, and rising transaction costs at checkpoints, reducing profitability and limiting volumes reaching urban centers [14].

Urban markets experienced relative prioritization, as commercial actors redirected supplies to higher-value consumers. By contrast, rural markets faced scarcities, creating geographic disparities in availability [16]. Consumers in peripheral areas often paid higher prices despite lower purchasing power, deepening food security inequalities [12].

The segmentation between rural and urban consumption widened as transport bottlenecks lengthened supply chains and increased spoilage risks, especially given limited cold chain capacity [13]. These conditions illustrate how policy responses designed for health emergencies inadvertently magnified market inefficiencies, with direct implications for access and affordability.

Understanding the nutrition consequences of these disruptions requires attention to demand-side adjustments.

Table 1 Poultry consumption trends by income group during and post-pandemic

Income Group	Pre-Pandemic Consumption (kg/capita/year)	During Pandemic (kg/capita/year)	Post-Pandemic (kg/capita/year)	Observed Trends
Low-income	6.5	3.2	4.1	Sharp decline during pandemic due to price shocks; partial recovery but below pre-pandemic levels.
Lower-middle	9.8	6.1	7.5	Consumption contracted significantly; substitution with cheaper proteins noted.
Upper-middle	14.7	11.3	13.6	Reduced but less severely affected; quicker recovery due to greater purchasing power.
High-income	21.5	18.9	22.3	Only marginal decline; post-pandemic consumption exceeded pre-crisis levels, suggesting resilience.

The table highlights how income-strapped households substituted poultry with cheaper proteins, such as fish by-products or plant-based alternatives, while higher-income groups maintained or only slightly reduced consumption [15]. These differentiated consumption trajectories underscore the broader equity challenge embedded in poultry supply disruptions [17].

3.4. Consumer Demand Shifts and Nutrition Implications

The pandemic not only disrupted supply but also transformed consumer behavior. Declining household incomes, linked to widespread job losses and informal sector contractions, reduced the ability of many families to purchase poultry products regularly [16]. Poultry, though affordable relative to other meats, became prohibitively expensive for vulnerable groups as feed price inflation cascaded into retail prices [12].

As a result, many households substituted chicken with cheaper protein alternatives, including legumes, small fish, and offal. While these provided some nutritional compensation, they did not fully replace the high-quality protein and micronutrient content of poultry [14]. The nutritional consequences were particularly concerning for children and women, for whom poultry is a key dietary component [18].

For wealthier households, the impact was less severe. Though consumption declined modestly, higher-income groups were able to maintain access to eggs and chicken, highlighting inequities in how disruptions affected nutrition security [13]. The persistence of such disparity's risks widening health and developmental gaps across socioeconomic lines.

Beyond direct nutrition impacts, the pandemic altered perceptions of food security. Households reported increased anxiety about the stability of poultry supply, leading some to diversify diets or explore informal, local producers as more reliable alternatives [17]. This behavioral shift may persist beyond the pandemic, reshaping consumer preferences toward locally produced and shorter-supply-chain poultry products [15].

The convergence of economic strain, substitution effects, and altered consumer expectations demonstrates how demand-side dynamics intertwined with supply disruptions. These patterns highlight the importance of resilience strategies that account not only for production-side risks but also for consumer welfare and equity [12].

4. Economic impact analysis

4.1. Smallholder Farmers

Smallholder poultry farmers, who constitute the majority of producers in West Africa, were the most severely affected by pandemic disruptions. With limited financial reserves, smallholders were unable to absorb the shocks of rising feed costs and erratic input availability [18]. Many sold flocks prematurely to cover household needs, often at prices that did not reflect the true cost of production [21]. The result was a wave of income losses, particularly in peri-urban and rural communities dependent on poultry for both nutrition and livelihood security.

Farm closures were common as prolonged volatility eroded the capacity to maintain operations [16]. Farmers reported difficulties restocking after initial sales, given the rising costs of day-old chicks and feed. Women and youth, disproportionately represented in backyard poultry systems, were among the hardest hit, raising concerns about the gendered dimensions of resilience [20]. The erosion of smallholder participation weakened community-based poultry supply, reducing local availability and further straining household food access [23].

The broader consequence was diminished resilience within the poultry sector. Smallholders, who traditionally serve as buffers by supplying local and informal markets, saw their role weakened. This reduced the diversity of supply chains and heightened reliance on fewer, larger producers, increasing systemic vulnerability to future shocks [19]. The cascading effects of income loss, farm closures, and weakened resilience underscore the precariousness of smallholder systems under pandemic-induced stress [22].

4.2. Commercial Producers and Integrated Firms

Commercial producers and vertically integrated firms demonstrated comparatively greater resilience to pandemic shocks, though they were not immune to disruption [17]. Larger actors were able to leverage economies of scale, maintain access to credit, and draw upon reserves of feed and veterinary inputs to sustain operations. Their vertical integration spanning feed milling, hatcheries, and processing allowed them to manage internal supply bottlenecks more effectively than smallholders [19].

Nevertheless, even commercial farms faced declining profitability as consumer purchasing power contracted. In many cases, integrated firms reduced margins to sustain market share, absorbing part of the cost burden internally [16]. Some firms innovated by adopting forward contracts, diversifying input sourcing, or investing in on-site feed alternatives to cushion against global market volatility [21]. These adaptive measures underscored the capacity of larger producers to manage risk through organizational flexibility and capital buffers.

