

# Analysis of Concerns of the Agricultural Sector in the Philippines using Associative Rule

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**Abstracts:** The Philippines is an agricultural country famous for its wide range of natural resources scattered over the archipelago. The country's agriculture sector comprises four sub-sectors: fisheries, farming, livestock, and forestry. The COVID-19 pandemic, according to the Food and Agriculture Organization, is straining food systems and causing food insecurity across the world. This study used a mixed method that analyzed qualitative data using quantitative analysis. Concerns voiced by agricultural sectors were analyzed utilizing the frequencies of words used. The study utilized the frequency of the words was TF-IDF or Term Frequency – Inverse Document Frequency to analyze agricultural word concerns. This schema was used as a numeric measure to show the importance of using words to voice out their concerns. The next step is the determination of word patterns using association rule Association Rule Mining. The result reveals the prevalent words used to express concern by the agriculture sector are "cash" and "seed" and "assist" + "cash" is the most frequent word pattern. The word "cash," the most commonly used word used by the agriculture sector to air their concern, reveals that this sector needs cash assistance to finance their agricultural activities. The result of this study can be utilized to address concerns in the agriculture sector. Furthermore, this research can be utilized in other sectors to analyze their concerns and provide necessary interventions.

**Keywords:** Agricultural Sector, Mixed Method, Machine Learning, Associative Rule.

## 1. INTRODUCTION

Philippines is an agricultural country famous for its wide range of natural resources scattered over the archipelago. The country's agriculture sector comprises four sub-sectors namely fisheries, farming, livestock, and forestry. It plays a significant role in the country's economy, contributing around one-tenth of GDP and a quarter of the labor force. The sector not only fed and nurtured its citizens, but also the rest of the globe; in fact, the Philippines is one of the world's top marine producers [1], leading exporter of abaca in the world [2], and one of the top exporters of bananas, pineapples, and nickel [3]. However, due to several natural calamities, including crop pest infestations, volcanic eruptions, contagious animal diseases (such as the swine flu), and the pandemic, the sector struggled with a great deal of stress. In their 2020 Annual Report, the Department of Agriculture noted that the Covid-19 outbreak was the worst catastrophe they had had since World War II [4].

A contagious illness known as coronavirus disease (COVID-19) is brought on by the SARS-CoV-2 virus and was first identified in humans in Wuhan, China December of 2019. It has largely been spreading across vast regions globally because of generating rapid and substantial human-to-human transmissions, which prompted the World Health Organization to proclaim COVID-19 a pandemic on March 11, 2020. During the media conference, WHO Director-General Dr. Tedros Adhanom Ghebreyesus stated that COVID-19 is not simply a public health issue but a crisis that would affect every sector [5].

The COVID-19 pandemic, according to the Food and Agriculture Organization, is straining food systems and causing food insecurity across the world. Border restrictions and lockdowns have disrupted food supply networks, which hastens a slow harvest, impedes food movement, and increases food loss and waste as farmers resort to dumping perishables [6]. According to a study, the COVID-19 pandemic during the first quarter of 2020 caused a 3.11% loss in Southeast Asia's total agricultural production due to a decline in farm labor and can be translated to a 1.4% decline in the region's GDP [7].

Globally, various research has been carried out on the effect of COVID-19 to the agricultural sector. For instance, a researcher from Peru confirmed that the pandemic has brought a significant influence on agriculture and the food supply chain, primarily affecting food demand and, as a result, food security, with a significant impact on the most vulnerable people [8]. In Thailand, result of a particular study showed that COVID-19 had a negative

impact on farmer's daily lives, increased the cost of planting, agrochemical, and fertilizers, decreased the prices of agricultural products, difficulty to access markets and logistics, and depression on farmers [9].

In the Philippines, just like any other country the agricultural sector forms the backbone of the economy and remains one of the top priorities of the government. Philippine president and the current head of Department of Agriculture said during his first state of the nation address that "one of the main drivers of our push for growth and employment will be in the agricultural sector" and urged the department to act quickly and effectively to address the many issues that threaten the nation's food supply and have for years stifled the growth of the farm. The Philippines has been faced with daunting and overwhelming problems in the agricultural sector. The growth in farm productivity over the past decade has been stagnant and even declining. With all this in mind, the researchers intend to investigate particularly in the concerns of farm laborers to better understand the impact of COVID-19 in the Philippine agricultural sector.

