

ESSAY

Global Suppliers and their effect on the global supply chain for food

Los proveedores mundiales y su efecto en la cadena mundial de suministro de alimentos

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Abstract

This conceptual article examines the effects of global suppliers on the global food supply chain, emphasizing the impact of globalization, COVID-19, digitization, sustainability, and geopolitical events. Drawing on 15 academic sources, the analysis is structured around six key research questions that explore the interdependence, disruptions, technological advances, and complexities associated with food supply chains. The findings highlight the ambivalent nature of globalization, which enhances efficiency and interconnectivity while increasing vulnerability to shocks. This review also highlights the role of pandemics in exposing systemic inequalities and inefficiencies, making the case for resilience and adaptability. The environmental impact of global food supply chains and trade-offs within sustainability are analyzed. In addition, technological innovations, particularly blockchain and IoT, are identified as transformative tools for improving traceability and transparency in the food supply chain industry. This review concludes by emphasizing the urgent need for strategic reforms to ensure stable, safe, and sustainable global food supply systems.

Keywords: food supply chains, globalization, sustainability, digitization, impact of COVID-

Resumen

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Este artículo conceptual examina los efectos de los proveedores globales en la cadena de suministro global de alimentos, enfatizando el impacto de la globalización, el COVID-19, la digitalización, la sostenibilidad y los eventos geopolíticos. Basándose en 15 fuentes académicas, el análisis se estructura en torno a seis preguntas clave de investigación que exploran la interdependencia, las interrupciones, los avances tecnológicos y las complejidades relacionadas con las cadenas de suministro de alimentos. Los hallazgos destacan la naturaleza ambivalente de la globalización, que mejora la eficiencia y la interconectividad al tiempo que aumenta la vulnerabilidad ante las crisis. Esta revisión también subraya el papel de la pandemia al exponer desigualdades e ineficiencias sistémicas, abogando por la resiliencia y la adaptabilidad. Se analiza el impacto ambiental de las cadenas de suministro de alimentos globales y los compromisos dentro de la sostenibilidad. Además, se identifican innovaciones tecnológicas, particularmente blockchain e IoT, como herramientas transformadoras para mejorar la trazabilidad y la transparencia en la industria de la cadena de suministro de alimentos. Esta revisión concluye enfatizando la necesidad urgente de reformas estratégicas para garantizar sistemas de suministro de alimentos globales estables, seguros y sostenibles.

Palabras clave: cadenas de suministros de alimentos, globalización, sostenibilidad, digitalización, impacto del COVID-19.

Introduction

This literature review focuses on global suppliers and their effect on the global food supply chain. It is strongly connected to the topic of Globalism and Agri-Food supply chains, which is increasingly important due to the rise of geopolitical disruptions and other threats to international agri-food supply chains. To assess this topic, the research has been divided into six key research questions, each focusing on a specific dimension and thus contributing to the overall understanding of the subject. These research questions are as follows:

1. How does globalization increase the interdependence of food supply chains?
2. How did COVID-19 impact the food supply chain?
3. What are some challenges in balancing food supply chain efficiency with sustainability?
4. Has dependence on global suppliers affected food security in vulnerable regions?
5. In the era of digitalization, how has technology impacted in the food supply chain, like Blockchain database for example?
6. What are the environmental impacts of maintaining global food supply chain, such as carbon emission and water consumption?

The research is based on fifteen academic sources comprising 401 pages. This shorter conceptual article summarizes the findings and critical assessment of the bibliography and topic. Articles

have been read, analyzed, and assessed for their contributions and gaps supporting this research. The critical analysis is divided into six research questions and the related articles to maintain the structure and focus of the research.

Critical Analysis

How does globalization increase the interdependence of food supply chains?

The research question “How does globalization increase the interdependence of food supply chains?” aims to analyze the connection between globalization and global food supply chains, focusing on the role of multinational enterprises (MNEs) and their impact on international agri-food supply chains. These MNEs are crucial actors in today’s globalized world, influencing the complexity and interdependency of food supply chains. Geopolitical events, such as the Ukraine-Russia war, further highlight this interdependence.