The performance gap between smallholders and integrated firms became more evident during the pandemic.

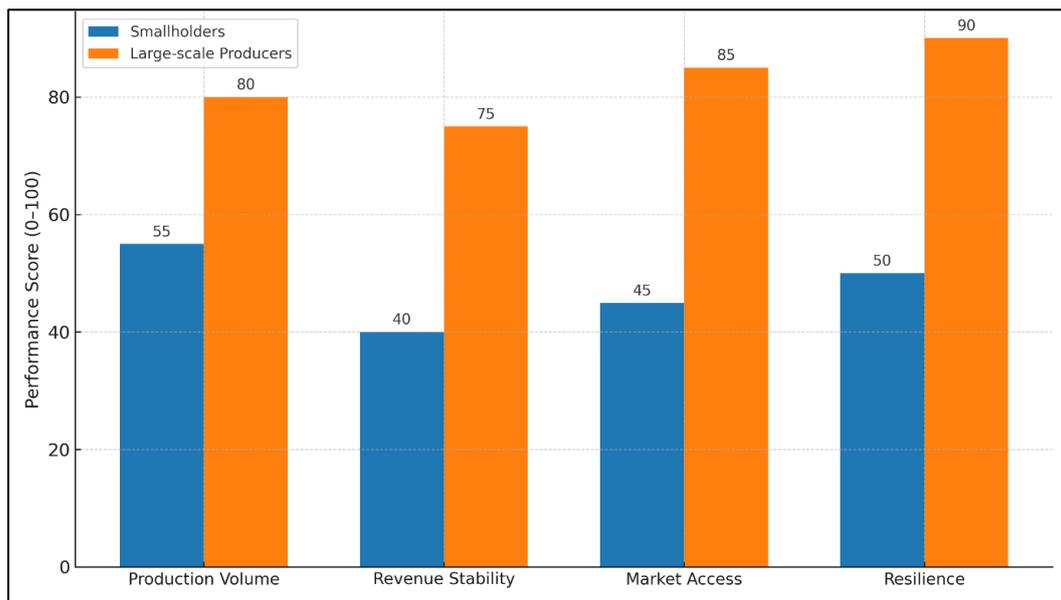


Figure 2 Comparative performance of smallholders vs. large-scale producers in pandemic period

The figure illustrates how smallholder production volumes contracted sharply, while integrated firms managed to sustain or even expand output, albeit at reduced profitability [20].

This divergence has important implications for the structure of West Africa's poultry sector. While larger producers stabilized supply during the crisis, their relative dominance risks marginalizing smallholders, further consolidating the industry [18]. Such concentration may enhance short-term efficiency but undermine long-term equity and inclusive development [22]. Balancing resilience with inclusivity thus emerges as a critical policy challenge.

4.3. Market Actors and Intermediaries

Market actors, including transporters, traders, and intermediaries operating live bird markets, faced disruptions that cascaded across supply chains [23]. Transport restrictions raised transaction costs, while curfews and checkpoint delays limited the movement of birds to urban centers [17]. Many transporters experienced significant income declines as volumes dropped, threatening the sustainability of livelihoods dependent on daily operations [19].

Live bird markets central to consumer access were further destabilized by health regulations and consumer fears. Temporary closures or reduced hours curtailed trading activity, leaving intermediaries with unsold stock and financial losses [20]. Traders adapted by shifting to informal neighborhood sales, but these lacked the volume and reliability of established markets [16].

The disruption of intermediaries had wider implications for supply chain resilience. With fewer actors linking producers to consumers, distribution bottlenecks became more pronounced, reinforcing price volatility and geographic disparities [22]. Market actors, though often overlooked, proved to be a critical link in sustaining poultry flows during crisis conditions.

4.4. National and Regional Economies

The poultry sector contributes significantly to GDP, employment, and trade balances in West Africa. Pandemic-induced disruptions reverberated beyond farms and markets to affect national and regional economies [21]. Declining poultry output reduced contributions to agricultural GDP, particularly in countries like Nigeria and Ghana where poultry constitutes a major subsector [16].

Employment losses were widespread, not only among farmers but also across feed mills, hatcheries, transport services, and processing plants [18]. These ripple effects underscored poultry's role as a labor-intensive industry that supports diverse livelihoods along its value chain. The contraction in employment aggravated broader economic distress, particularly in rural communities already vulnerable to poverty [19].

Trade balances also suffered. Reduced domestic production increased reliance on imports of frozen chicken in some countries, straining foreign exchange reserves [17]. Simultaneously, regional trade restrictions curtailed the flow of poultry products within the Economic Community of West African States (ECOWAS), weakening integration goals [23].

Taken together, these impacts highlight the sector's importance to macroeconomic stability. Disruptions in poultry supply chains were not merely localized shocks but systemic events influencing employment, trade, and economic recovery trajectories [20].

5. Food security outcomes

5.1. Availability

The availability dimension of food security was directly undermined by pandemic-related poultry supply chain disruptions. Declining production, driven by feed inflation, input scarcity, and constrained veterinary services, reduced the volume of poultry products accessible in both rural and urban markets [25]. Smallholder farmers who supply significant shares of local consumption were disproportionately affected, with many unable to sustain production cycles after incurring substantial losses [23].