The aim of this study is to explore and analyse the concerns of agricultural sector in the Philippines during Covid-19 pandemic using text analytic.

## 2. LITERATURE REVIEW

The COVID-19 pandemic brought a global crisis that devastated the world economy and was also felt by the food and agriculture sector [10], not to state other massive stresses the farmers faced, such as volcanic eruption, infectious animal disease, crop pest infestation, and a series of typhoons [11]. With this, the sector noticed that the spread of virus containment disrupted the supply of the agri-food product having a shift in the demand level of some commodities. There were also delays to transport and logistics services. Manifestation of disruptions was also visible in the mobility of people, and the lockdowns caused labor shortages in the agricultural sector in many countries. Indeed, the COVID-19 pandemic wreaked havoc on the global and national economies. But, no matter what happens, people must eat [11].

In 2021, Statista from the Agriculture in the Philippines statistics and facts mentioned that a quarter of employed Filipinos are seen in the agricultural sector [12]. This sector is divided into four sub-sectors: farming, fisheries, livestock, and forestry. Highlighting the farming sub-sector, the Center for Agrarian Reform (2019) discussed the types of farmers [13]. The first is the farmer who has his family farm. They are independent and bound to traditional agriculture. The second type is the landless worker who hires out his labor to other small farmers in seasonal periods. Another type is the share tenant, where patron-client relations are present. The fourth type is the migrant or permanent hacienda agricultural worker. Next is the so-called regular casual who work within plantations. They are often linked to transnational corporations. Another type is a member of a land consolidation, where there are group activities in production, credit, and marketing. A farmer linked to a cooperative network or corporation is the seventh type. Lastly, some farmers are considered the agrarian reform beneficiaries and receive some government support.

Many authors and organizations described Filipino farmers, most of whom had the same idea. A typical farmer works on about one hectare or less of rice land as a tenant. Specifically, that is 1.29 hectares, according to the Center for Agrarian Reform and Rural Development [13]. Furthermore, 70% of the rural poor, or 13 million, are farmers and fishermen, while 52% are owners or cultivators. The Filipino farmer's average age is 57 years old, with a Grade 5 average educational attainment, and earns Php 280.37 per day or \$6 compared to the \$10 national average wage. Additionally, most farmers are in Western Visayas (Filipino Farmers – a dying breed, 2013; Center for Agrarian Reform and Rural Development, 2019; Obispo, 2014; Reyes, 2021). Farmers' age and limited education make them less receptive to new farming technologies that can boost their chances of earning even in volatile weather (Filipino Farmers – a dying breed, 2013). The problem with farming is that it is associated with poverty. This is because of poor productivity growth, under-investment in infrastructure, high population growth, low quality of social service, low product prices, natural calamities, the risk associated with unpredictable market demand, poor education background, and conflict in the townspeople [14,15]. Villegas (2020) added that the farmers remain poor because of people who prey on them to achieve influence. The deaf ears neglected the agricultural sector leading to the idea that a farmer's life is inferior even before the pandemic afflicted the country [16,17].

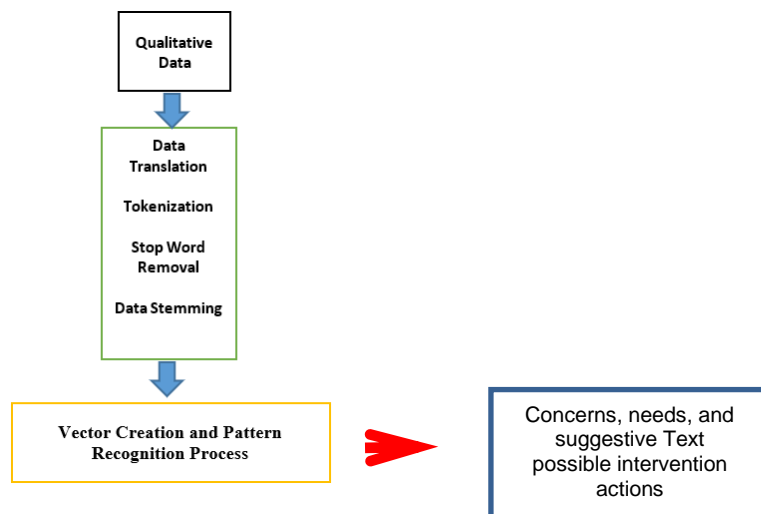
Farmers' aspirations are simple. They dream of having their land, a better future for their children, sustainable and other sources of income, and a good quality of life [13,15]. Farmers mentioned that neither pandemic nor typhoon was their most significant problem. It is the volatility of rice grains in the market, for it contributes to the intensive neo-liberalization of the country's economy. Neo liberalization means hope to bring development and improved quality of life, especially in developing countries. The price of domestic rice plummets because of the extensive importation of vast quantities of cheap rice. This forces farmers into debt bondage that keeps them tied up in poverty. Further, some farmers grieved the lack of adequate government support, leading them to think that only prominent entrepreneurs benefit from the current system. But despite all these, many remain optimistic about the agricultural industry in the country [18].