The article “Globalization in Agriculture and Food: The Role of Multinational Enterprises,” by Maria Scopolla (2021, p. 2-34), discusses the influence of MNEs on international agri-food supply chains. MNEs exemplify the international integration of organizations in food supply chains, holding significant responsibility and power. The article highlights the complexity of these supply chains and the role of MNEs as global actors. However, it has a limited focus on interdependence and lacks a detailed discussion on how globalization increases the interdependence of food supply chains. The sector-specific analysis and the absence of policy implications are notable gaps.

The case study, “Impact of Ukraine War on Global Energy and Food Supply Chains: A Case Study of South Asia,” by Farah Naz and Martin Kear (2022, p. 2-16), examines the effects of the Russia-Ukraine war on international food supply chains, particularly focusing on food security in emerging and developing nations. The study shows how disruptions in international food supply chains highlight the world’s dependence on globalization. However, the article also covers energy, broadening its scope beyond food. It lacks solution strategies and future outlooks on geopolitical events’ impact on global supply chains.

In summary, globalization significantly increases the interdependence of food supply chains by integrating MNEs into the agricultural and food sectors. These MNEs play a crucial role in shaping the economy and society, impacting food security and resource availability in developing countries. The complexity of global supply chains, exemplified by products like bananas and Nutella, highlights the necessity of international trade and the interdependence it creates. These supply chains rely on efficient and cost-effective production methods enabled by globalization, but they also become vulnerable to geopolitical events and crises, which can disrupt the flow of goods and affect global food security. The ongoing Ukraine-Russia war demonstrates how conflicts can severely impact international food supply chains, illustrating the fragility of global food supply chains and the

critical role of globalization in maintaining food security. Sustaining these supply chains is essential, as any disruption can lead to global food shortages, emphasizing the interconnected nature of the world's food systems.

How did COVID-19 impact the food supply chain?

This literature review explores the research question, “How did COVID-19 impact the food supply chain?” by examining existing research. The pandemic caused disruptions in global systems such as healthcare, economics, and supply chains, along with lockdowns and travel restrictions, resulting in food insecurity, rising costs, and shifts in consumer behavior. The pandemic exposed the fragility of traditional supply chain models and highlighted the need for greater resilience and adaptability.

In the book *Beyond Global Food Supply Chains Crisis, Disruption, Regeneration*, the authors Victoria Stead and Melinda Hinkson (2015, p. 19-29, 33-43, 79-88, 93-101, 155-164) discuss the challenges and weaknesses in the global food supply chain due to the pandemic. Key impacts include the vulnerability of food supply chains, border closures, labour shortages, and panic buying. Agriculture gained visibility as agro investors saw it as a profit opportunity, but this approach ignored the basis of food insecurity.

The book highlights the impacts of the pandemic on global food supply chains, exposing their vulnerability and the need for change. However, the focus on Australia may limit the broader global implications.

This article from Michael Omotayo Alabi and Ojelanki Ngwenyama (2023, p. 2-15) discusses the disruptions caused by the pandemic on global food supply chains, focusing on North America. It highlights food shortages, border closures, food wastage, and farm labour shortages, leading to food insecurity. The article emphasizes the need for stronger technology and better management to mitigate future crises. The focus on Canada and the United States provides a global perspective.

In the article by Shilpa Aggarwal et al. (2020, p. 6-8, 8-16) “Did covid-19 market disruptions disrupt food security? Evidence from households in rural Liberia and Malawi,” the authors explore whether COVID-19 market disruptions affected food security in rural areas. The impact was different from the rest of the world, with these rural areas relying on agriculture to mitigate the negative effects. The article highlights the resilience of rural areas due to their dependence on agriculture. However, it presents some gaps, as the findings may not fully apply to other regions.

The authors explore the impact of the COVID-19 pandemic on global food supply chains and food security, offering different perspectives. Alabi and Ngwenyama focus on high-income countries, while Aggarwal et al. focus on rural areas in Africa. The literature highlights the need for transformation and reshaping of global food supply chains for more efficiency, especially during

crises. According to Hinkson and Stead, the vulnerabilities and inequalities in the global food system have been intensified by COVID-19, revealing new possibilities for transformation. 4

What are some challenges in balancing food supply chain efficiency with sustainability?

