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COVID-19 Pandemic and Rice Farming Value Chain:

Global Impact and Recommendations

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Abstract

This study reviews existing literature to examine the effects of the COVID-19 pandemic on the rice value chain segments, namely input provision, paddy production, paddy aggregation, rice processing, and marketing/distribution, and to identify the recommendations to lessen the impact of COVID-19 on the rice value chain. According to existing studies, the short-term to medium-term impacts of the COVID-19 pandemic on the rice value chain include interruptions in accessing farm inputs, limited labor supply in land preparation, poor crop management, late rice planting, declined paddy availability, higher cost of paddy procurement, increased costs for rice milling, packaging and shipping, the higher price of rice, delays in the rice distribution process due to mobility restrictions and lockdowns and increased use of e-commerce in buying and selling produce. Previous studies recommended solutions or strategies to lessen the impact of the COVID-19 pandemic on the rice value chain. Results of past studies emphasized the importance of agricultural research toward rice productivity and profitability to ensure ideal crop management and to achieve just-in-time rice planting and harvesting. Also, the availability of farm inputs should be maintained and monitored. Thus, major logistical bottlenecks should be minimized to avoid supply chain distractions. Most researchers recommended investing in new

digital technologies to improve efficiency in rice production, decrease farm inputs and water usage, promote digital services in buying and selling paddy and milled rice, and public-private sector partnership through research and development. This study will be helpful to rice breeders, scientists, researchers, policymakers, and decision-makers in leading the development of proposals for new rice varieties, food security, nutrition, and improving land soil health and seed certifications. Future studies may explore the disruptions in the rice value chain that will have long-term impacts on Sustainable Development Goals.

Keywords: *rice farming; value chain; literature review; systematic; pandemic*

Introduction

Background of the Study

Chen (2020) noted that rice is a prime source of caloric intake for half of the world's population, and Esiobu (2020) described it as the essential global food security crop. Gomez et al. (2022) said that China, India, Indonesia, Bangladesh, Vietnam, Myanmar, Thailand, the Philippines, Japan, Pakistan, Cambodia, the Republic of Korea, Nepal, Sri Lanka, and other Asian countries accounted for 90% of the world's total rice production. Esiobu (2020) claimed that rice farming is known worldwide as vital activity; thus, the COVID-19 pandemic has greatly affected the entire rice value chain. Each segment of the rice value chain system has an impact on farming activities. Therefore, the COVID-19 pandemic has brought adversities to farmers, particularly in countries with agrarian economies.

During the pandemic, poverty, hunger, debts, and farm economic failures have intensified (Jakhotiya, 2021; Menon et al., 2022). Tortajada and Lim (2021) cited that according to FAO (2020), during the COVID-19 pandemic, logistics in food value chains such as transportation,

warehousing, procurement, packaging, and inventory management have been bothered, unfavorably affecting the quantity of food available and its quality, freshness, safety, access to markets, and affordability. Previous studies, like the paper of Sinuraya (2021), discussed the impact of the COVID-19 pandemic on the competitiveness and comparative advantages of rice production, while Erlina and Elbaar (2021) investigated only the impact of the COVID-19 pandemic on local rice supply chain flow. However, according to Gregorio and Ancog (2020), the effects of COVID-19 could be better presented across the value chain. The value chain shows the actors from the farmer-producers to the processors, distributors, retailers, and finally reaching the consumers. Hence, millions of rice value chain actors were greatly affected during the pandemic (Bhandari et al. (2020).

Objectives of the Study

The focus of this literature review is to examine the effects of the COVID-19 pandemic on the segments of dissemination of disturbances in the rice value chain. The specific objectives are (1) to examine the effects of the COVID-19 pandemic on input provision, paddy production, paddy aggregation, rice processing, and marketing/distribution and (2) to identify the strategies/recommendations to lessen the impact of COVID-19 on the rice value chain.

Review Questions

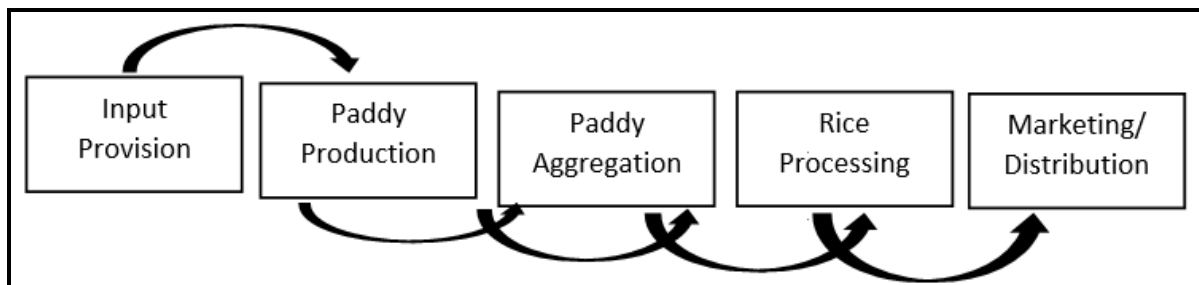
Does this literature review aim to answer the following questions: (1) what are the impacts of the COVID-19 pandemic on the Rice Value Chain? (2). what solutions will minimize the impact of COVID-19 on the rice value chain?