Small farmers have also encountered difficulty accessing inputs and markets for their produce. The government can help market failure by uniting buyers and producer organizations to support them. Reyes (2021) further stated that DA provided four support services extended to the farmers [16]. These are social infrastructure, livelihood enterprise development, financial/credit assistance, and the climate-resilient farm productivity project. There will also be a provision of support for preparing and implementing profitable business plans that benefit both parties [19]. As the secretary of the Department of Agrarian Reform (DAR), John Castriociones mentioned, "it is high time that farmers get all the help that they need since they take the cudgel for the nation's requirements during the pandemic by providing food on our table," [16]. For this reason alone – the need to provide food to eat, agriculture registered a positive contribution to the economy compared to the other movers, such as construction, real estate, and manufacturing. Right after the declaration of community quarantine by President Rodrigo Roa Duterte in March 2020, DA implemented the "Food Resiliency Action Plan." This aimed to ensure that there would be enough and affordable food supply for Metro Manila and other urban areas. During this time, DA strengthened its "Bantay Presyo Task Force" to monitor and enforce the department's expanded list of suggested retail prices (SRP) for agri-fishery commodities [11]. Additionally, the DA coordinated with various private and local government sectors and launched the "Kadiwa ni Ani at Kita" program, providing more options for the public to access affordable agri-products during the pandemic. Kadiwa or Katuwang sa Diwa at Gawa para sa Masaganang Ani at Mataas na Kita was a flagship program to improve marketing linkages between urban areas and farmers. Under this program are the Kadiwa Express and Kadiwa Online, which facilitate the transfer of goods and online placement. Kadiwa ni Ani at Kita directly connects producers and consumers. Another implemented project nationwide was the Duterte administration's Php31 billion "Plant Plant Plant Program" or "Ahon Lahat, Pagkaing Sapat (ALPAS) Laban sa COVID-19," which benefited the farmers, fishers, and consumers. This program sought to increase national agri-products such as production of quality seeds, use of modern technologies and right inputs to increase productivity levels. Parallel to this program is the country's importation of 300,000 tons of rice through a government-to-government purchase arrangement. DA implemented key strategies to grow and fuel the Philippine agriculture and fishery sector into a modernized and industrialized economic powerhouse by clustering and consolidation called "Bayanihan Agri Cluster." This aims to unite government interventions such as provisions of loans, farm mechanization, free seeds and fertilizers, and market support. There was also an implementation upscaling of Agriculture 4.0, also called the fourth agricultural revolution, which seeks the use of innovative farming technologies [11,20,21].

Various organizations, countries, and individuals lent their hand in coming up with swift and reliable interventions to elevate food production during the pandemic because of possible disruption in the agricultural system for a long-term period. Indeed, Filipino farmers are the new heroes as the country faces the global crisis [16].

### **3. MATERIEL AND METHODS**

This study used a mixed method that analyzed qualitative data using quantitative analysis. Concerns voiced by the agricultural sector during the COVID pandemic period were analyzed using the frequency of words used.



**Figure 1.** Conceptual Framework

### 3.1 Data Gathering

The respondents were four hundred (400) argi-farmers from the agricultural sector in the province of Pangasinan. The four hundred (400) respondents were randomly selected and asked to answer a survey questionnaire about their agricultural sustainability. The survey questionnaire was divided into several categories; however, the focus of this article is on the concerns of this sector.

