

EXTERNAL AND INTERNAL THREATS TO FOOD SECURITY

Tsvetan MARKOV

Research Institute of Mountain Stockbreeding and Agriculture, Agricultural Academy, 281, Vasil Levski Street, 5600 Troyan, Bulgaria, Sofia, Bulgaria, E-mail: markov.tsvetan88@gmail.com

Corresponding author: markov.tsvetan88@gmail.com

Abstract

Food security is a paramount global concern, where the delicate balance of availability, affordability, and stability of food resources faces continuous threats from external and internal factors. The present paper provides an in-depth research work of these threats, examining their multifaceted impacts on agricultural systems and the global food supply. Through an extensive analysis of contemporary literature and empirical evidence, the present study navigates the complex web of challenges that threatens food security. Insights gathered from this research pave the way for potential strategies to mitigate the threats, promoting a more sustainable global food landscape. It emphasizes the urgency of a collective and interdisciplinary approach to preserve the future of food security in an evolving and challenging global environment.

Key words: food security, external threats, internal threats, agriculture, political instability

INTRODUCTION

The foundational pillar of human well-being is inextricably intertwined with the concept of food security, a condition that ensures that people have continuous access to sufficient, safe, and nutritious food for a healthy and prosperous existence [30]. However, achieving this critical balance is constantly challenged by a complex interaction of external and internal factors, which necessitates careful research work on the multilateral challenges that impedes global food security.

External threats, emblematic of the complex environmental changes caused by climate change, have emerged as major determinants that affect the stability and availability of food resources globally [22]. The increase in extreme weather events, changes in rainfall patterns, and changes in temperature regimes are contributing to the vulnerability of agricultural systems, impacting crop yields and compromising the overall sustainability of food production [10]. At the same time, geopolitical conflicts and their side effects are becoming increasingly powerful disruptors of the global food supply chain, manifesting in trade disruptions, food embargoes, and local hunger. These external dynamics therefore

necessitate nuanced and adaptive strategies to strengthen food security in an ever-changing global landscape.

Along with external threats, internal challenges rooted in the structure of agricultural practices and distribution systems further complicate the quest for food security. Unsustainable agricultural practices, driven by a combination of resource mismanagement and economic constraints, contribute to soil erosion, reduce agricultural productivity and compromise the long-term viability of food systems [20]. Furthermore, inefficiencies in distribution systems perpetuate inequitable access to food resources and intensify issues of food affordability and equity [11].

This complex interplay of external and internal factors forms a complex web of challenges that defy simple solutions, requiring an interdisciplinary lens to understand the complex dynamics that threatens global food security. Therefore, in-depth research work on both external and internal threats becomes imperative to lay the foundations for evidence-based, sustainable, and resilient strategies to strengthen global food systems.

MATERIALS AND METHODS

A comprehensive review of existing literature was conducted to identify and analyze external and internal threats to food security. Peer-reviewed scientific journals, reports from international organizations, and data from agricultural databases were systematically surveyed to gather information on the impact of climate change, geopolitical conflicts, agricultural practices, and other important factors on food security. The analysis aimed to provide a comprehensive understanding of the interconnected character of these threats and their implications for global food systems. The present paper quotes pieces from works of Bulgarian and foreign authors. Summaries and conclusions are made. Some of the results are presented by figures.

RESULTS AND DISCUSSIONS

External Threats to Global Food Security

Food security, a cornerstone of human well-being, faces an increasingly complex set of external threats that challenge the delicate balance of availability, affordability, and stability of food resources on a global scale. The aim is to provide a comprehensive overview of external threats to global food security, highlighting their diverse character and emphasizing the urgent need for interdisciplinary solutions. External threats to food security include: *climate change, natural disasters, pest and disease outbreaks, global trade disruptions, global economic turmoil, political instability and conflict, health crises, and land erosion* (Figure 1).