The contraction of supply was further aggravated by logistical bottlenecks in transporting birds, eggs, and feed across regions [28]. Border closures limited cross-border trade in both inputs and finished poultry products, reducing diversity in market offerings and inflating dependency on domestic production. For countries with fragile infrastructure, these constraints resulted in heightened spoilage rates, especially where cold chain facilities were absent [24].

Commercial producers maintained partial stability, but their dominance could not offset widespread smallholder exits [26]. Consequently, aggregate production volumes declined, narrowing the availability of poultry at precisely the moment when households needed affordable, high-quality protein most. The result was a structural mismatch between rising demand for food security and reduced sectoral output, revealing poultry's vulnerability to systemic shocks [27].

5.2. Accessibility

Accessibility was primarily constrained by rising prices that outpaced household purchasing power. Feed-driven cost inflation cascaded into consumer prices, making poultry less affordable for low- and middle-income groups [23]. As incomes contracted due to pandemic-induced job losses, consumers struggled to maintain regular consumption of poultry, even when products remained physically present in markets [25].

Table 2 Food security dimensions and pandemic-related poultry sector disruptions

Food Security Dimension	Pandemic-Related Disruptions	Examples from Poultry Sector	Long-Term Implications
Availability	Production bottlenecks, reduced feed imports, farm closures	Decline in local poultry supply due to feed shortages and disease risks	Persistent supply gaps, increased reliance on imports
Accessibility	Rising prices vs. declining household incomes	Poultry became unaffordable for low-income households during peak lockdowns	Widening inequality in protein access; dietary shifts to cheaper substitutes
Utilization	Changes in diet quality, reduced protein intake	Lower consumption of poultry meat and eggs among vulnerable groups	Nutritional deficiencies, especially in children and women
Stability	Market volatility, weak storage and transport capacity	Supply chain shocks from border closures and transport restrictions	Long-term uncertainty in food systems, undermining resilience

The table synthesizes how accessibility, alongside other dimensions, was directly shaped by poultry sector instability [27].

This created a bifurcation in access: wealthier households retained purchasing power and continued accessing eggs and poultry meat, while vulnerable groups were excluded from consistent consumption [26]. The inflationary pressures exacerbated inequality, reinforcing existing socioeconomic divides in nutrition outcomes [28].

The interplay between availability and affordability was evident in household coping strategies. Many shifted to smaller portion sizes, less frequent consumption, or substituted with cheaper proteins, often at the expense of nutritional adequacy [24]. The combined effect underscores how accessibility not only availability determined actual food security outcomes during the crisis.

5.3. Utilization

Utilization, which concerns how food contributes to dietary quality and health, was compromised as households substituted poultry with less nutrient-dense alternatives. Eggs and chicken, rich in high-quality protein, vitamins, and minerals, were often replaced with legumes, offal, or low-cost fish residues during the crisis [25]. While substitutions provided caloric intake, they did not deliver equivalent micronutrient benefits, raising risks of dietary inadequacy [23].

The nutritional consequences were particularly acute for children and women, for whom poultry consumption is often prioritized [26]. Diet shifts may have contributed to worsening hidden hunger, undermining progress toward nutrition goals [28]. Beyond nutrient intake, reduced access to safe and regulated poultry increased reliance on informal markets, elevating risks of foodborne illnesses [24]. Thus, utilization challenges extended beyond nutrient deficits to encompass food safety, compounding food security risks.

5.4. Stability

The stability dimension reflects whether food security can be maintained over time, and pandemic disruptions highlighted the fragility of poultry-dependent systems. Repeated shocks to feed prices, veterinary inputs, and market flows created instability that eroded household and producer confidence [27]. Even as some conditions improved post-pandemic, volatility in global grain markets continued to destabilize poultry production [23].

For smallholders, stability was undermined by cumulative losses that reduced capacity to re-enter production, weakening the resilience of local supply systems [25]. Commercial producers fared better but still operated under uncertainty due to fluctuating costs and changing consumer demand [26]. These dynamics increased dependency on imported poultry in some countries, creating vulnerabilities tied to external trade conditions [28].

Long-term stability requires not just recovery from immediate disruptions but structural reforms in feed production, veterinary infrastructure, and regional trade facilitation [24]. Without such interventions, the poultry sector remains exposed to recurring crises, limiting its capacity to reliably contribute to food security in West Africa [27].

6. Policy responses and institutional interventions

6.1. Emergency Measures During the Pandemic

In the immediate aftermath of the pandemic, West African governments and development partners adopted emergency measures to cushion poultry producers and consumers. Short-term subsidies were introduced in some countries to partially offset rising feed costs, though implementation varied in scope and efficiency [29]. In Nigeria, for instance, targeted support included temporary restrictions on maize exports and allocations from national grain reserves to feed millers [26]. Such interventions helped stabilize supply in the short term but were insufficient to address structural vulnerabilities.

Food aid programs also sought to mitigate nutritional impacts, particularly in urban centers where income shocks severely limited household purchasing power [32]. However, distribution inefficiencies and limited coverage meant that many vulnerable groups especially rural households dependent on informal poultry markets were excluded. Smallholder farmers, often operating outside formal registration systems, faced difficulties in accessing subsidies or aid [27].