### 3.2 Data Processing

#### 3.2.1 Data translation

Some concern responses were in Filipino and needed to be translated into English. Google Excel was utilized to translate Filipino words into their English forms.

#### 3.2.2 Tokenization

Splitting up the concerns into it tokens form.

#### 3.2.3 Data Stop Words Removal

Next is the use of the Rapidminer Stopwords (Dictionary) operator to remove all the words equal to the stopwords from the given concern response dataset.

#### 3.2.4 Data Stemming

Rapidminer tool was is to reduce the concern responses word into a base form.

### 3.3 Vector Creation and Pattern Recognition Process

The study utilized the frequency of the words TF-IDF or Term Frequency – Inverse Document Frequency to analyze agricultural needs and their concerns. The method used to determine the dominant agricultural words and patterns is the frequency of the appearance of words in the tweets, which has greater importance. The next step is the determination of word patterns using association rule mining. Association Rules Association rule mining searches for very important associations and relationships among words in the set of feedback (dataset). This rule presents the frequency at which a word/word pattern occurs in feedback. This is an analytical technique to discover how words or word patterns are related to each other.

## 4. RESULT AND DISCUSSION

### 4.1 Profile of the Respondents

Figure 2 reveals the sources of income among the respondents. It is evident from the data that a significant majority (62%) of those engaged in the agricultural sector primarily rely on income derived from farming. Following closely is fishing, which constitutes a substantial percentage of the respondents' income, approximately 20%.

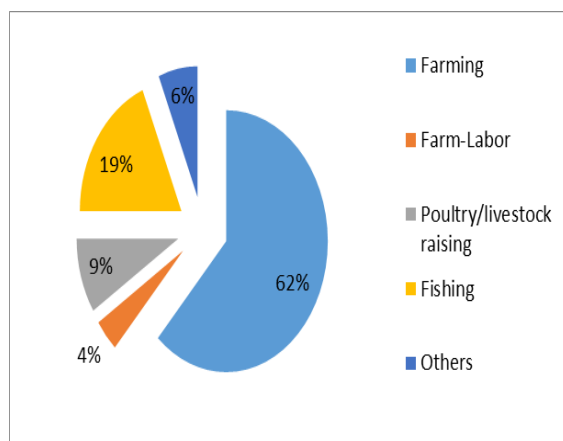


Figure 2. Source of Income of the Respondents

### 4.2 Concerns of the Agricultural Sector

Table 1 displays the commonly used words in the agricultural sector when expressing their concerns to the government.

Table 1. Most Frequent Words Used the Agricultural Sector to Raise their Concern to the Government

Words Used to Voice Concern	Support	No. of time Appeared word appeared Together in the Dataset
cash	0.102	10200
seed	0.067	6700
price	0.063	6300
boat	0.055	5500
Irrigation	0.051	5100
Net	0.051	5100
Equipment	0.047	4700
Fish	0.047	4700
Input	0.047	4700
Addition	0.039	3900
Fair	0.035	3500
Farm	0.035	3500
Farmer	0.035	3500
Fertilizer	0.035	3500
Vitamin	0.035	3500

The prevalent words used to air concern by the agriculture sector are "cash" (0.102) or 10200 times that the word appeared in the dataset, "seed" (0.067) or 6700 times that the word appeared in the dataset, followed after "price" and "boat". The word "cash," the most used word used by the agriculture sector to air their concern, reveals that this sector needs cash assistance to finance their agricultural activities. Cash assistance is mandated by Republic Act No. 11598, or the "Cash Assistance for Filipino Farmers Act", which mandates the Department of Agriculture to provide conditional cash grants, which currently amount to P5,000.00 to farmers tilling 2 hectares or less.

Furthermore, "seed" is the 2nd most used word found in the dataset, and this means that farmers ask the government for a seed subsidy. The Agricultural Development Program: Binhi Para sa mga Magsasaka - Rice Seeds Subsidy Program for Farmers under the Angat Kabuhayan sa Agrikultura Program (AKAP) was implemented by the government to assist farmers.