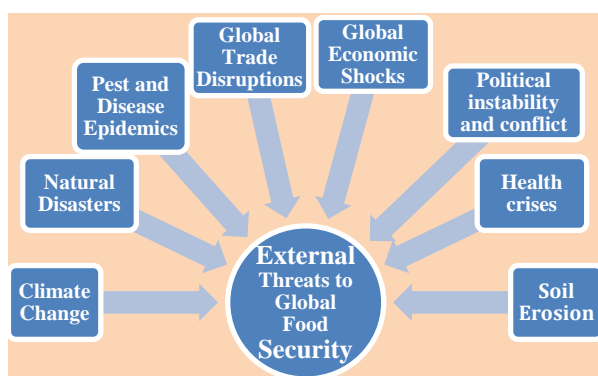


Fig. 1. External Threats to Global Food Security
Source: Information summarized by author.

Climate Change

Climate change, characterized by changes in long-term weather patterns, is emerging as a complex and pervasive threat to global food security. The diverse effects of climate change, including severe weather occurrences, alterations in rainfall patterns, increasing temperatures, and shifts in the frequency and severity of climate-related disasters, present considerable obstacles to global agricultural practices and food production. [21].

A significant sign of climate change is the growing frequency and intensity of extreme weather phenomena. Floods, droughts, hurricanes, and heat waves are becoming more common, disrupting agricultural operations and causing significant losses in crop yields [21]. These events not only directly damage crops but also cause soil erosion and nutrient depletion, further compromising the long-term productivity of agricultural lands.

Changes in precipitation patterns, including variations in the intensity and distribution of precipitation, have profound implications for agriculture [21]. Excessive rainfall can lead to waterlogging and leaching of nutrients, which harms crop growth, while prolonged droughts lead to water scarcity and reduce irrigation capacity and agricultural production.

Rising global temperatures are contributing to changes in vegetation and altering the suitability of regions for certain crops [21]. Thermal stress on crops affects their development, ripening, and overall productivity, which leads to changes in the geographical distribution of suitable areas for growing different crops.

Disasters linked to climate, like wildfires and storms, are occurring more often and with greater severity, leading to immediate harm to crops, livestock, and farming infrastructure. These events often result in soil degradation, reduction of cultivable land, and interruptions in distribution networks, exacerbating issues related to food security. Additionally, the effects of climate change are not limited to land-based ecosystems, as rising sea levels also impact coastal regions and agricultural zones at lower elevations [21]. The encroachment of saltwater into freshwater supplies undermines the viability of land for

farming, particularly in areas reliant on rice cultivation. Addressing the effects of climate change on worldwide food security necessitates a comprehensive strategy that includes adaptive measures, sustainable farming techniques, and global collaboration [8]. Enhanced efforts in scientific research, investment in climate-resilient crop varieties, and the promotion of climate-friendly agricultural techniques are integral components of a comprehensive strategy to strengthen global food security in the face of ongoing climate change challenges.

Natural Disasters

Natural disasters, characterized by sudden and intense geological, meteorological, or hydrological events, pose a significant threat to global food security. These events, ranging from earthquakes and hurricanes to tsunamis and wildfires, can cause widespread and profound impacts on agricultural systems, disrupting food production, distribution networks, and overall food availability [4]. Earthquakes resulting from tectonic plate movements have the potential to cause severe damage to agricultural infrastructure, including irrigation systems, storage facilities, and transportation networks [4]. Soil displacement, soil shaking, and changes in topography can compromise cropland productivity, leading to both short- and long-term disruptions to food production.

Tropical storms such as hurricanes and typhoons, characterized by strong winds and heavy rainfall, can cause significant damage to crops and livestock [4]. Accompanying floods and storm surges can lead to soil erosion, salinization, and loss of arable land, which further impacts the agricultural sector and compromises food security.

Tsunamis triggered by underwater seismic activity can flood coastal areas and lead to saltwater intrusion into fertile lands [4]. This infiltration negatively affects soil quality and renders agricultural land unsuitable for cultivation, posing a long-term threat to food production in the affected regions.

Wildfires, often aggravated by prolonged periods of drought and high temperatures, can devastate agricultural landscapes, destroying crops, orchards, and rangelands [4].

Consequences of wildfires include soil degradation and nutrient loss, affecting the resilience of ecosystems that support food production.

Cyclones, characterized by strong winds and heavy rainfall, can cause extensive crop damage and disrupt agricultural operations, especially in coastal areas [4]. Subsequent floods can lead to waterlogging and nutrient leaching, which harms soil health and agricultural productivity.