This research question assesses the challenge of international supply chains in relation to their environmental impact. It examines several factors influencing the degree of sustainability in an environmental context, focusing on how global agri-food supply chains are affected by sustainability efforts and their aftermath.

The academic paper “Environmental Impacts Along Food Supply Chains: Methods, Findings and Evidence Gaps” from Koen Deconinck and Lucinda Toyama (2022, p. 2-17) examines the environmental impact on various stages of the agro-food supply chain. It assesses the impact and emissions related to international trade of agro-food products, and relates the importing country, consumers, and their consumption habits to the environmental impact. The article does not specifically focus on the effectiveness of international food supply chains and lacks current geopolitical events and developments.

The book *Beyond Global Food Supply Chains Crisis, Disruption, Regeneration* by Victoria Stead and Melinda Hinkson (2015, p. 33-43) examines the impact of the COVID-19 pandemic on global food supply chains. The chapter “COVID-19 as a Push for Sustainability” explores the pandemic as a test for the resilience and sustainability of global agri-food supply chains. The book is not sufficiently focused on sustainability and examines the connections and relations of the topics.

The academic review from Gaufang et. al. (2024, p. 1-6, 15-26), “Sustainability in Global AgriFood Supply Chains: Insights from a Comprehensive Literature Review and the ABCDE Framework”, summarizes numerous articles on sustainability in agricultural food production. It assesses the interrelation of international trade and different regions regarding food and agriculture, focusing on the differences between consumer and producer countries and related production efficiency. The review does not focus on supply chains and their specific impact, and it focuses more on research methods and methodologies than on the scientific topic itself.

Balancing food supply chain efficiency with sustainability presents several challenges. Deconinck and Toyama highlight the environmental impact of different stages of the agro-food supply chain, while Stead and Hinkson discuss the pandemic’s role in testing the resilience and sustainability of these supply chains. Gaufang et al. focus on the interrelation of international trade and regional differences in food production. The literature emphasizes the need for strategic planning, consumer education, and policy interventions to address these challenges and achieve a balance between efficiency and sustainability in global food supply chains.

Has dependence on global suppliers affected food security in vulnerable regions?

Dependence on global suppliers is inevitable. International trade concerns every country, and they cannot produce everything they need independently. This dependence impacts food security, especially in vulnerable regions, which are more exposed to disruptions in the global supply chain. Events like the COVID-19 pandemic and the Russia-Ukraine conflict have highlighted these vulnerabilities.

This thesis from Trésor-Éco and Jean-Philippe (2015, p. 1-8) focuses on improving reforestation efforts to combat climate change by optimizing reforestation value chains. It develops decision-making tools and models to improve coordination and planning within the reforestation process, including a seed allocation model and a tool for integrated production and transportation planning.

The thesis addresses key issues in reforestation, enhancing sustainability and operational efficiency. However, it needs to consider application in different regions, financial aspects, and social implications.

The report from the Government of Canada (2024, p. 1-6) analyses Costa Rica's agro-food market, highlighting opportunities for Canadian exporters. Despite favorable conditions, exporters face challenges such as tariffs, import regulations, and competition from U.S. suppliers. The report suggests focusing on niche markets and building local partnerships. The report identifies opportunities but lacks deep analysis of competitive profiles, consumer behavior, and regulatory barriers. It also needs detailed solutions for logistical challenges and strategies for sustainability practices.

The article from the World Economic forum (2022, p. 1-5) discusses the impact of the Ukraine war on global food security, highlighting disruptions in food exports and rising food prices, especially affecting low-income countries. It stresses the importance of global cooperation to stabilize markets and assist vulnerable populations.

The article effectively addresses the food insecurity crisis but could benefit from exploring local agricultural innovations and specific policy actions to stabilize prices and supply chains. The article from Sovini Mondal (2024, p. 1-3) emphasizes the need for sustainable agriculture to achieve global food security. It suggests increasing agricultural resilience through sustainable practices, strengthening local food systems, and international cooperation.

The article argues for systemic change in food systems, highlighting the importance of sustainable practices and local food systems. It calls for investment in agriculture and collaboration among governments, international organizations, and the private sector.