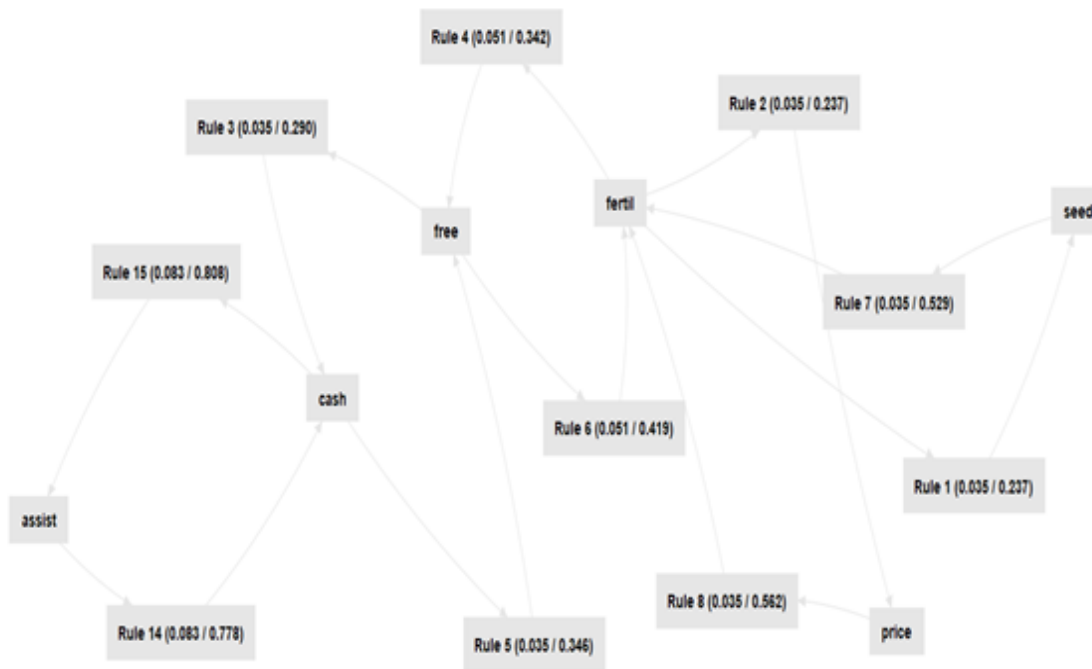
"Price" is also one of the dominant words used by the agricultural sector. This may be related to the price of agricultural inputs and the output of the farmers. This is one of the major concerns of farmers; they sell their products in a very low price, but the prices of agricultural inputs are so high.

Other top words like "price" can be related to the low prices of some agricultural products like "palay" which cannot return the investment of the farmers in the plating of rice. Furthermore, oversupply of other agricultural products results in very low prices for the said products. Other interesting words were "boat" and "net" which were used to catch fish. This indicates that every fisherman voiced their concerns that they needed fishing tools such as a boat and net.

**Table 2. Most Frequent Word Patterns Used the Agricultural Sector to Raise their Concern to the Government**

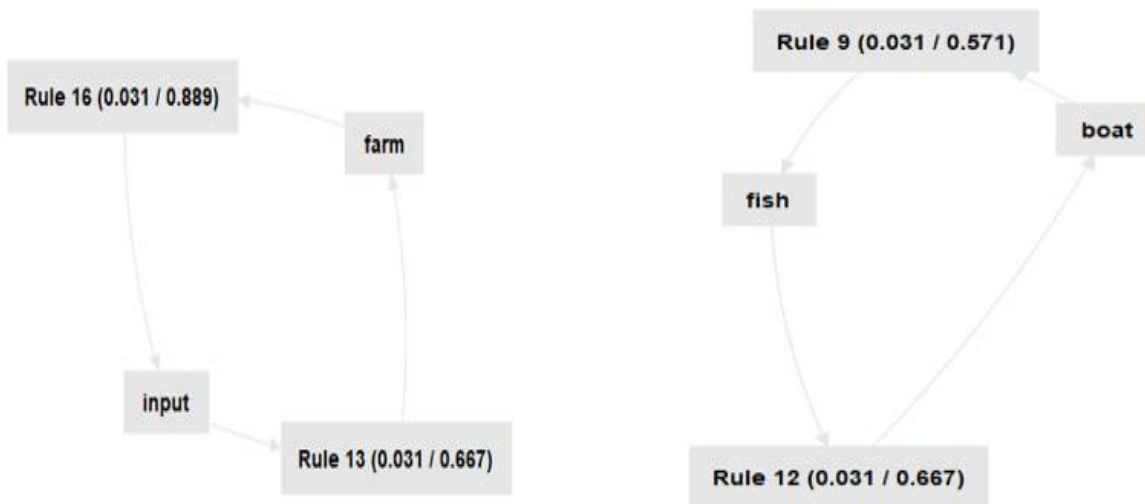
Words Used to Voice Concern 1	Words Used to Voice Concern 2	Support	No. of time Appeared two word appeared Together in the Dataset
Assistance	cash	0.083	8300
Restrict	travel	0.039	3900
Fertilizer	seed	0.035	3500
Fertilizer	price	0.035	3500
free	cash	0.035	3500
boat	fish	0.031	3100
input	farm	0.031	3100