Civil society organizations played a critical complementary role by facilitating local relief, mobilizing feed donations, and linking farmers to emergency markets [30]. Yet these efforts remained fragmented and localized. The overarching lesson is that emergency measures provided short-term relief but could not fundamentally alter the systemic exposure of poultry supply chains to external shocks. A more comprehensive resilience agenda is necessary to avoid repeated reliance on ad hoc crisis responses [28].

6.2. Long-Term Policy Gaps

Despite the emergency measures, long-standing policy gaps continue to constrain poultry sector resilience. Weak veterinary systems remain a major challenge, limiting the capacity to detect, prevent, and respond to disease outbreaks [31]. This gap was exacerbated during the pandemic, when restrictions reduced already limited veterinary coverage and heightened risks of avian influenza resurgence [26].

Fragmented supply chains further undermine efficiency. Smallholders lack structured linkages to input suppliers and output markets, resulting in inefficiencies that increase vulnerability to disruptions [27]. Efforts to integrate smallholders into value chains through cooperatives and contract farming have been uneven and poorly coordinated across the region [30].

Infrastructure limitations particularly in cold chains and transport networks continue to restrict distribution efficiency [28]. Addressing these gaps requires sustained investment, yet policies remain reactive rather than strategic. The absence of comprehensive, long-term poultry development frameworks leaves the sector exposed to recurring crises.

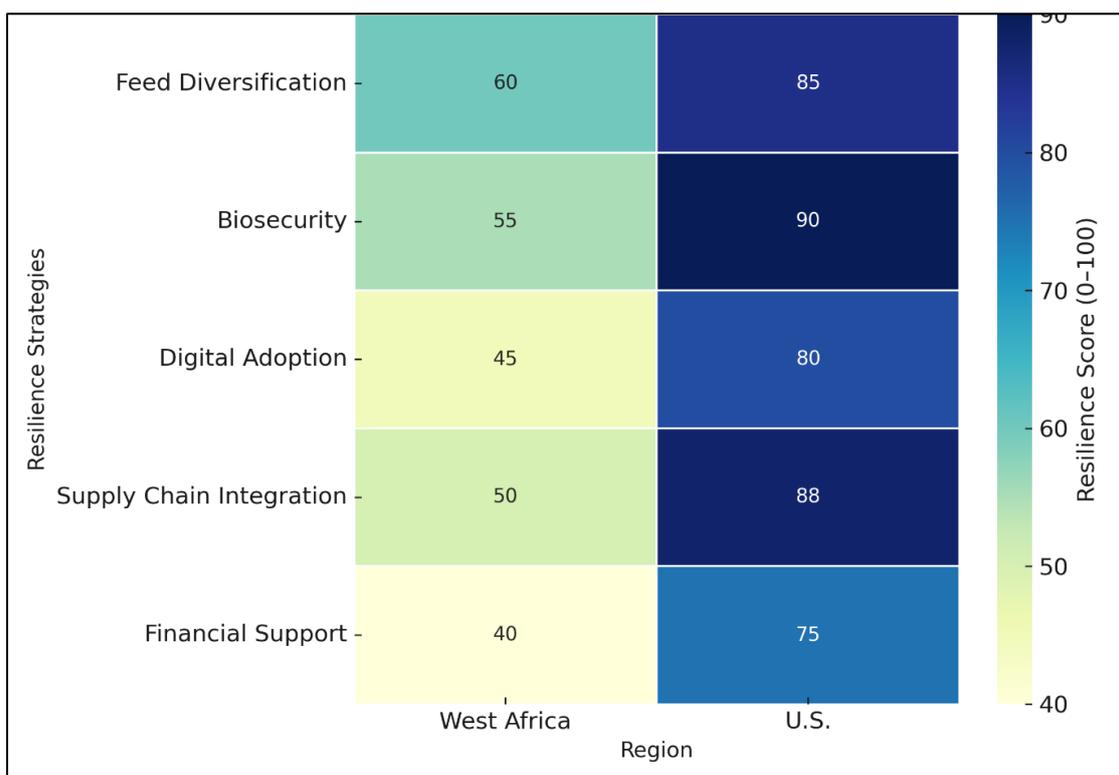


Figure 3 Comparative resilience strategies between West Africa and the U.S. poultry sector

The figure highlights how systemic gaps in veterinary systems and supply chains distinguish West African vulnerabilities from U.S. resilience approaches [32].

6.3. Regional Cooperation and Trade Policies

Regional integration under the Economic Community of West African States (ECOWAS) provides a potential pathway for strengthening poultry resilience. However, the pandemic exposed weaknesses in cross-border coordination, as individual states adopted unilateral restrictions that disrupted trade in feed, chicks, and poultry products [29]. These measures undermined regional food security by fragmenting supply flows and raising transaction costs for traders [33].

Greater harmonization of policies is necessary to facilitate trade. Establishing regional grain reserves, harmonized veterinary standards, and coordinated border protocols could reduce the volatility experienced during future crises [26]. Cross-border initiatives to facilitate maize and soybean trade are particularly critical, given the dependence of poultry feed on regional production systems [30].

ECOWAS frameworks provide opportunities to develop collective strategies, but implementation has been slow and uneven. Strengthening enforcement mechanisms and fostering trust among member states are essential for realizing the benefits of regional cooperation [28]. Without such reforms, the poultry sector will remain fragmented and vulnerable to localized disruptions that reverberate across borders [31].