Research Framework and Methodology

Research Framework

Figure 1

The Value Chain Analysis Framework (Mataia et al., 2020)



This paper modified the Value Chain analysis framework of Mataia et al. (2020) as an appropriate model to illustrate the interrelated segments in the rice value chain. The Value Chain analysis framework in Figure 1 illustrates the interrelated segments related to input provision, production, aggregation, processing, and marketing/distribution, carried out among the entire network of chain actors. Gomez et al. (2022) mentioned that the rice value chain describes the flows of the rice commodity and value-adding activities; hence, the value chain is found at the core of high-impact and sustainable initiatives focused on improving productivity. The following are the key activities of each variable used in the study:

Input Provision. Anh et al. (2020) explained that the rice value chain started with input provision wherein farmers acquired farm inputs such as seeds, fertilizers, pesticides, and farm equipment from stores, agencies, seed growers, and Agri input suppliers.

Paddy Production. Paddy is the rice harvested from the plant with its husk intact. This segment includes seed selection, land preparation, crop establishment, crop care and maintenance (like pest management), harvesting and threshing, and hauling.

Paddy Aggregation- This segment refers to the supply of paddy or collecting paddy for sale to large miller traders and includes drying, trucking, handling, and storing.

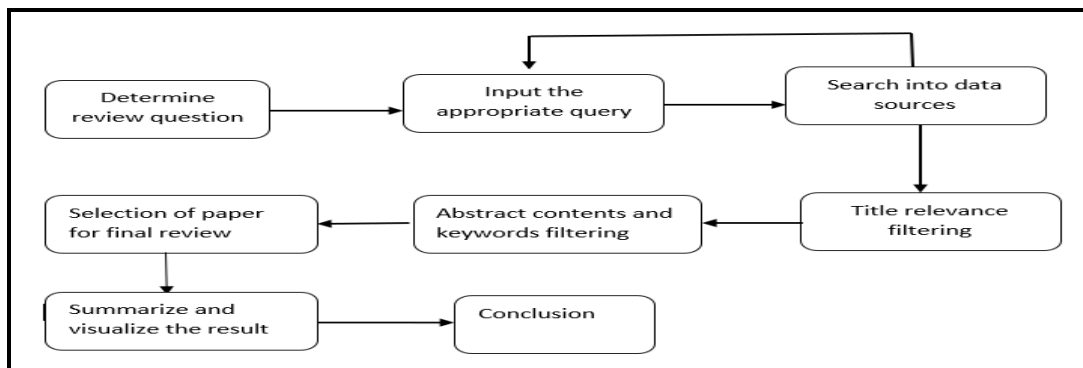
Rice Processing- Transforming paddy into rice, milling, classifying, packaging, and storing. Millers should be concerned with the paddy quality in terms of cleanliness to avoid impurities such as stone and sharp objects that can cause damage to the mills (Twine et al., 2021).

Marketing/ Distribution- The segment includes delivery of milled rice from the mills to the distribution channels to final users, rice trading, and transportation/shipping. The primary channels that connect rice farmers to local and international consumers are paddy traders, millers, retailers, and exporters (Kumse et al., 2021). Thamthanakoon (2022) cited that channels must also recognize the payment mode and speed.

Review Methodology

Figure 2

Review Methodology (Dominic et al., 2021)



Journal and Article Selection

This paper adopted and modified Dominic et al.'s systematic literature review method (2021), as shown in Figure 2. They were using the DLSU Libraries A-Z Databases, which contain 84 databases. These queries were searched into reputed databases like Scopus, Science Direct, Emerald Management Journals, and Google Scholar: Query 1: qualitative paper impacts of COVID-19 pandemic on the rice value chain; Query 2: impacts of COVID-19 pandemic on rice industry; Query 3: awareness of COVID-19 pandemic among rice farmers; Query 4: impacts of COVID-19 pandemic on rice farming and Query 6: strategies to minimize the impacts of the pandemic in rice farming. Likewise, the following keywords were also used: Keywords 1: rice farming during the pandemic; Keywords 2: COVID-19 effects on rice; Keywords 3: solutions to pandemic effects on rice and Keywords 4: rice value chain. There were 50 papers (Academic Journals=30, Conference papers =10, Briefs/Reports=10) that covered the impacts of the COVID-19 pandemic on the rice value chain and strategies to minimize the impacts of the pandemic in the rice value chain. Only academic peer-reviewed research articles published from 2020 to 2022 were sorted. There are 20 articles included based on title relevance and abstract contents, and 30 articles excluded based on title relevance and abstract contents. By keyword search, there were ten identified in Google Scholar, ten articles in Emerald Management, five in Scopus, and five in Science Direct.