Volcanic eruptions, although less frequent, can have a profound impact on agriculture through the deposition of ash and volcanic materials [4]. This ash fall can disrupt sunlight penetration, alter soil pH, and introduce toxic elements, adversely affecting yields and food production.

Mitigating the impact of natural disasters on global food security requires a multi-pronged approach, including pre-disaster preparedness, sustainable agricultural practices, and effective post-disaster response mechanisms [7]. Strengthening early warning systems, implementing sustainable land use practices, and improving adaptive capacity within vulnerable communities are key components of a comprehensive strategy to address the complex challenges posed by natural disasters to food security.

Pest and Disease Epidemics

Pest and disease outbreaks affecting crops, livestock, and fisheries are persistent and multifaceted threats to global food security. These biological challenges, often intensified by environmental change and globalization, can significantly reduce agricultural productivity, threatening the availability of food for populations worldwide [11].

In agriculture, pests such as insects, fungi, and nematodes pose constant challenges to crop production. Invasive species driven by globalization and climate change can spread rapidly and destroy crops, resulting in significant yield losses [11]. Examples include the fall armyworm, which has demonstrated its ability to devastate maize crops on continents [9].

Livestock diseases, ranging from viral and bacterial infections to parasitic infestations, have profound implications for food security

due to their impact on animal health and productivity. Foot-and-mouth disease, for example, can cause significant economic losses and disrupt livestock livelihoods [11].

Diseases affecting aquatic species in the fishery can lead to mass mortality and reduced fishing catches. The emergence of new pathogens in aquatic environments, often associated with environmental changes and aquaculture practices, poses challenges to the maintenance of fish resources [13].

The emergence of new and more dangerous plant diseases, such as those caused by fungi and bacteria, introduces uncertainty into agricultural ecosystems. Pathogens such as bacterial wilt affecting bananas and tomatoes emphasize the dynamic character of plant diseases and their potential to cause widespread crop failure [13].

Globalization plays a major role in the spread of pests and diseases, facilitated by increased international trade and travel. Invasive species unintentionally transported across borders can establish in new regions and pose a threat to local agriculture [2]. This enhanced the interconnected nature of global food systems and the need for international cooperation in pest and disease management.

Mitigating the impact of pest and disease outbreaks on global food security requires a holistic and integrated approach. This includes the development and implementation of sustainable agricultural practices, the promotion of resilient crop varieties, and the improvement of early detection and rapid response mechanisms [13]. Furthermore, international cooperation is crucial to address the transboundary nature of these challenges and prevent the spread of pests and diseases across borders.

Global Trade Disruptions

Global trade disruptions resulting from trade conflicts, protectionist measures, or geopolitical tensions pose complex challenges to global food security. While the interlinkage of global markets fosters economic expansion, it also introduces weaknesses in the food supply chain that can have worldwide repercussions, impacting the availability and cost of food [32]. International trade disputes, frequently manifested in the form of tariffs

and trade obstacles, can hinder the cross-border movement of agricultural commodities. Such tariffs may result in higher prices for imported food items, impacting the affordability of food in countries that rely on imports [32]. Ongoing trade tensions between major economies highlight potential risks to global food security.

During periods of crisis or geopolitical tension, countries may implement food export restrictions to ensure domestic supplies. Although a protective measure for the exporting nation, these restrictions can escalate food shortages in importing countries, especially those that are highly dependent on staple food imports [32].

Global food supply chains, intricately linked through complex networks of producers, distributors, and retailers, are vulnerable to disruptions caused by trade tensions. Any supply chain disruptions, whether due to logistical challenges or geopolitical events, can lead to delays, shortages, and increased food prices [32].

Countries highly dependent on global markets for their food supply face increased risks during trade disruptions. Reliance on imports of essential commodities exposes these countries to the uncertainty of international trade relations, potentially compromising their ability to secure stable and affordable food supplies [32]:

Trade disruptions can disproportionately affect small-sized farmers in developing countries who rely on international markets for income. Reduced access to global markets due to trade tensions can hamper their economic prospects and sustainability, further perpetuating poverty and food insecurity [15]. Global trade disruptions contribute to increased volatility in food prices and affect both importing and exporting countries. Sudden changes in trade dynamics can lead to price spikes, which makes food less affordable for vulnerable populations and escalate food insecurity [32].