Dependence on global suppliers significantly impacts food security in vulnerable regions, especially

during international crises. Strengthening local and regional production, investing in sustainable agricultural systems, and promoting food self-sufficiency are crucial to reducing vulnerability. The literature highlights the need for strategic planning, consumer education, and policy interventions to address these challenges and ensure food security.

In the era of digitalization, how has technology impacted on the food supply chain, like Blockchain database for example?

In today's digital age, technology has transformed global food supply chains. This literature review explores different methods that have influenced this process, improving security, stability, and identifying gaps. The article "Unleashing the Potential of Digitalization in the Agri-Food Chain for Integrated Food Systems," by Krupitzer, C., & Stein, A. (2023, p. 2-16), examines how technology can transform food supply chains. It focuses on trends in information technology such as AI, machine learning, IoT, cyber-physical systems, cloud computing, and blockchain technology. The article aligns with the researchers' approach, exploring how these technologies can transform global food supply chains. It provides a broad concept and contextualization of current trends and technologies in the food industry.

The paper "The Rise of Blockchain Technology in Agriculture and Food Supply Chains" by Kamilaris, A., Fonts, A., & Prenafeta-Boldó, F. X. (2019, p. 1-15, 17-27), explores the impact and implementation of blockchain technology in food supply chains. It highlights blockchain's ability to increase traceability, transparency, and efficiency, while also addressing challenges such as uneven adoption, high costs, and governance issues. The article is relevant to the research question, exploring the impact of blockchain technology on food supply chains. It highlights the challenges and gaps that prevent widespread implementation, providing valuable insights for the literature review.

The article "Processes, Benefits, and Challenges for Adoption of Blockchain Technologies in Food Supply Chains: A Thematic Analysis" from Si-Chen et. al. (2020, p. 3-9, 11-13, 17-24) focuses on the benefits and challenges of implementing blockchain technology in food supply chains. It highlights blockchain's potential to improve efficiency, traceability, and safety, while also addressing challenges such as integration, costs, and scalability. The article aligns with the literature review, exploring the impact of new technologies on food supply chains. It addresses the gaps and challenges, providing a comprehensive analysis.

The article from Stefanella Stranieri et. al. (2020, p. 2-13, 16- 18) examines three food supply chains that have implemented blockchain technology, highlighting its positive impact on efficiency, quality, security, and trust. It also notes that the benefits vary depending on the chain and expected efficiency. The article is relevant to the literature review, exploring the impact of blockchain technology on food supply chains. It provides case studies that illustrate the benefits and challenges

of implementing blockchain technology.

The literature review demonstrates how digital technologies, particularly blockchain, are reshaping and transforming food supply chains. The articles collectively address the potential and challenges, offering a comprehensive understanding of how to leverage blockchain and other technologies for a more secure, transparent, and efficient food supply chain. Krupitzer and Stein (2023, p. 2-16) focus on broader IT trends, while the other articles provide specific insights into blockchain technology's impact on food supply chains.

What are the environmental impacts of maintaining global food supply chain, such as carbon emission and water consumption?

The thesis from Mahtabalsadat Mousavijad (2023, p. 1-19, 74-86) focuses on improving reforestation efforts to address climate change through better planning and decision-making tools for managing multi-product, multi-site value chains. It aims to optimize the reforestation process by enhancing coordination among stakeholders, improving seed allocation, and integrating production with transportation planning. The research, applied to the Quebec reforestation system, uses models to match seeds with appropriate sites, balance inventories, and improve efficiency. This thesis offers valuable insights into optimizing reforestation systems. It addresses challenges in large-scale reforestation by ensuring the right seeds are planted in the right areas at the right time. The framework and collaborative planning approach could improve cooperation between stakeholders. The decision-making tool for integrated production and transportation planning considers resource constraints and environmental sustainability. The study's focus on Quebec provides a real-world application, showing how changes in planning can improve both short-term and long-term sustainability.

While comprehensive, the thesis could be expanded to consider other regions with different challenges. It could also delve deeper into financial aspects and social factors, such as local community involvement. Incorporating a broader social perspective could make the models more universally applicable and ensure the benefits of reforestation reach all segments of society.

This thesis significantly contributes to reforestation planning by introducing models that improve seed allocation, operational planning, and sustainability. It provides practical tools for reforestation efforts, particularly in regions like Quebec, and helps stakeholders optimize their processes. Future work could expand the scope to include different regions, financial analyses, and social considerations to further strengthen the applicability and effectiveness of the proposed solutions.