Findings

Impacts of COVID-19 on the Rice Value Chain Segments

Table 1

Impacts of COVID-19 on Input Provision Segment

Author/s and Year of Publication	Region/Country of Study	Results Summary
Menon et al. (2022)	Southern Indian state of Kerala	This paper showed that the pandemic disrupted Kole wetland rice farming, such as rising costs of farm inputs. Hence, due to the increasing price of seeds and fertilizers, farmers hesitate to procure farm inputs during the lockdown.
Fox et al. (2020).	Southeast Asia	Results showed that most farmers need help purchasing seeds and fertilizers in Thailand.
ADB Brief (2020).	Pakistan	The report stated that farmers in Pakistan were faced with disturbances related to COVID-19, like the delivery of seeds and purchasing of fertilizer, pesticides, and diesel fuel.
Bhandari et al.(2020)	Asia	This report noted that there were disturbances in seeds, fertilizers, and pesticides in countries like the Philippines, India, Bangladesh, and other Asian countries.
Wahyudi et al. (2021)	Indramayu District, Indonesia	Rice farmers needed help in receiving subsidized fertilizers.
Erlina and Elbaar (2021)	Central Kalimantan, Indonesia	In Kapuas District, the pandemic affected the availability of fertilizers and medicines for rice farming.
Arouna et al. (2020).	West Africa	In West Africa, there was also a need for accessing inputs like fertilizer, pesticides, seeds, and labor.
Esiobu (2020)	Southeast Nigeria	Because of transport restrictions, Agri input suppliers have encountered difficulties in buying seeds, fertilizers, products for crop protection, and equipment that caused rice farmers to delay in planting rice.

Table 2*Impacts of COVID-19 on the Paddy Production Segment*

Author/s and Year of Publication	Region/Country of Study	Results Summary
Adnan and Nordin (2021)	Malaysia	The study highlighted that due to the COVID-19 epidemic, the Malaysian paddy industry was challenged to use modernized rice farming to address the problem faced by the paddy sector.
Bollido (2020)	San Jorge, Samar, Philippines,	The study explained that rice farmers were most affected because they had planted their rice during the pandemic, and they could not visit their farms.
Chhetri (2021)	India	The paper cited that farmers need more labor supply in land preparation for rice cultivation and labor for rice transplanting.
Bhandari et al. (2020)	Asia	The authors mentioned that Bangladeshi farmers experienced several problems: declining farmland cultivation, poor crop management, and delayed rice planting.
Wahyudi et al. (2021)	Indramayu District, West Java, Indonesia	Results indicated that farmers did not experience challenges during the pandemic regarding paddy fields preparation and cultivation, planting paddy, irrigation activities, and weeds removal process.
Fox et al. (2020).	Southeast Asia	Reports showed that farmers could not plant rice in Myanmar and Laos due to the suspension of government loans and no operation of microfinancing firms.
Niaz et al. (2022)	China	Findings in this documentary analysis noted that rice cultivators were only comfortable working in their rice fields with proper safety procedures.
Esiobu (2020)	Southeast Nigeria	Declined in the variety of rice fields planted, including farm sizes and cultivation of less labor-intensive rice varieties, were noted during the pandemic in South Nigeria.
Wardad (2020)	Not mentioned	This report mentioned that paddy prices are decreasing during a pandemic; therefore, rice farmers can not make a profit.

Table 3*Impacts of COVID-19 on the Paddy Aggregation Segment*

Author/s and Year of Publication	Region/Country of Study	Results Summary
Bhandari et al. (2020)	Asia	It highlighted that rice mills in Asia faced challenges like a decline in paddy availability and milled rice demand, and a shortage of mill technicians was also reported.
IFPRI (2021)	Myanmar	In Myanmar, the pandemic caused a higher cost of paddy procurement due to fewer trucks available to procure paddy.
ASPIRES (2020)	Tanzania	The report cited that paddy stocks became dormant in warehouses from Kenya and Rwanda
Arouna et al. (2020).	West Africa	This paper said that due to the pandemic, there was a problem in the procurement of paddy in West Africa due to lockdowns.
Gultom et al. (2021)	Lampung, Indonesia	The paper showed that during the pandemic, farmers of paddy in the district of Lampung began offering their paddy up to outside Lampung for more extensive geographical coverage.
Sivanantha and Sunil (2020)	India	The study mentioned that paddy straw, rice bran, and paddy farmers generally consider rice husks useless; however, to make it beneficial for them, they used the paddy-by-products for mushroom cultivation.