Mitigating the impact of global trade disruptions on food security requires a coordinated and multifaceted approach. This includes promoting transparent and predictable trade policies, increasing the

resilience of local food systems, and promoting international cooperation to address the root causes of trade tensions [15].

Global Economic Shocks

Global economic shocks, characterized by widespread economic downturns, financial crises and disruptions in international trade, have profound implications for agricultural systems and global food security. These shocks, often triggered by factors as diverse as recessions, currency fluctuations and commodity price volatility, can lead to complex challenges that reverberate throughout the food supply chain [31].

Economic shocks contribute to increased volatility in commodity prices, which affect key agricultural inputs such as fertilizers, fuels and machinery. Fluctuations in these prices can affect production costs, affect farmers' decision-making processes, and potentially lead to changes in crop choices and land-use practices [31].

Economic downturns can disrupt international trade flows, affecting exports and imports of agricultural goods. Reduced demand for exports can affect the incomes of exporting nations, while disruptions in imports can lead to shortages and higher prices in importing countries, especially those that are highly dependent on global food markets [31]. Economic crises often limit access to financial resources for agricultural production. Reduced credit availability and increased interest rates can limit farmers' ability to invest in inputs, technology and infrastructure, potentially leading to reduced productivity and agricultural output [31].

Rural communities, heavily dependent on agriculture for their living, are particularly vulnerable to economic shocks. Income losses, reduced employment opportunities and increased poverty levels can compromise the stability of these communities, contributing to increased food insecurity [31].

Economic shocks can affect consumers' purchasing power by affecting their ability to afford food. Sudden economic downturns or financial crises can lead to income loss and food price increase, limiting access to nutritious food for vulnerable populations [31].

Governments facing economic challenges may experience budget constraints, affecting their ability to implement effective agricultural policies and provide support to farmers. Reduced public investment in agriculture can hinder efforts to increase productivity and sustainability in the sector [31].

Mitigating the impact of global economic shocks on agricultural systems and food security requires a comprehensive and adaptive approach. This includes measures such as social safety nets to protect vulnerable populations, policies to stabilize commodity prices, and international cooperation to address systemic problems contributing to economic shocks [31].

Political Instability and Conflicts

Political instability and armed conflict, widespread challenges in different regions, have profound and far-reaching impacts on agricultural systems, food production and global food security. The complex interconnections between political dynamics and food security necessitate an in-depth study of the multifaceted consequences of such disruptions [7, 17].

Political instability and conflicts often lead to population displacement and disruption of agricultural activities. Forced migration, whether within borders or between nations, uproots communities and disrupts traditional agricultural practices, leading to immediate and long-term consequences for food production [7].

Conflict zones often experience acute food shortages due to disruptions in production, distribution and access. The destruction of infrastructure, including transport networks and markets, impedes the movement of food, contributing to localized and sometimes widespread food insecurity [7].

Ongoing conflicts often impede humanitarian access to affected populations, making it challenging to deliver basic food aid and support. Access constraints, security risks and logistical challenges impede timely and sufficient delivery of food aid to those in need [17].

Political instability and conflicts lead to the destruction of livelihoods, especially in rural

areas that are heavily dependent on agriculture. Farmers may lose their land, livestock and equipment, escalating poverty levels and hindering the recovery of affected communities [7].

Conflict zones have witnessed the destruction of vital agricultural infrastructure, including irrigation systems, storage facilities and processing plants. The purposeful destruction of such infrastructure disturbs the entire agricultural value chain and breaks the sustainability of food systems [17].

Long-term conflicts contribute to a decline in agricultural productivity as a result of reduced investment, lack of technology transfer and abandonment of sustainable agricultural practices. This, in turn, has long-term implications for the recovery and reconstruction of post-conflict food systems [7].

Conflict intensifies social and economic disparities, as disproportionately affects vulnerable groups. Women, children and marginalized communities often bear the burden of the consequences, facing increased risks of malnutrition, displacement and limited access to resources [17].

Managing the complex interaction between political instability, conflict and food security requires concerted efforts on multiple fronts. Strategies include conflict resolution and prevention, post-conflict recovery, investment in sustainable agricultural systems, and the promotion of inclusive policies that prioritize the needs of vulnerable populations [17].