Table 2 reveals that "assist" + "cash" obtains the highest frequency with 0.083, or 8300 times that the word pattern was used to voice out their concern to the government. The respondents ask for financial assistance to be utilized on their farm. The government is mandated to facilitate short-term intervention to provide financial assistance to the agricultural sector under Republic Act No. 11598 or the "Cash Assistance for Filipino Farmers Act" Another interesting combination of words used to voice out their concern are "fertilizer" + "seed" and "fertilizer" + "price," which both obtained 0.035, or 3500 times that were used. Another important input in the agricultural sector is fertilizer and seed, and the price of these commodities was so high. The agricultural sector asks to reduce the prices of these commodities.



**Figure 5.** The graphical representation of the discovered rules of words/word patters Used by Agricultural Sector (Farming) to Raise their Concern to the Government

Other interesting words were "boat" and "net" which were used to catch fish, as shown in table 2 and figure 5. This indicates that every fisherman voiced their concerns that they needed this fishing tool, such as a boat and fishing net. The government extends this type of assistance; however, not all areas in the Philippines have benefited from this program or activity. The government should launch an investment program to improve fisheries production as part of long term plans to increase rural incomes and boost social development in the country's poorest fishing regions.



**Figure 6.** The graphical representation of the discovered rules of words/word patters Used by Agricultural Sector Fishing and Animal to raise their Concern to the Government.

In the case of livestock farmers, table 2 and figure 6 reveal that they used "farm" + "input" to voice their concern. According to Cervantes the lack of cheap inputs and feed costs in the Philippines remain among the 3322

highest in the region [22]. The government should address this concern to help livestock farmers and to have stable agricultural output in the Philippines.

## CONCLUSION

The COVID-19 pandemic, according to the Food and Agriculture Organization, is straining food systems and causing food insecurity across the world. The aim of this study is to explore the concerns of the agricultural sector in the Philippines during the COVID-19 pandemic using text analysis. This study used a mixed method that analyzed qualitative data using quantitative analysis. Concerns voiced by the agricultural sector were analyzed using the frequency of words used. The personal profile of the agricultural sector respondents was that 2 to 3 members of the household were working in agricultural areas, they were working as farm workers and fishermen, and they were mostly high school and elementary school graduates. The prevalent words used to express concern by the agriculture sector were "cash" and "seed". Other top words like "price" can be related to the low prices of some agricultural products like "palay" which cannot return the investment of the farmers in the plating of rice. Furthermore, oversupply of other agricultural products results in very low prices for the said products. In terms of word patterns, "assist" + "cash" obtain the highest frequency. This method of analyzing concerns in the agricultural sector is very useful because respondent responses were direct opinions and feelings.