Conclusion

To conclude this review about global suppliers and their effect on global agri-supply chains, one must consider the numerous aspects and facets connected to this topic. Another important point is the interconnection between the topics seen throughout the research and review.

Globalization significantly affects the interdependence of food supply chains by integrating multinational enterprises (MNEs) into the agricultural and food sectors. MNEs influence food security and resource availability in developing countries, highlighting the complexity and necessity of international supply chains. The efficiency and cost-effectiveness brought by globalization often come at the expense of resilience and sustainability.

Geopolitical events further underscore the interdependence of food supply chains. The Ukraine-Russia war, for instance, has disrupted global food supply chains, particularly affecting countries dependent on imports from these regions. The war's impact, combined with the ongoing challenges posed by the COVID-19 pandemic, demonstrates the need for strategic planning and resilience to ensure food security in an interconnected world.

The COVID-19 pandemic exposed and exacerbated the vulnerabilities and inequalities inherent in global food supply chains, highlighting the fragile balance between availability, distribution, and accessibility of food. Developing countries faced the most severe impacts due to border closures, transportation restrictions, and labor shortages, which compounded existing food insecurity. However, the pandemic also illuminated disparities in food systems, as some agricultural regions, particularly in Africa, were less affected due to their subsistence farming practices but remained vulnerable.

These insights underscore the urgent need for transformative changes in global food systems, focusing on building resilience, addressing inequalities, and reducing reliance on fragile supply chains. Strengthening local food production, fostering sustainable agricultural practices, and ensuring equitable access to resources are critical steps toward a more secure and inclusive global food system.

Another topic linked to global agri-food supply chains and MNEs is sustainability. Balancing food supply chain efficiency with sustainability presents several challenges. One major challenge is considering the environmental performance of both producing and consuming countries. Factors such as consumer awareness, sustainability labeling, and diligence by importing firms significantly influence the sustainability of agro-food supply chains. Consumers' preferences for regional and seasonal products versus imported and non-seasonal goods can heavily impact overall sustainability.

When looking at sustainability, it is also important to consider ethics. Especially in vulnerable regions, stable agri-food supply chains are important to maintain food security. Countries specialize

in certain products, benefiting from economies of scale and advanced technology tailored to their natural conditions. This specialization and the global demand for diverse food products drive international trade. For example, Costa Rica imports 55% of its supermarket food, despite being a significant agri-food exporter, to satisfy consumer preferences for diverse and affordable products.

Urbanization and population growth further increase dependence on global suppliers. Global trade agreements facilitate this dependence by eliminating trade barriers and promoting economic cooperation. Climate change exacerbates the situation, especially for vulnerable regions, particularly those with high poverty rates, limited economic resources, and exposure to natural disasters, face significant food security risks. Political instability and conflicts further disrupt food production and access, making these regions even more dependent on global food supply chains.

Another challenge lies in the inherent trade-offs between efficiency and sustainability. Globalization has enabled highly efficient and interconnected supply chains, maximizing resource efficiency and profitability. However, this often comes at the cost of sustainability. Additionally, the agricultural sector is highly vulnerable to natural events such as climate change, droughts, and floods, which can disrupt supply chains and exacerbate sustainability issues. Geopolitical factors, such as trade tariffs and market fluctuations, further complicate the balance between efficiency and sustainability. The COVID-19 pandemic highlighted the fragility of global food supply chains and underscored the need for resilience, which is crucial for both efficiency and sustainability.

Technology has become increasingly important in today's globalized world of supply chains. The global food supply chain, while essential for delivering food across continents, comes with significant environmental costs, primarily due to greenhouse gas emissions from transportation, deforestation for agriculture, and excessive water usage. Transportation is a major contributor to carbon emissions, as products often require multiple modes of transport, each adding to the overall emissions.

Companies are increasingly focusing on reducing emissions by improving energy efficiency, using renewable energy, and investing in green projects like reforestation. The concept of a circular economy, which reduces waste by reusing materials, is gaining traction to create more resilient and eco-friendly supply chains. Additionally, storage operations contribute to pollution and climate change. Inefficient inventory management can lead to excess stock and significant resource wastage, further impacting the environment. Balancing efficiency with sustainability in the global food supply chain requires strategic planning and the adoption of innovative technologies and practices.