Global Health Crises

Global health crises, typical for pandemics such as the COVID-19 pandemic, present multifaceted challenges that extend beyond public health to affect food supply chains and global food security [14, 23].

Health crises disrupt various elements of food supply chains, including production, processing, transport and distribution. Movement restrictions, lockdowns and health protocols contribute to labor shortages, logistical challenges and disruptions in the flow of goods, which affect food availability in local and international markets [14].

Health crises often result in labor shortages in the agricultural sector because of illness,

quarantine measures or worker migration. Reduced labor availability impedes agricultural activities such as planting, harvesting and processing, thereby affecting overall productivity and causes disruptions in the food supply chain [23].

The financial fallout from health emergencies, such as unemployment and diminished earnings, impacts individuals' buying power and their capacity to obtain food. This challenge in affording food is increasingly becoming a significant issue, particularly for at-risk groups, contributing to a rise in food insecurity [23].

The globalized nature of food supply chains increases their vulnerability to disruption during health crises. Interconnectedness and cross-border dependencies make it difficult to limit impacts to specific regions, as seen during the ripple effects of the COVID-19 pandemic on international trade and food distribution [14].

Health concerns have an impact on consumer behavior leading to changes in food preferences, purchasing patterns and demand for specific products. These changes can create challenges for manufacturers and suppliers, requiring adaptability to evolving market dynamics [23].

Transport restrictions, that is a key component of food supply chains, can lead to delays in the supply of agricultural raw materials and finished products. Perishable goods may spoil, contributing to food waste, while non-perishable goods may experience long transport times, affecting overall food availability [15].

Health crises require adaptation and innovation in food supply chains. Technologies such as online agricultural trading platforms, contactless delivery systems and digital supply chain management solutions are emerging as strategies to address disruptions and ensure a continuous flow of food products [23].

Navigating the complex interplay between health crises and food security requires a comprehensive approach. Strategies include strengthening local food systems, increasing the resilience of supply chains, implementing crisis response policies and promoting

international cooperation to address systemic vulnerabilities [15].

Soil Erosion

Soil erosion, a complex and multifaceted environmental challenge, poses a significant threat to agricultural systems and the overall global food security landscape. This phenomenon, driven by unsustainable land use practices, deforestation and soil degradation, has far-reaching consequences for the capacity of land to support food production [26, 11].

Unsustainable agricultural practices, such as excessive chemical use, monoculture farming and poor land management, contribute to the degradation of cultivated land. Soil erosion, loss of soil fertility and reduced water holding capacity are among the results of these practices, reducing the ability of the land to support productive agriculture [26].

Deforestation caused by agricultural expansion and other changes in land use leads to the loss of critical ecosystems. Forests, which have a crucial role in soil conservation and maintaining biodiversity, are essential for sustainable land management. Their destruction contributes to soil erosion, reduced water quality and disruption of the ecological balance, all of which affect agricultural productivity [26].

Soil degradation encompasses processes such as nutrient depletion, salinization and acidification. Prolonged cultivation without adequate nutrient replenishment and sustainable practices leads to poor soil health. Depletion of essential nutrients, such as nitrogen and phosphorus, compromises soil fertility and reduces its capacity to support diverse and productive crops [11].

Land degradation leads to the loss of arable land, which reduce the total land available for cultivation. This, combined with reduced soil fertility, results in reduced yields. Main food crops are particularly vulnerable, which leads to challenges in meeting the growing global food demand [26].

Land degradation contributes to water scarcity because degraded soils have a lower capacity to retain water. In arid and semi-arid regions, the desertification process is intensifying, turning fertile land into unproductive desert

landscapes [18]. This further escalates the challenges to sustaining agriculture in the affected areas [26].

Land degradation contributes to climate change through feedback mechanisms. Deforested areas, for example, reduce the capacity to capture carbon dioxide, worsening greenhouse gas emissions. Climate change, in turn, can intensify land degradation processes, which create a feedback loop that further compromises the agriculture sustainability [26].

Land degradation management and its implications for global food security requires comprehensive strategies. Sustainable land management practices, afforestation efforts and the promotion of agro-ecological approaches are integral components of a sustainable and productive agricultural system [11, 26].