Table 4*Impacts of COVID-19 on the Rice Processing Segment*

Author/s and Year of Publication	Region/Country of Study	Results Summary
Bhandari et al.(2020)	Asia	Findings showed there were disturbances in rice processing in Asia, namely in traditional husking, milling, and shortage of packaging materials.
Wahyudi et al. (2021)	Indramayu District, West Java, Indonesia	Farmers of Cikedung District noticed a decreased price of dry-milled grain.
IFPRI (2021)	Myanmar	The paper cited a shortage of laborers willing to work in mills.
ERA	California	The findings of this report presented that due to the

ECONOMICS (2020)		COVID-19 pandemic, the costs for rice milling, packaging, and shipping were increased in California.
Arouna et al. (2020).	West Africa	It was observed that during the pandemic, there was a decline in labor productivity and efficiency in rice milling in West Africa, causing social distancing.
Ankrah et al. (2021)	Ghana	The paper showed that rice processing in Ghana was disturbed at a marginal level. Hence, workers in rice mills observed safety and health protocols.
Mancombu and Chennai (2021)	Vietnam	Due to strict COVID protocols, Vietnam experienced a shortage of rice mill laborers, in which only 50% of their labor force was deployed.

Table 5

Impacts of COVID-19 on the Marketing/Distribution Segment

Author/s and Year of Publication	Region/Country of Study	Results Summary
Nasir et al. (2021)	Java, Indonesia	This study stated that during the pandemic, the government-imposed lockdown did not affect rice distribution because the government protects the food supply chain performance.
Magpale et al. (2021)	Nueva Ecija, Philippines	The paper showed that rice retailers were significantly affected by the pandemic due to the scheduling of persons allowed to go to the market. There was also a decrease in the number of sacks sold daily.
Viet Nam (2021).	Mekong Delta	The report cited that in Mekong Delta, farmers cannot sell their rice because there are no traders to buy the grain.
Bhandari et al.(2021)	Asia	The authors observed that there was a shift in marketing behavior. Thus, there was increased use of online services, especially in buying food.
ASPIRES (2020)	Tanzania	Rice buyers decreased in Kenya and Rwanda, which resulted in a price increase in rice.
Erlina and Elbaar (2021)	Central Kalimantan, Indonesia	The impact of COVID-19 was mainly felt in the rice distribution process due to delays brought about by movement restrictions. Therefore, the impact of Covid-19 is mainly felt by distributors/wholesalers who flow products to other places.
Ankrah et al. (2021)	Ghana	The results presented that due to the pandemic, the demand for rice in Ghana increased; however it did not suffer a rice shortage. Meanwhile, there was a decrease in export volumes of rice. Due to mobility restrictions, truck

		drivers were hesitant to deliver rice to their destinations. Thus, distribution inefficiency was observed.
Esiobu (2020)	Southeast Nigeria	Findings showed poor market access and poor sales of rice produced.
Gultom et al. (2021)	Lampung, Indonesia	The good effect of the pandemic was also noted in terms of rice marketing in Lampung because they maximized E-commerce.
Mancombu and Chennai (2021)	Vietnam	The pandemic affected the rice trade in Vietnam, which resulted in no trader or exporter coming onward to purchase the autumn rice crops.

Strategies/recommendations to lessen the impact of COVID-19 on the rice value chain

Table 6

Strategies to lessen the impact of COVID-19 on the rice value chain

Author/s and Year of Publication	Region/Country of Study	Key strategies
Kathiresan et al. (2020)	Africa	This paper suggested monitoring the rice value chain activities, accelerating the provision of direct financial incentives to farmers for the procurement of farm inputs, strengthening linkages among the value chain actors, and promoting rice processing quality and capacity of small to medium-scale rice mills.
Hellin (2021)	Not Specified	The report cited the presence of innovative technological interventions as vital through the execution of a platform called Sustainable Impact Through Rice-Based Systems.
Bereir (2020)	Sudan	This study cited that farmers will be provided help through agricultural extension organizations by providing agricultural inputs to improve storage capacities to cope during a pandemic.
Bhardwaj (2021)	Not Specified	The author emphasized having a rice breeding innovations platform from genetic screening to seed processing, launching The Network for Accelerated Rice Variety Impact (NARVI) to ensure that farmers will be aware of improved rice varieties, and implementing the hybrid rice technology.
Jifroudi et	Iran	The results recommended increasing the conversion ratio