6.4. Lessons from the U.S. and Other Regions

Comparative insights from the United States and other regions highlight strategies that could inform West Africa's poultry resilience agenda. In the U.S., strong vertical integration allowed producers to manage input and output flows internally, reducing exposure to external shocks [32]. Large-scale investments in cold chain infrastructure and biosecurity further bolstered stability, ensuring continuity in production and distribution even under pandemic restrictions [27].

Additionally, advanced veterinary networks provided rapid surveillance and disease management, minimizing risks of cascading losses [29]. While the structural differences between West Africa and the U.S. are significant, key lessons emerge: the importance of integrated supply chains, investment in veterinary systems, and proactive infrastructure planning [33].

Adapting these lessons to local contexts requires balancing efficiency with inclusivity, ensuring smallholder participation while building systemic resilience. These comparative insights underscore the urgency of long-term planning beyond crisis-driven measures [26].

7. Future directions for resilient poultry systems

7.1. Strengthening Supply Chain Infrastructure

Resilient poultry systems in West Africa require robust infrastructure capable of absorbing and adapting to shocks. Weaknesses in storage, transport, and processing facilities were central to the vulnerabilities exposed during the pandemic [34]. Poor rural road networks hindered the movement of feed and live birds, inflating costs and limiting access to urban markets. Investment in all-weather roads and feeder routes would reduce delays and spoilage, ensuring that farmers remain connected to critical value chain actors [32].

Storage infrastructure, particularly cold chain facilities, remains limited across the region. The absence of reliable refrigeration increased losses during trade restrictions and heightened consumer reliance on informal markets with minimal safety oversight [36]. Expanding cold storage and distribution hubs near production zones and urban centers would enhance both efficiency and food safety.

Processing capacity also requires attention. Most poultry in West Africa is sold live, limiting opportunities for value addition and increasing exposure to market disruptions. Establishing decentralized processing units could stabilize demand, provide standardized products, and reduce reliance on informal intermediaries [35].

By investing in transport, storage, and processing, governments and private actors can transform poultry systems into more resilient, market-responsive structures. These investments, while capital-intensive, are essential for mitigating future disruptions and ensuring stable poultry availability [38].

7.2. Promoting Local Feed Production

Feed dependence remains the Achilles heel of poultry production in West Africa. Heavy reliance on imported soybean meal and premixes exposes the sector to global market volatility and currency fluctuations [33]. Promoting local feed production offers a pathway to reduce external dependency while supporting broader agricultural development.

Expanding maize and soybean cultivation within the region can serve as a foundation for domestic feed industries [32]. However, this requires coordinated investment in seed systems, extension services, and irrigation infrastructure to raise yields. Diversification into alternative feed resources, such as sorghum, cassava peels, and insect protein, could further cushion against supply shocks [37].

Smallholder inclusion in feed production is equally important. Linking crop farmers with poultry producers through contract schemes or cooperatives could stabilize prices and create mutual benefits across agricultural subsectors [36]. Regional policies promoting trade in feed grains would also enhance availability and reduce cross-border frictions [34].

Investing in feed sovereignty is therefore not just an economic strategy but a food security imperative. Localized feed production strengthens resilience, reduces cost pressures, and provides greater autonomy to West African poultry systems [35].

7.3. Digital and Financial Innovations

Digital and financial innovations present powerful opportunities to enhance resilience across poultry value chains. Mobile platforms have expanded rapidly across West Africa, offering tools for real-time price information, input sourcing, and market coordination [38]. Integrating poultry-specific modules into such platforms could help farmers anticipate feed price shifts, locate veterinary services, and connect with buyers more efficiently [33].

Financial innovations are equally critical. Access to credit remains a persistent barrier for smallholders, many of whom operate outside formal banking systems [36]. Mobile banking solutions and microfinance schemes tailored to poultry producers could provide working capital for inputs during crises. Insurance mechanisms particularly index-based products linked to feed prices or disease outbreaks could further reduce risks, allowing farmers to plan with greater confidence [34].