Each of these factors poses unique challenges that disrupt the delicate balance of food production, distribution, and availability worldwide. The multifaceted nature of these threats underscores the urgent need for interdisciplinary and international cooperation to devise and implement effective strategies for mitigation and adaptation.

Key to addressing these challenges is the adoption of sustainable agricultural practices, enhancement of global and local food systems' resilience, and commitment to continuous scientific research and innovation. Equally important is the role of policy-making that supports transparent trade practices, stabilizes economies, and prioritizes the needs of the most vulnerable populations.

The interconnectedness of these threats also highlights the importance of a proactive approach in anticipating and preparing for future challenges. This involves strengthening early warning systems, investing in climate-resilient agriculture, promoting sustainable land use, and fostering global cooperation to manage and mitigate the impacts of these threats on food security.

In essence, ensuring global food security in the face of these external threats requires a concerted effort from governments, international organizations, the private sector, and communities. By working collaboratively

and strategically, it is possible to build a more robust, equitable, and sustainable global food system capable of withstanding the challenges of today and tomorrow.

Internal Threats to Food Security

Global food security faces internal challenges primarily stemming from agricultural systems, especially due to unsustainable methods and the intensification of agriculture. This section offers an in-depth examination of these challenges, emphasizing their impact on food production, biodiversity, and enduring sustainability.

A schema on internal threats is shown in Fig. 2.

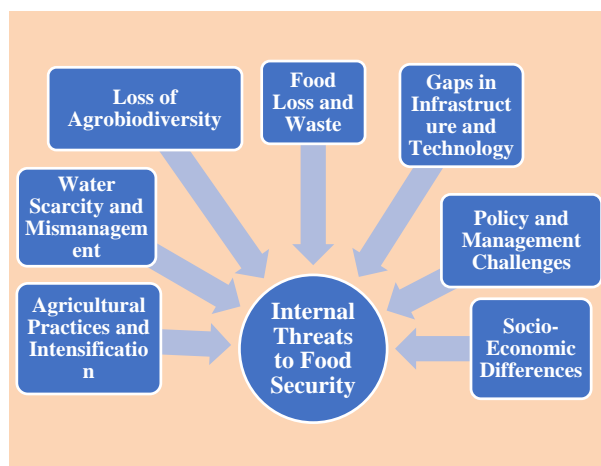


Fig. 2. Internal Threats to Food Security
Source: Information summarized by author.

Agricultural Practices and Intensification

One internal threat results from the excessive use of agrochemicals in modern agriculture. The application of fertilizers and pesticides contributes to soil degradation, which have a negative impact on soil structure, fertility and overall health [19]. This method jeopardizes the enduring viability of agricultural systems. Monoculture, or cultivating a single type of crop across large expanses, poses another internal risk. This approach diminishes biodiversity and increases the vulnerability of crops to pests and diseases [25]. Lack of crop diversity undermines the resilience of agricultural ecosystems.

Poor land management practices, such as improper irrigation and erosion control, contribute to soil degradation. This internal threat reduces the capacity of the land to

sustain agricultural productivity in the long term [19].

The intensification of agriculture often leads to a soil fertility decrease. Continuous cultivation without proper soil management depletes essential nutrients, affecting crop quality and posing a lasting domestic challenge to food security [25].

Excessive use of agrochemicals, monoculture practices, poor land management and impacts on soil fertility collectively compromise the sustainability and resilience of agricultural systems. Addressing these domestic challenges is essential to fostering a more sustainable and secure global food landscape.

Water Scarcity and Mismanagement

Water scarcity and mismanagement pose enormous domestic threats to global food security, affecting the availability and efficiency of water resources crucial to agricultural production. This section provides a detailed analysis of the domestic challenges posed by water scarcity and mismanagement, exploring their implications for food systems.

One of the internal threats arises from inefficient irrigation practices in agriculture. In many regions, conventional irrigation methods lead to significant water loss due to over-irrigation or inefficient distribution systems [16]. This intensifies water scarcity concerns and compromises the sustainability of food production.

Over-abstraction of groundwater for agricultural purposes contributes to domestic water scarcity. In regions highly dependent on groundwater, excessive pumping can lead to depletion of aquifers, affecting both current and future water availability [24].