al. (2020)		of paddy to rice by investing in new technologies for cultivating, harvesting and milling.
Shahrul and Alwee (2021)	Not Specified	The authors mentioned in the report that there must be a public-private research and development consortium to support innovations in rice science.
Cavite et al. (2021)	Thailand	Recommended use of modern farm systems, more efficient farm planning, and incorporation of intelligent packaging to rice certification systems
Esfandabadi and Asl (2021)	Mazandaran, Iran	This paper showed that policymakers should support sustainable rice production and move towards SDG2, No Hunger, by balancing the supply and demand of the rice market.
Pede (2021)	Not Specified	The report noted that in response to the negative effects of the pandemic on the rice value chain, the author suggested having food security policies like increasing yields, labor-saving technologies and digital tools in agriculture, collective actions in farming, and the recognition of the IRRI Global Rice Model (IGRM) that focuses on rice production, price, and trade.
Ayanlade and Radeny (2020)	Sub-Saharan Africa	The government should focus on major logistical bottlenecks
Mangurai et al. (2022)	India	The authors cited applications of digital technologies in agriculture during the pandemic, like artificial intelligence, blockchain, the internet of things, Geographic Information Systems, robotics, and automation.
Singh et al. (2020).	Not mentioned	The paper emphasized the importance of a resilient supply chain system during the pandemic. The authors developed a model to help develop a resilient and responsive food supply chain.
Reardon et al.(2020)	India	Authors suggested that the government should know how to combine health measures with strategies to make the rice market work, prevent food security crises and Unemployment.
Sers and Mughal (2020)	West Africa	West African countries should consider improving public spending on agriculture with superior attention to actions on improving rice productivity.
Kim et al. (2020).	Not mentioned	The report suggested that a more resilient and efficient agriculture system should be developed through smart agriculture and mechanization and adoption of digital agriculture to improve rice production capacity.

Synthesis

Notable studies on the impacts of the COVID-19 pandemic are summarized in Tables 1-5. These are considered short-term to medium-term impacts of the COVID-19 pandemic in the rice value chain: (1) Disruptions in accessing farm inputs like seeds, fertilizer, pesticides, and equipment caused the higher cost of farm inputs. (2) Shortage in labor supply in land preparation, cultivating less labor-intensive rice varieties, poor crop management, and delayed rice planting. (3) Paddy stocks became dormant in warehouses, declined paddy availability, and increased the cost of paddy procurement. (4) Increased costs for rice milling, packaging, shipping, and shortage of packaging materials. Lastly, (5) increased use of e-commerce in agri-food marketing, the higher price of rice, delays in the rice distribution process due to mobility restrictions and lockdowns, and increased demand for rice.

Conflicts in the rice value chain will also bring long-term impacts on the following Sustainable Development Goals: SDG 1: Poverty, SDG 2: Hunger, SDG 3: Good Health and Well-Being; SDG 8: Decent Work and Economic Growth, SDG 9: Industry, Innovation, and Infrastructure, SDG 11: Sustainable Cities and Communities and SDG 12: Responsible Consumption and Production. According to Hellin (2021), the Philippines was recognized as the first country to approve commercial cultivation to address the issues of malnutrition. Kholi (2021) said that to help lessen poverty, hunger, and malnutrition, there should be a mandate to generate novel rice varieties in rice-consuming regions.

Studies on the strategies to lessen the impact of covid-19 on the rice value chain are listed in Table 6. The COVID-19 pandemic has interrupted all the segments in the rice value chain. Previous studies recommended solutions or strategies to lessen the impact of the COVID-19 pandemic on the rice value chain. Lubinga (2020) suggested in his study that there should be

profiling of rice-producing farmers, conducting a needs assessment, undertaking to benchmark, strengthening the channels to support rice farmers, and providing support to deserving rice farmers. Moreover, the results of the past studies emphasized the following actions: (1) the importance of agricultural research toward rice productivity and profitability. (2) To ensure ideal crop management and to achieve just-in-time rice planting and harvesting, the availability of farm inputs should be maintained and monitored. (3) Major logistical bottlenecks should be minimized to avoid supply chain distractions. (4) Accelerating projects related to water management and seed distribution. (5) Investing in new digital technologies to improve efficiency in rice production, decrease farm inputs and reduce water usage. (6) Promoting the use of digital services in buying and selling paddy and milled rice. Lastly, (7) Public-private sector partnership through research and development and to invest in national and international rice trade, food security, and market data collection.