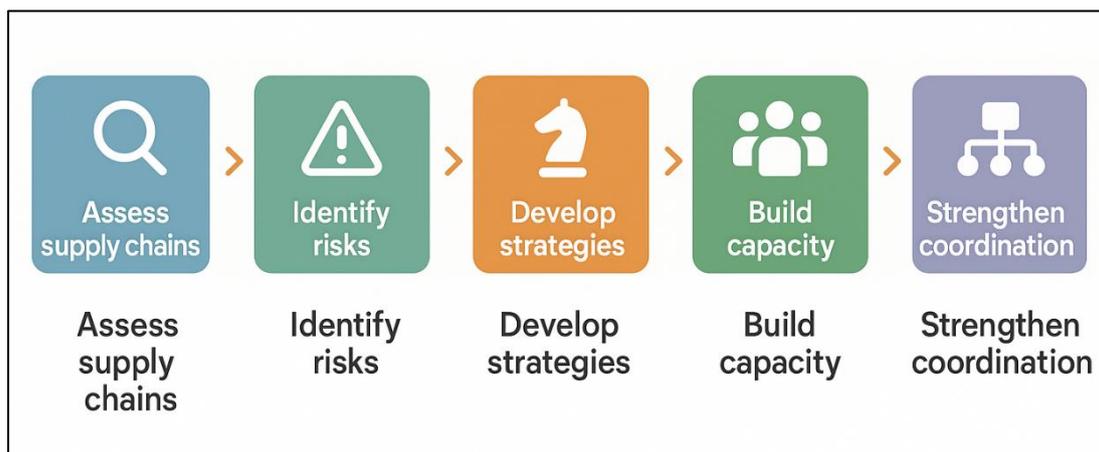


Figure 4 Roadmap for building resilient poultry supply chains in West Africa

The figure outlines how digital technologies, financial tools, and insurance products can intersect to create a comprehensive resilience roadmap [37]. By embedding these tools across the value chain, both smallholders and commercial producers can mitigate volatility and sustain operations under uncertain conditions.

These innovations not only enhance economic resilience but also empower marginalized groups. Women and youth, who often face exclusion from formal finance, could particularly benefit from mobile-based access to credit and risk management solutions [32].

7.4. Community-Based Adaptation

Community-based adaptation offers a complementary pathway to building resilience by embedding solutions within social and cultural contexts. Women, who play central roles in backyard poultry systems, can be empowered through training, access to inputs, and cooperative structures that increase their bargaining power [36]. Strengthening women's participation ensures that resilience strategies also deliver gender-equitable outcomes [35].

Youth engagement is similarly vital. Poultry farming provides an accessible entry point into agribusiness, and targeted programs can help young people adopt modern production and digital tools [37]. Such inclusion not only supports livelihoods but also revitalizes rural economies, reducing migration pressures.

Cooperative models offer additional resilience benefits by pooling resources for feed purchases, veterinary services, and transport [38]. Collective bargaining can reduce input costs and improve access to formal markets, particularly for smallholders who lack individual scale.

Community-led initiatives, when supported by enabling policies, ensure that resilience strategies are not top-down impositions but locally relevant adaptations [33]. By fostering inclusive participation, these models strengthen both

social and economic resilience, embedding poultry more firmly as a pillar of food security and livelihood stability in West Africa [34].

8. Conclusion

Synthesis of Findings

This article has examined how pandemic-induced disruptions to poultry supply chains in West Africa reverberated across food systems, livelihoods, and national economies. At the production level, soaring feed prices, scarcity of veterinary inputs, and border restrictions combined to weaken both smallholder and commercial actors. While large integrated firms demonstrated greater resilience, smallholders—the backbone of local supply—suffered widespread losses, closures, and reduced participation in markets. The imbalance created a dual burden: declining availability of poultry products and widening inequities in who could access them.

Market actors and intermediaries also faced unprecedented challenges, from transport delays to disrupted live bird markets, amplifying geographic disparities in supply. On the demand side, declining purchasing power and rising prices forced households to substitute poultry with less nutritious alternatives, undermining utilization and exacerbating hidden hunger. Stability, the fourth dimension of food security, was compromised by the sector's systemic reliance on imported inputs and fragmented infrastructure, leaving poultry systems vulnerable to repeated crises.

The findings highlight a clear linkage between supply chain disruptions, economic strain, and food security outcomes. The pandemic exposed not only immediate vulnerabilities but also structural weaknesses that predated the crisis. It revealed how shocks to one subsector can cascade through entire economies, impacting employment, trade, and nutrition. Poultry, given its centrality in diets and livelihoods, stands as both a bellwether of resilience and a critical entry point for strengthening food systems in West Africa.

Implications for Policy and Practice

The analysis underscores several priorities for governments, industry, and communities seeking to build resilience in poultry systems. First, investment in infrastructure roads, cold storage, and processing facilities is essential to reduce losses and stabilize supply. Without these, producers remain trapped in cycles of inefficiency and vulnerability. Second, reducing dependence on imported feed and veterinary inputs is crucial. Promoting local grain production, alternative protein sources, and regional trade integration can mitigate exposure to global shocks.

Equally important are digital and financial innovations that expand access to credit, insurance, and market information. Smallholders, particularly women and youth, require targeted support to ensure inclusion in resilience strategies. Cooperative models can amplify their collective bargaining power while creating platforms for shared investment.

For policymakers, the challenge is to align emergency responses with long-term frameworks. Short-term subsidies and food aid, though necessary in crises, must evolve into structural reforms that strengthen veterinary systems, integrate smallholders into value chains, and harmonize regional trade rules. For industry and civil society, partnership is vital in co-developing practical tools that balance efficiency with equity.

Final Reflections

The disruptions to poultry supply chains during the pandemic hold broader lessons for food system resilience and equity. They demonstrate how fragile systems can quickly unravel when confronted with global shocks, and how inequities deepen when responses fail to account for marginalized groups. Yet the crisis also revealed pathways forward: the potential of digital innovation, the importance of regional cooperation, and the power of community-based adaptation.

Resilience in West Africa's poultry sector cannot be achieved solely through technological or economic interventions. It requires a systemic approach that integrates infrastructure, policy reform, and inclusive participation. The broader lesson is clear: food security depends not only on the volume of production but also on the fairness and stability of access. By embedding equity at the center of resilience strategies, West Africa can transform poultry supply chains from vulnerable systems into pillars of sustainable, inclusive growth.