Internal threats also arise from the pollution of water sources used in agriculture. Pollution from agricultural runoff, agrochemicals and industrial discharges poses risks to water quality, affecting both the environment and the suitability of water for irrigation [16].

Water scarcity directly affects crop yields and food production. In regions where water is a limiting factor, reduced irrigation can lead to reduced agricultural productivity, affecting the overall availability of food resources [24].

Water scarcity directly affects crop yields and food production. Inefficient irrigation

practices, over-extraction of groundwater, pollution of water sources and the consequent impact on yields collectively contribute to the vulnerability of food systems. Addressing these domestic challenges is imperative to ensure sustainable water use and increase the sustainability of global food production.

Loss of Agrobiodiversity

Global food security is also threatened internally by the diminishing agrobiodiversity in farming systems. This section thoroughly examines the issues arising from reduced crop diversity, discussing how it affects resilience, adaptability, and sustainability in the long run. Furthermore, the use of high-yielding varieties (HYVs) has played a significant role in the decrease of agrobiodiversity in modern agriculture. The widespread cultivation of a limited number of genetically uniform crops optimized for high productivity reduces the overall diversity of cultivated plants [3].

A decrease in crop diversity increases the vulnerability of agricultural systems to pests, diseases and environmental stress. Monocultures resulting from HYV adoption lack the genetic variability necessary for natural resistance, making crops more susceptible to internal threats [29].

Loss of agrobiodiversity reduces the resilience of food systems. Diverse crop varieties provide a natural buffer against environmental fluctuations and uncertainties, increasing the adaptability and resilience of agriculture [3]. Agricultural systems with reduced agrobiodiversity face constraints in adapting to changing climate conditions. Lack of genetic diversity limits the crop ability to develop and thrive under new climate scenarios, which poses intrinsic challenges to long-term food security [29].

The adoption of high-yielding varieties, increased vulnerability to pests and diseases, reduced resilience of food systems, and constraints on climate adaptation collectively call into question the sustainability and adaptability of agriculture. Managing these domestic challenges is crucial to fostering a diverse and sustainable global food landscape.

Food Loss and Waste

Global food security faces internal threats due to the substantial issue of food loss and waste

along the food supply chain. This section delivers a detailed exploration of the internal aspects of food loss and waste, elucidating their complex consequences for resource utilization, sustainability, and food security.

The inefficiency of post-harvest practices is such an internal threat, where inadequate handling, storage and transportation contribute to significant food loss. Post-harvest losses occur at various stages of the supply chain, from farm to market, undermining efforts to optimize resource use [12].

Lack of proper storage facilities is a key domestic challenge that leads to food wastage. Insufficient storage infrastructure for perishable goods leads to spoilage, reducing the total quantity and quality of food available for consumption [13].

Internal factors also include consumer behavior that contributes to food waste. Practices such as over-purchasing, improper storage at home and discarding edible food products escalate the overall impact of food waste in communities [12].

The difficulty in reallocating excess food to those who need it is a key internal factor contributing to food loss and waste. Challenges in logistics, regulatory barriers, and insufficient collaboration among involved parties obstruct attempts to divert surplus food to regions struggling with food insecurity [12]. Apart from the direct effects on food accessibility, internal elements associated with food loss and waste also have environmental consequences. The breakdown of thrown away food leads to the production of greenhouse gases, which adds to climate change and further exacerbates challenges in global sustainability [12].

Inefficient post-harvest practices, inadequate storage, consumer behaviour, redistribution challenges and environmental impacts together highlight the need for comprehensive strategies to address internal inefficiencies in the food supply chain.

Gaps in Infrastructure and Technology

Internal risks to worldwide food security are closely tied to the lack of infrastructure and technological advancements in agricultural systems. This comprehensive analysis delves

into the intricacies of these domestic issues, examining how shortcomings in infrastructure and technology hinder the effectiveness of food production and distribution globally. Inadequate road infrastructure significantly undermines the effectiveness of food distribution systems. In regions with inadequate or substandard roads, transit times increase, resulting in delays in the transport of agricultural production and an increased risk of post-harvest losses [1].