## REFERENCES

- [1] FAO. 2020. The State of World Fisheries and Aquaculture 2020. Sustainability in action. Rome <https://doi.org/10.4060/ca9229en>
- [2] Abaca Industry Profile, PCAARRD's Industry Strategic Science and Technology Plans. <https://ispweb.pcaarrd.dost.gov.ph/>
- [3] Workman, D. (2020), Philippines Top 10 Exports, World's Top Exports. <https://www.worldstopexports.com/philippines-top-10-exports/>
- [4] Department of Agriculture, The Year in Review: Philippine Agriculture Rises to the Challenge of the Times, 2020 Year-End Report. <https://www.da.gov.ph/wp-content/uploads/2020/12/2020-Year-end-Report.pdf>
- [5] World Health Organization, WHO Director-General's Opening Remarks at the Media Briefing on COVID-19- March 11, 2020
- [6] FAO Covid-19 Response and Recovery Programme, Food and Agriculture Organization of the United Nations. <https://www.fao.org/partnerships/resource-partners/covid-19/en/>
- [7] Gregorio, G., & Ancog, R. ,2020. Assessing the impact of the COVID-19 pandemic on agricultural production in Southeast Asia: Toward transformative change in agricultural food system. Asian Journal of Agriculture and Development, 17(1), 1–14. <https://doi.org/10.37801/ajad2020.17.1.1>
- [8] Siche, R. (2020). What is the impact of covid-19 disease on agriculture? Scientia Agropecuaria, 11(1), 3–6. <https://doi.org/10.17268/sci.agropecu.2020.01.00>
- [9] Sappamrer, R., et al. ,2022. Impact of covid-19 pandemic on daily lives, agricultural working lives, and mental health of farmers in northern Thailand. Sustainability, 14(3), 1189. <https://doi.org/10.3390/su14031189>
- [10] COVID-19 and the Food and Agricultural Sector: Issues and Policy Responses. (2022, April 29). Retrieved November 4, 2022, from [https://read.oecd-ilibrary.org/view/?ref=130\\_130816-9uut45lj4q](https://read.oecd-ilibrary.org/view/?ref=130_130816-9uut45lj4q)
- [11] DA Strategic Communications. (2020, December). 2020 Year-end Report - Department of Agriculture. Retrieved November 5, 2022, from <https://www.da.gov.ph/wp-content/uploads/2020/12/2020-Year-end-Report.pdf>
- [12] Jam, F. A., Singh, S. K. G., Ng, B., & Aziz, N. (2018). The interactive effect of uncertainty avoidance cultural values and leadership styles on open service innovation: A look at malaysian healthcare sector. International Journal of Business and Administrative Studies, 4(5), 208-223.
- [13] Statista, 2021, October 26. Agriculture in the Philippines - statistics & facts. Retrieved November 5, 2022, from <https://www.statista.com/topics/5744/agriculture-industry-in-the-philippines/>
- [14] Center for Agrarian Reform and Rural Development, 2019, May 27. The Filipino Farmer. Retrieved November 5, 2022, from <https://www.carrd.org.ph/documentations/59>
- [15] Filipino farmers - a dying breed? - Philippines., 2013, February 26. Retrieved November 5, 2022, from <https://reliefweb.int/report/philippines/filipino-farmers-dying-breed>
- [16] Obispo, K., 2014, December 9. The Profile of the Filipino Farmer. Retrieved November 5, 2022, from <https://www.slideshare.net/KarlLouisseObispo/the-profile-of-the-filipino-farmer>
- [17] Reyes, R. O., 2021, February 24. Filipino farmers declared as 'new heroes' amid pandemic. SUNSTAR. Retrieved from <https://www.sunstar.com.ph>
- [18] Villegas, E. F., 2020, November 24. [OPINION] Knowing the Filipino farmer. RAPPLER. Retrieved from <https://www.rappler.com>
- [19] Habacon, P. J. P., 2021, March 12. [OPINION] Why Filipino farmers suffer. RAPPLER. Retrieved from <https://www.rappler.com>
- [20] Jam, F. A., Singh, S. K. G., Ng, B., & Aziz, N. (2018). The interactive effect of uncertainty avoidance cultural values and leadership styles on open service innovation: A look at malaysian healthcare sector. International Journal of Business and Administrative Studies, 4(5), 208-223.
- [21] PHILIPPINES: Vibrant Agriculture is Key to Faster Recovery and Poverty Reduction. (2020, September 8). World Bank. Retrieved from <https://www.worldbank.org>



- [22] Philippines: Philippine Government Launches Plant Plant Plant Program. , 2020, April 21. Retrieved November 6, 2022, from <https://www.fas.usda.gov/data/philippines-philippine-government-launches-plant-plant-plant-program>
- [23] Gregorio, G.B., and Ancog, R.C., 2020. "Impact of COVID-19 pandemic on agriculture production in Southeast Asia: Reinforcing
- [24] transformative change in agricultural food systems." SEARCA Policy Paper 2020-1. SEARCA, College, Los Baños, Laguna, Philippines.
- [25] Cervantes, F.M., 2022, Agri sector needs more public, private investment: solon, Philippine News Agency

DOI: <https://doi.org/10.15379/ijmst.v10i3.3293>

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