References

- [1] Galanakis CM. The “vertigo” of the food sector within the triangle of climate change, the post-pandemic world, and the Russian-Ukrainian war. *Foods*. 2023 Feb 7;12(4):721.
- [2] Belarmino LC, Pabsdorf MN, Padula AD. Impacts of the COVID-19 pandemic on the production costs and competitiveness of the Brazilian chicken meat chain. *Economies*. 2023 Sep 18;11(9):238.
- [3] Otoko J. Optimizing cost, time, and contamination control in cleanroom construction using advanced BIM, digital twin, and AI-driven project management solutions. *World J Adv Res Rev*. 2023;19(02):1623-38. doi: <https://doi.org/10.30574/wjarr.2023.19.2.1570>
- [4] Calderon C, Kabundi A, Eliste P, Goyal A, Kubota M, Korman V, Forget VD. *Africa's Pulse*, No. 26, October 2022. World Bank Publications; 2022 Oct 4.
- [5] Ejedegba EO. Equitable healthcare in the age of AI: predictive analytics for closing gaps in access and outcomes. *Int J Res Publ Rev*. 2022 Dec;3(12):2882-94.
- [6] Soetan O. Sustainable automation pipelines powered by lightweight AI optimizing industrial efficiency while preserving transparency, compliance, and equity in decision processes. *Int J Comput Appl Technol Res*. 2023 Jan;12(12):218-33. doi:10.7753/IJCATR1212.1022.
- [7] Solarin A, Chukwunweike J. Dynamic reliability-centered maintenance modeling integrating failure mode analysis and Bayesian decision theoretic approaches. *International Journal of Science and Research Archive*. 2023 Mar;8(1):136. doi:10.30574/ijstra.2023.8.1.0136.
- [8] Cariappa AA, Acharya KK, Adhav CA, Sendhil R, Ramasundaram P. Impact of COVID-19 on the Indian agricultural system: A 10-point strategy for post-pandemic recovery. *Outlook on Agriculture*. 2021 Mar;50(1):26-33.
- [9] Ukaoha, C.A., Anthony, I., Alabi, O.O., Ajabare, D.B., Oluleye, O.D., Njoku, V.O. (2022). PROFIT EFFICIENCY OF SOYBEAN PRODUCTION IN FEDERAL CAPITAL TERRITORY, NIGERIA. *European Journal of Agricultural and Food Sciences*,4(5), 28-37. <https://doi.org/10.24018/ejfood.2022.4.5.530>
- [10] Agbugba IK, Agbagwa SK, Anumudu CK, Ekwebelem OC, Al-Sharify ZT, Isaac-Bamgboye FJ, Onyeaka H. The evolving state of food security in Nigeria amidst the COVID-19 pandemic—A review. *Open Agriculture*. 2022 Nov 17;7(1):899-909.
- [11] Emmanuel Oluwagbade, Alemede Vincent, Odumbo Oluwole, Animashaun Blessing. LIFECYCLE GOVERNANCE FOR EXPLAINABLE AI IN PHARMACEUTICAL SUPPLY CHAINS: A FRAMEWORK FOR CONTINUOUS VALIDATION, BIAS AUDITING, AND EQUITABLE HEALTHCARE DELIVERY. *International Journal of Engineering Technology Research & Management (IJETRM)*. 2023Nov21;07(11).
- [12] Kumareswaran K, Jayasinghe GY. Systematic review on ensuring the global food security and covid-19 pandemic resilient food systems: towards accomplishing sustainable development goals targets. *Discover sustainability*. 2022 Aug 31;3(1):29.
- [13] Agbagwa S, Odeyemi O, Anyogu A, Anumudu C, Ekwebelem OC, Agbugba I, Onyeaka H. Strategies to mitigate the impact of COVID-19 on food security and malnutrition in Nigeria. *European Journal of Nutrition & Food Safety*. 2021 Mar 29;13(2):103-9.
- [14] Njoku, V.O., Ukaoha, C.A., Anthony, L., Ajabare, D.B., Oluleye, O.D. (2022). ASSESSMENT OF INVESTMENT DECISIONS AND FINANCIAL PERFORMANCE OF SMALL AND MEDIUM ENTERPRISES IN FEDERAL CAPITAL TERRITORY, NIGERIA. *International Journal of Small and Medium Enterprises*, 5(1), 40-50. <https://doi.org/10.46281/ijsmes.v5i1.1813>
- [15] Struwig M, Watson S. Working capital management and systems disruption during the COVID-19 pandemic: evidence from South Africa. *Athens Journal of Business & Economics*. 2023;9(1):45-58.
- [16] Jamiu OA, Chukwunweike J. DEVELOPING SCALABLE DATA PIPELINES FOR REAL-TIME ANOMALY DETECTION IN INDUSTRIAL IOT SENSOR NETWORKS. *International Journal Of Engineering Technology Research & Management (IJETRM)*. 2023Dec21;07(12):497–513.
- [17] Haque MK, Zaman MR, Rahman MA, Hossain MY, Shurid TI, Rimi TA, Arby H, Rabbany MG. A review on impacts of COVID-19 on global agricultural system and Scope for Bangladesh after pandemic. *Environmental Science and Pollution Research*. 2022 Aug;29(36):54060-71.