The era of digitalization has brought transformative advancements to the food supply chain, addressing critical challenges such as inefficiency, lack of transparency, and food safety. Technologies like blockchain, IoT, and artificial intelligence have played pivotal roles in enhancing traceability, optimizing logistics, and ensuring the quality of food products from production to consumption.

IoT has improved the monitoring and management of perishable goods, reduced waste, and ensured food safety. Ultimately, embracing these technologies fosters a more efficient, equitable, and sustainable global food system.

Globalization integrates multinational enterprises (MNEs) into agricultural and food sectors, increasing interdependence. MNEs impact food security and resource availability in developing countries. The complexity of global supply chains, like those for bananas and Nutella, shows the necessity of international trade. However, these supply chains are vulnerable to geopolitical events, such as the Ukraine-Russia war, which disrupts food supply and highlights the fragility of global food security. Sustaining these supply chains is essential, as any disruption can lead to global food shortages, emphasizing the interconnected nature of the world's food systems.

The COVID-19 pandemic disrupted global food supply chains, affecting food availability, distribution, and accessibility. Restrictions like border closures and transportation limits exposed the vulnerabilities and inequalities in food systems, particularly in developing countries. Some African countries, reliant on agriculture, were less affected but still faced significant challenges. The pandemic highlighted the need for greater resilience and adaptability in food supply chains.

Balancing efficiency with sustainability in food supply chains is challenging. Environmental impacts must be considered for both producing and consuming countries. Consumer preferences and the high carbon footprint of certain products complicate sustainability efforts. Globalization has increased efficiency but often at the cost of sustainability, leading to exploitation and higher emissions. The agricultural sector is highly vulnerable to natural events such as climate change, droughts, and floods, which can disrupt supply chains and exacerbate sustainability issues. Geopolitical factors, such as trade tariffs and market fluctuations, further complicate the balance. The COVID-19 pandemic highlighted the fragility of global food supply chains and underscored the need for resilience. Achieving a balance requires addressing these challenges through strategic planning, consumer education, and policy interventions.

Dependence on global suppliers impacts food security in vulnerable regions, especially during crises. These regions rely on imports for basic nutrition, making them susceptible to disruptions. Strengthening local production and sustainable agricultural systems can reduce this vulnerability. However, many countries prioritize exporting for income over local consumption, complicating efforts to achieve food self-sufficiency. Investing in sustainable agricultural systems, improving logistical infrastructure, and promoting food self-sufficiency could help alleviate pressure on global supply chains. Adopting sustainable farming practices and strengthening local food systems could significantly reduce dependence on global food supply chains.

Digital technologies like blockchain, IoT, and AI have transformed food supply chains by improving traceability, transparency, and efficiency. Blockchain ensures accurate tracking of food products,

enhancing food safety and benefiting small-scale farmers. IoT devices monitor conditions in real-time, optimizing logistics and reducing waste. These technologies address global challenges like food fraud and equitable market access. For example, companies like Walmart have adopted blockchain to reduce the time it takes to trace food origins, significantly enhancing food safety during contamination outbreaks. Together, these technologies optimize logistical processes and address global challenges such as food fraud, waste reduction, and equitable market access, paving the way for a more efficient and sustainable food system.

Global food supply chains have significant environmental costs, including carbon emissions, water consumption, and biodiversity loss. Transportation and production processes contribute heavily to emissions. Inefficient water management and excessive packaging worsen environmental degradation. Sustainable practices like renewable energy, efficient water use, and local sourcing are essential to mitigate these impacts and ensure a more resilient system. Food production, transportation, and packaging consume substantial amounts of water, further straining water resources, particularly in areas already facing water scarcity. Protecting biodiversity through responsible sourcing, supporting agroecological farming practices, and collaborating with stakeholders like NGOs and local communities are critical steps toward reducing the environmental footprint of the food supply chain. While the global food supply chain plays a vital role in meeting global demand, its environmental costs necessitate urgent changes to ensure a more sustainable and resilient system.

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