Contributions and Research Implications

Significance of the Study

This study makes various unique contributions to the existing literature. This study will be helpful to rice breeders, scientists, researchers, policymakers, and decision-makers in leading the development of proposals for new rice varieties, food security, nutrition, improving land soil health, and seed certifications. Globally, COVID-19 brought lockdowns that disturbed the livelihoods of billions of people. The policies and programs associated with input supply and rice production, rice processing, marketing, and logistics were also interrupted due to the pandemic. This paper summarized the impacts of COVID-19 on the rice value chain internationally and the strategies implemented to minimize those impacts. The findings showed that there needed more access to farm input supply shortage of labor in land cultivation and milling during the

pandemic. These findings are relevant to input dealers, rice farmers, millers, rice traders, and consumers to think of strategies to increase rice yields, develop a resilient rice farming system, and circulate innovative technological intervention.

Aday et al. (2020) said that more infrastructure investment should be required to allow upgraded sanitation systems, and crop yield information models must be used to help the government sector make grain marketing decisions. During the pandemic, access to digital services or virtual channels was strengthened. This finding is relevant to information technologies and digital marketers to offer technical support to farmers, and digital services should be promoted to rice farmers for crop management, pest management, weather forecasting, marketing, and finance. Another effect of the pandemic on rice farmers was a shortage of capital. This finding is relevant to the government sector and microfinancing institutions to provide financial support to smallholder farmers and small to medium-scale millers through low-interest loans.

Future Studies

Future studies are urged to explore the disruptions of the rice value chain that will have long-term impacts on the following Sustainable Development Goals: SDG 1: Poverty, SDG 2: Hunger, SDG 3: Good Health and Well-Being, SDG 8: Decent Work and Economic Growth, SDG 9: Industry, Innovation, and Infrastructure, SDG 11: Sustainable Cities and Communities and SDG 12: Responsible Consumption and Production. Further research must consider examining actions or strategies to promote the rice sector's development and advance policy procedures in the post-pandemic time. It is also interesting that future studies discuss the SWOT Analysis of digital agriculture and mechanization in the post-pandemic era.

References

- Aday,S., Aday, M. S. (2020). Impact of COVID-19 on the food supply chain. *Food Quality and Safety. Advance Access publication*. doi:10.1093/fqsafe/fyaa024.
- Adnan, N. and Nordin, S. (2021). How covid 19 affect the Malaysian paddy industry? The adoption of green fertilizer is a potential resolution. *Environment, Development, and Sustainability*. <https://doi.org/10.1007/s10668-020-00978-6>.
- Agricultural Sector Policy and Institutional Reforms Strengthening. (2020). Impact of covid-19 on staples and food markets in Tanzania. *ASPIRES Policy Brief*.
- Anh, D. T., Tinh, T. V., Vang, N. N. (2020). The domestic rice value chain in the Mekong delta. *Centre for Agricultural Policy, Institute of Policy and Strategy for Agriculture and Rural Development, Ministry of Agriculture and Rural Development*. Chapter 18. https://doi.org/10.1007/978-981-15-0998-8_18.
- Ankrah, A. D, Holmes, A.A, Boakye, A.A. (2021). Ghana's rice value chain resilience in the context of COVID-19. *Social Sciences & Humanities Open*. <https://www.sciencedirect.com/journal/social-sciences-and-humanities-open>.
- Arouna, A., Soullier, G., Mendez del Villar, P., Demont, M. (2020). Policy options for mitigating impacts of COVID-19 on domestic rice value chains and food security in West Africa. *Global Food Security*. <https://doi.org/10.1016/j.gfs.2020.100405>.
- Asian Development Bank. (2020). COVID-19 impact on farm households in punjab, Pakistan: analysis of data from a cross-sectional survey. *ADB Brief*. <https://www.adb.org/sites/default/files/publication/624751/covid-19-farm-households-punjab-pakistan.pdf>.
- Ayanlade, A., Radeny, M. (2020). COVID-19 and food security in Sub-Saharan Africa:

- implications of lockdown during agricultural planting seasons. *NPJ. Science of Food*.
<https://www.nature.com/articles/s41538-020-00073-0>.
- Bereir, A.M. (2020). Impact of covid19 on Sudan agriculture: the role of the agricultural extension during the pandemic era. *International Journal of Agricultural Science, Research and Technology in Extension and Education Systems (IJASRT in EESs)*.
<http://ijasrt.iau-shoushtar.ac.ir/>.
- Bhandari, H., Balié, J. Pede, V. and Meah, N. (2020). Impact of covid-19 on the rice value chain (RVC) in asia. *Policy Brief. International Rice Research Institute (IRRI)*.
- Bhardwaj, H. (2021). Rice breeding innovations. Policy Brief. *International Rice Research Institute (IRRI)*.
- Bollido, M.E. (2020). Economic security assessment of San Jorge, Samar, Philippines, as it experiences coronavirus. *Journal of Agriculture, Food Systems, and Community Development*. ISSN: 2152-0801 online.
- Cavite, H.J.M, Kerdsriserm, C, Suwanmaneepong, S. (2021). Strategic guidelines for community enterprise development: a case in rural Thailand. *Journal of Enterprising Communities: People and Places in the Global Economy*. <https://www.emerald.com/insight/1750-6204.htm>.
- Chen C, van Groenigen KJ, Yang H, Hungate BA, Yang B, Tian Y, et al. (2020). Global warming and shifts in cropping systems together reduce China's rice production. *Glob Food Sec*. <https://doi.org/10.1016/j.gfs.2020.100359>.
- Chhetri, K. A., Sapkota, B. T., Maharjan, S. (2021). Impact of COVID-19 on access to inputs for crop production in India: assessment of disruption caused by covid-19 in farm inputs provision. *Wageningen, The Netherlands: CGIAR Research Program on Climate*

Change, Agriculture and Food Security.

- Esfandabadi, S. H., Asl, M. G. (2021). Drought assessment in paddy rice fields using remote sensing technology towards achieving food security and SDG2. *British Food Journal*. <https://www.emerald.com/insight/0007-070X.htm>.
- Esiobu, N. S (2020). How Does COVID-19 Pandemic Affect Rice Yield? Lessons from Southeast Nigeria. *Journal of Biology, Agriculture, and Healthcare*. ISSN 2224-3208 (Paper) ISSN 2225-093X (Online). Vol.10, No.15.
- ERA Economics LLC. (2020). Economic impacts of the covid-19 pandemic on California agriculture. *ERA Economics Final Report*.
- Erlina, Y. and Elbaar, E. (2021). Impact of Covid-19 pandemic on local rice supply chain flow patterns in Kapuas regency, Central Kalimantan, Indonesia. *WSEAS Transactions on Business and Economics*.
- Fox, J., Promkhambut, A., and Yokying, P. (2020). Impact of covid-19 on rice farmers in southeast Asia. *East-West Center*. <https://www.eastwestcenter.org/news-center/east-west-wire/impact-covid-19-rice-farmers-in-southeast-asia>.
- Gomez, D., Ageh, E. A., Kwaghngu, H. A. (2022). Effect of rice value chain program on rice production in the Gambia. *Asian Food Science Journal*. 21(5): 1-13, 2022; Article no.AFSJ.85207. ISSN: 2581-7752.
- Gregorio, G.B., and Ancog, R.C. (2020). Assessing the Impact of the COVID-19 Pandemic on Agricultural Production in Southeast Asia: Toward Transformative Change in Agricultural Food Systems. *Asian Journal of Agriculture and Development*. 17(1): 1–13. <https://doi.org/10.37801/ajad2020.17.1.1>.
- Gultom, I. A., Subing, M. A, Puspa, A.K., Harpain. (2021). The impact of the pandemic on rice

- farmers in Lampung province. Looking at the Implications and Solutions in the Time of Pandemic through Social, Economic, Educational, Health, and Legal Points of View and Perspectives. *The International Conference of Universitas Pekalongan*.
- Hellin, J. (2021). Sustainable impact through rice-based systems. *Policy Brief. International Rice Research Institute (IRRI)*.
- International Food Policy Research Institute. (2021). Agro-processing, food prices, and covid-19 shocks. Evidence from Myanmar's rice mills. *IFPRI-Myanmar*.
- Jifroudi, S. A. S, Teimoury, E., Barzinpour, F. (2020). Designing and planning a rice supply chain: a case study for Iran farmlands. *Decision Science Letters*. DOI: 10.5267/j.dsl.2020.1.001.
- Kathiresan, A., Nagai, T., Haneishi, Y. (2020). Policy options for galvanizing Africa's rice sector against impacts of COVID-19. *World Development*.
<https://doi.org/10.1016/j.worlddev.2020.105126>.
- Kim, K., Kim, S., Park, C.Y. (2020). Safeguarding food security amid COVID-19. *Economics, Politics and Public Policy in East Asia and the Pacific*. <https://www.eastasiaforum.org/>
- Kholi, A. (2021). The drive to move forward in pandemic circumstances. *Policy Brief. International Rice Research Institute (IRRI)*.
- Kumse, K., Suzuki, N., Sato, K., Demont, M. (2021). The spillover effect of direct competition between marketing cooperatives and private intermediaries: evidence from the Thai rice value chain. *Food Policy* 101. <https://doi.org/10.1016/j.foodpol.2021.102051>.
- Lubinga, M.H. (2020). Abating adverse effects of global shocks on south africa's rice imports: a case of a covid-19 pandemic. *National Agricultural Marketing Council (NAMC)*.
- Magpale, Diana B., Tabigne, L. D., Beley, A.J., Estrella, R. C., Angeles, V.B., Balaria, F. E