- [18] Putri NS. Navigating Global Agricultural Trade Challenges in Post-Pandemic in ASEAN. *SUKUK: INTERNATIONAL JOURNAL OF BANKING, FINANCE, MANAGEMENT AND BUSINESS*. 2022 Jan 10;1(1):27-37.
- [19] Ajabare, D.B., Anthony, L., Alabi, O.O., Njoku, V.O., Ukaoha, C.A., Oluleye, O.D. (2022). RESOURCE USE EFFICIENCY AND PROFITABILITY ANALYSIS OF TOMATO PRODUCTION IN FEDERAL CAPITAL TERRITORY. *European Journal of Agricultural and Food Sciences*,4 (5),72-82. <https://doi.org/10.24018/ejfood.2022.4.5.539>
- [20] Sundram P. Food security in ASEAN: progress, challenges and future. *Frontiers in Sustainable Food Systems*. 2023 Oct 10;7:1260619.
- [21] Vyas S, Chanana N, Chanana M, Aggarwal PK. From farm to fork: early impacts of COVID-19 on food supply chain. *Frontiers in Sustainable Food Systems*. 2021 Nov 4;5:658290.
- [22] Hamid S, Mir MY. Global Agri-food sector: challenges and opportunities in COVID-19 pandemic. *Frontiers in sociology*. 2021 Jul 12;6:647337.
- [23] Oluleye, O.D., Anthony, I., Ukaoha, C.A., Alabi, O.O., Njoku, V.O., Ajabare, D.B., Suleiman, A.A. (2022). TECHNICAL EFFICIENCY OF COWPEA PRODUCTION IN NASARAWA STATE, NIGERIA. *European Journal of Agricultural and Food Sciences*,4(5), 120-127. <https://doi.org/10.24018/ejfood.2022.4.5.550>
- [24] Otoko J, Otoko GA. Cleanroom-driven aerospace and defense manufacturing: enabling precision engineering, military readiness, and economic growth. *Int J Comput Appl Technol Res*. 2023;12(11):42-56. doi:10.7753/IJCATR1211.1007
- [25] Sridhar A, Balakrishnan A, Jacob MM, Sillanpää M, Dayanandan N. Global impact of COVID-19 on agriculture: role of sustainable agriculture and digital farming. *Environmental Science and Pollution Research*. 2023 Mar;30(15):42509-25.
- [26] Jha PK, Middendorf G, Faye A, Middendorf BJ, Prasad PV. Lives and livelihoods in smallholder farming systems of Senegal: impacts, adaptation, and resilience to COVID-19. *Land*. 2023 Jan 5;12(1):178.
- [27] Arumugam S, Özkan B, Jayaraman A, Mockaisamy P. Impacts of Covid-19 pandemic on global agriculture, livelihoods and food systems. *Journal of Agricultural Sciences*. 2021 Jan 1;27(3):239-46.
- [28] Markandya A, Salcone J, Hussain S, Mueller A, Thambi S. Covid, the environment and food systems: Contain, cope and rebuild better. *Frontiers in environmental Science*. 2021 Jul 6;9:674432.
- [29] Ghosh-Jerath S, Kapoor R, Dhasmana A, Singh A, Downs S, Ahmed S. Effect of COVID-19 pandemic on food systems and determinants of resilience in indigenous communities of Jharkhand State, India: a serial cross-sectional study. *Frontiers in sustainable food systems*. 2022 Mar 24;6:724321.
- [30] Tian X, Zhou Y, Wang H. The impact of COVID-19 on food consumption and dietary quality of rural households in China. *Foods*. 2022 Feb 10;11(4):510.
- [31] Cohen MJ, editor. *Advances in food security and sustainability*. Elsevier; 2023 Nov 1.
- [32] Ho TM. *Modeling Fertilizer Market Volatility and Trade Dependencies in a Complex Economic Era*. North Carolina State University; 2023.
- [33] Necula D, Ungureanu-Iuga M, Ognean L. The Agri-Food and Mountain Products Market: Insights beyond the COVID-19 Pandemic. *Agronomy*. 2023 Oct 30;13(11):2739.
- [34] Cao L, Li T, Wang R, Zhu J. Impact of COVID-19 on China's agricultural trade. *China Agricultural Economic Review*. 2021 Jan 12;13(1):1-21.
- [35] Wei C, Zhang M, Chen W, Ge Y, Wang D, Zhang D, Xue D, Cheng Q, Cheng C, Zhang W. After the pandemic: the global seafood trade market forecasts in 2030. *Humanities and Social Sciences Communications*. 2023 Sep 15;10(1):1-3.
- [36] Jemimah Otoko. MULTI OBJECTIVE OPTIMIZATION OF COST, CONTAMINATION CONTROL, AND SUSTAINABILITY IN CLEANROOM CONSTRUCTION: A DECISIONSUPPORT MODEL INTEGRATING LEAN SIX SIGMA, MONTE CARLO SIMULATION, AND COMPUTATIONAL FLUID DYNAMICS (CFD). *International Journal of Engineering Technology Research & Management (ijetrm)*. 2023Jan21;07(01).
- [37] Amare M, Abay KA, Hatzenbuehler PL. Spatial market integration of food markets during a shock: Evidence from food markets in Nigeria. *Intl Food Policy Res Inst*; 2023 Nov 8.