Internal threats are amplified when there is limited access to modern agricultural technology. The lack of advanced tools and machinery hinders the adoption of efficient farming practices, which affect the productivity and overall sustainability of agricultural systems [27].

The lack of adequate storage facilities represents a significant domestic challenge to global food security. Inefficient post-harvest storage leads to increased food losses, especially in regions where perishable crops prevail, affecting the availability of food for consumption [12].

Infrastructure and technology gaps disproportionately affect smallholder farmers, which may lack the resources to overcome these challenges. The limitations in access to markets and productivity contribute to internal threats, as they cause poverty and impede sustainable agricultural practices [27].

Managing infrastructure and technology gaps is crucial to improving global food security. Investments in transport, the promotion of modern agricultural technologies, improved storage facilities and targeted support for smallholder farmers collectively form the basis for building sustainable and efficient food systems.

Policy and Management Challenges

Internal threats to global food security are closely related to policy and governance challenges governing agricultural systems. This comprehensive analysis delves into the nuanced nature of these internal threats, exploring their multifaceted impacts on the development of sustainable and resilient food systems.

A critical domestic challenge lies in the formulation and implementation of

agricultural policies. When policies lack coherence, they fail to adapt to the dynamic nature of agriculture, or prioritize short-term gains over long-term sustainability, they contribute significantly to internal threats to food production and distribution [5]. Inadequate investment in rural development is a significant domestic challenge. Insufficient financial allocation for rural areas affects critical aspects such as infrastructure, education and health, which keep the differences and hinder the creation of resilient and sustainable food systems [28].

The effectiveness of internal governance structures is fundamental to the integrity of food systems. Faults in governance, such as corruption, lack of transparency and ineffectiveness of regulatory bodies, reduce the capacity to implement and enforce policies effectively, intensifying domestic threats to food production and distribution [5]. Policy and governance challenges have a direct impact on the promotion and adoption of sustainable agricultural practices. In the absence of clear policies that support environmentally sound and socially responsible farming methods, domestic threats to soil health, biodiversity and ecosystem resilience persist [5].

Coherence and adaptability of agricultural policies, increased investment in rural development, strengthening of governance structures and promotion of sustainable practices collectively form the basis for building sustainable and equitable food systems.

Socio-Economic Differences

Socio-economic disparities pose a significant internal threat to global food security, intertwining economic inequalities with access to and availability of basic food resources. This in-depth analysis delves into the multifaceted nature of socioeconomic disparities and their profound implications for fair food distribution on a global scale.

A significant domestic challenge arises from discrepancy in wealth distribution, where certain segments of the population possess significantly more economic resources than others. This wealth gap directly affects people's purchasing capacity, as it affects their

ability to access a varied and nutritious diet [6].

The absence or inadequacy of social safety nets exacerbates internal threats to food security. Vulnerable populations, deprived of sufficient economic support during times of crisis or hardship, face increased challenges in securing reliable and nutritious food supplies [13].

Socio-economic disparities are perpetuated by unequal access to education and employment opportunities. Limited access to quality education and well-paid jobs limits people's ability to escape poverty and secure sufficient food resources for themselves and their families [13].

Initiatives aimed at redistributing wealth, strengthening social safety nets, and promoting equitable access to education and employment opportunities collectively contribute to mitigating domestic threats and promoting a more inclusive and sustainable global food system.

CONCLUSIONS

Global food security is under constant threat from both external and internal factors. External threats such as climate change, natural disasters, global trade disruptions, conflicts and pandemics can quickly disrupt food supply chains and availability. Internal challenges such as unsustainable agricultural practices, water scarcity, biodiversity loss, food loss and waste, inadequate infrastructure, governance issues and socio-economic disparities further exacerbate risks to food security.

A comprehensive and collaborative approach is essential to address these complex challenges. Internationally, countries must cooperate on climate-resilient agriculture, disaster preparedness and trade policies to mitigate external threats. Domestically, sustainable agricultural practices, improved water management, conservation of agrobiodiversity, reduced food waste, improved infrastructure and fair governance are crucial for building sustainable food systems.

In conclusion, achieving global food security requires concerted efforts at local, national and international levels. Although the challenges are significant, proactive measures, innovative solutions and global cooperation can pave the way to a more secure and sustainable food future for all.

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