- (2021). Effect of covid-19 pandemic among rice retailers in nueva ecija. *International Journal of Advanced Engineering, Management and Science*. <http://www.ijaems.com/>.
- Mangurai, S., Solikhin, A., Octaviani, E. A., Anidah. (2022). Upgrading" Indonesia's digital agriculture through research and application during the covid-19 pandemic. *Agriculture and Development Note* Vol. 11 No. 1.
- Mancombu, S. R and Chennai. (2021). Vietnam rice trade in limbo as Covid crisis spreads. *Businessline*. <https://www.thehindubusinessline.com/>.
- Menon, A., Vogt, D.S (2022). Effects of the covid-19 pandemic on farmers and their responses: a study of three farming systems in Kerala, south India. *MDPI*.
- Nasir, M. A., Jamhari, Mulyo, J.H. (2021). The implications of the COVID-19 pandemic on rice market performance in Java, Indonesia. *The 7th International Conference on Sustainable Agriculture and Environment. IOP Conf. Series: Earth and Environmental Science 637 (2021) 012049. IOP Publishing*.
- Niaz, A., Asad, M.M., Abdulmuhsin, A.A., Shavanov, M. and Churi, P. (2022). Risk factors for the rice crop farming community in China: a documentary analysis of the challenges during post-COVID-19. *Asian Education and Development Studies*, Vol. 11 No. 2, pp. 298-310. <https://doi-org.dlsu.idm.oclc.org/10.1108/AEDS-11-2020-0257>.
- Pede, V. (2021). Formulating food security policies for the rapidly evolving global agri-food systems. *Policy Brief. International Rice Research Institute (IRRI)*.
- Reardon, T., Mishra, A., Nuthalapati, C.S.R., Bellemare, M. F., Zilberman, D. (2020). Covid-19's disruption of India's transformed food supply chains. *Economic and Political Weekly*.
- Wahyudi, Fahmid, I. M., Salman, D., and Suhab, S. (2021). Impact of the covid-19 pandemic on

- rice farming planning in Indramayu district, west java. 2nd International Conference on Agriculture and Applied Science. *IOP Conf. Series: Earth and Environmental Science*.
- Wardad, Y. (2020). Farmers incur loss amid fall in rice, paddy prices: Traders, millers to make a profit amid pandemic. *The Financial Express*. <https://thefinancialexpress.com>.
- Sers, C.F., Mughal, M. (2021). Covid-19 outbreak and the need for rice self-sufficiency in West Africa. *World Development*. <https://doi.org/10.1016/j.worlddev.2020.105071>.
- Shahrul, S., Alwee, R. S. (2021). Integrative research support platform. *Policy Brief. International Rice Research Institute (IRRI)*.
- Singh, K., Kumar, R., Panchal, R., Tiwari, K. M. (2020). Impact of COVID-19 on logistics systems and disruptions in food supply chain. *International Journal of Production Research*. <https://doi.org/10.1080/00207543.2020.1792000>
- Sinuraya, J. F, and Setiyanto, A. (2021). The effect of the COVID-19 outbreak on the competitive and comparative advantages of rice production in West Java, Indonesia. *IOP Conf. Series: Earth and Environmental Science*.
- Sivanantha, J. and Sunil, J. A. (2020). The paddy cultivation in the era of the coronavirus (covid – 19) pandemic crisis prompts changes in paddy cultivation. *Agriculture and Food, ESN Publications*.
- Suwardi. (2021). Indonesian food security during the Covid-19 pandemic. *IOP Conf. Series: Earth and Environmental Science*. doi:10.1088/1755-1315/756/1/012037.
- Thamthanakoon, N., Huang, I.Y., Eastham, J., Ward, S. & Manning, L. (2022). Factors driving Thailand rice farmer decision-making in the choice of marketing channel. *British Food Journal*, Vol. 124 No. 1, pp. 331–349. <https://doi-org.dlsu.idm.oclc.org/10.1108/BFJ-11-2020-1040>

Twine, E.E., Adur-Okello, S.E., Mujawamariya, G. and Ndindeng, S.A. (2021). Targeting millers to improve rice marketing in Uganda. *British Food Journal*, Vol. 123 No. 13, pp. 454-468. <https://doi-org.dlsu.idm.oclc.org/10.1108/BFJ-05-2021-0505>.

Viet Nam News (2021). Commercial banks directed to aid rice industry amid pandemic. <https://vietnamnews.vn/economy>