Impact of Covid-19 pandemic on vegetable farmers in North Sumatra

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Abstract. This research was conducted from June to August 2020 with the research locations were the two main vegetable producer regencies in North Sumatra, namely Karo Regency and Simalungun Regency. The purpose of this study was to determine the impact of the Covid-19 pandemic on the vegetable farmer's income, to determine which factors most influenced vegetable farmer’s income during the pandemic, and to recommend policies to reduce the impact of the pandemic on vegetable farmers in North Sumatra. Data were collected through interviews with 53 vegetable farmers in two districts whose locations were selected purposively while the respondent farmers were selected by judgment. The data in this study were analyzed using descriptive methods through a quantitative approach. The results show that as many as 92.9% of respondents stated that their income had decreased during the Covid-19 pandemic. Factors causing a decrease in farmers income were rising prices for fertilizers and pesticides (89.3%), worries about activities due to the pandemic (98.2%), limited transportation for marketing among provinces (23.2%), regional transportation restrictions (46.4%), and time restrictions on selling in the market (26.8%), several government policies towards farmers during a pandemic must be implemented immediately.

1. Introduction
Since the beginning, information of the case of the corona virus infection that caused by the Covid-19 affected several countries including Indonesia in early March 2020. Various efforts to deal with Covid-19 have been carried out by the government to reduce the impact of the pandemic in various sectors. The impact caused by this pandemic is not only the health sector but the economic sector is also have a serious impacts. Restrictions on community activities affect business activities which then have an impact on the economy. The report that written in August 2020 from the Central Statistics Agency (BPS) stated that Indonesia’s economic growth in the second quarter of 2020 was minus 5.32 percent. Previously, in the first quarter of 2020, BPS reported that Indonesia’s economic growth only grew by 2.97 percent, down considerably from the growth of 5.02 percent in the same period in 2019 [1].

With the spread of the Covid-19 pandemic throughout the world at first, the health crisis became an economic crisis, and it could have become a security crisis. Several countries are anticipating the spread of this virus by implementing lockdowns to prevent the spread of the virus become even more widely, while the Indonesian government has taken a policy of not implementing lockdowns because of the very
large impact of lockdowns on the economy. Although the impact of the pandemic on health is enormous, given the very rapid spread of the virus, Indonesia has implemented large-scale social restrictions (PSBB) in several areas. This step is considered to be able to help reduce the very fast spread of the virus [2].

As a sector that is part of the economic development of Southeast Asia, agriculture has an important position, when something causes this sector to be unfavorable, the impact will be felt by many people. Post-Covid-19 pandemic shows that several impacts have occurred in the agricultural sector in several countries such as Malaysia, namely a decrease in the number of workers, damage to supply chains, difficulties in selling agricultural products, banning exports, and closing restaurants [3]. Whereas in Indonesia, the impact on increasing input prices, disrupting supply chains, and decreasing demand for certain agricultural products, especially tertiary products [2]. Meanwhile, the Philippines has an impact on the supply chain from farmers to consumers, plus a lockdown [4]. Conditions in Laos are not much different, where the impact of this pandemic is in the form of reduced demand for farmers’ products, limited distribution, and increased prices for rice and meat [2] in Thailand, the impact most felt by the agricultural sector is reduced exports of agricultural products, whereas exports are an important part of agricultural development in this country.

The agricultural sector must be a priority need in dealing with the impact of Covid-19 in Indonesia. This sector cannot be underestimated, because it is directly related to the basic needs of mankind. Furthermore, the most important thing in a situation like this is the guarantee of easy access to food at a fair or normal price for the whole community. The spread of Covid-19 is very dangerous and has a wide impact on various sectors. One of the effects is the disruption of farmer production in all regions. The issue of food security is very important as well as being vulnerable to problems in disaster situations, including catastrophic disease outbreaks such as the Covid-19 pandemic. Food security indicates the availability of access to food sources so that they can meet basic needs [5].

As the Covid-19 outbreak continues to spread across the globe, it is important to respond to existing and possible impacts on the agricultural sector, from both a food supply and demand perspective. It is imperative to ensure that global and national food supply chains continue to function in ensuring the availability of food supplies, preventing a food crisis from occurring in countries already experiencing food security and nutrition challenges, and reducing the negative impact of the pandemic as a whole on the global economy. Food security is one of the pillars towards economic resilience and national stability [6].

Although the share of agricultural employment in total employment has declined from 40.2 percent to 26.8 percent over the past two decades, agriculture provides the livelihoods of more than one billion people worldwide and remains the backbone of many low-income countries counting. 60.4 percent of total employment1 and accounts for two-thirds of gross domestic product in these countries. This sector is particularly important in Africa and Asia, where the share of employment in agriculture to the total is 49 and 30.5 percent, respectively. The agricultural sector is the main source of employment opportunities for women, accounting for 41.9 percent of the entire agricultural workforce in developing countries [7].

North Sumatra is one of the centers of horticultural agriculture in Indonesia. Horticultural products in North Sumatra thrive, such as vegetables, fruits, ornamental plants, and many cultivated medicines whose results are not only fulfilling local needs but also exported abroad [8]. Seasonal vegetable and fruit crops are widely cultivated in North Sumatra. Plants that are superior commodities in North Sumatra in 2019 include chilies, cayenne pepper, long beans, cauliflower, potatoes, cabbage, Chinese cabbage, eggplant, tomatoes, and carrots. These ten types of superior plants have the largest production capacity of the 26 seasonal vegetable and fruit crops in North Sumatra. The largest vegetable production is chili, which is 154,008 tons with a harvest area of 16,076 hectares. In general, the areas that are the centers of vegetable crops in North Sumatra are in highland areas such as Karo and Simalungun Districts [9].
To find out the impact of the Covid-19 pandemic on the income of vegetable farmers, and determine which factors affected the income of vegetable farmers the most during the Covid-19 Pandemic, and recommend policies to reduce the impact of the pandemic on vegetable farmers in North Sumatra, it is necessary to study the impact of the Covid-19 pandemic on vegetable farmers in North Sumatra.

2. Methodology
The research activity was carried out in Simalungun Regency and Karo Regency, North Sumatra Province. The location selection was determined purposively with the consideration that the area is a center for horticultural crops in North Sumatra Province. The research was carried out for (3) three months, from June to August 2020. The types and sources of data used in this study were primary and secondary data, both quantitative and qualitative. Primary data used comes from survey data and direct interview data. Meanwhile, secondary data were taken from data sourced from related agencies. Survey data were obtained by conducting surveys and direct observations with vegetable horticultural farmers affected by the Covid-19 pandemic. Interview data were obtained by conducting interviews with farmers and agricultural extension agents to obtain information about the impact of Covid-19 on farming carried out by vegetable farmers starting from the availability of inputs needed from planting to horticultural marketing during the Covid-19 pandemic. Respondents farmers were 53 people selected based on the assessment. The search for information collected included the characteristics of the respondents, the commodities cultivated, the factors inhibiting farming faced in the field during the Covid-19 pandemic.

The data and information obtained were analyzed descriptively with a quantitative approach. The required quantitative data and information are processed using the Microsoft Excel program which is then presented in a tabulated form that aims to classify and facilitate data analysis.

3. Results and discussion

3.1. The existing conditions of the Research Location
The research location was conducted in two areas, namely Karo Regency and Simalungun Regency, North Sumatra Province. These two areas are the centers of horticultural commodities in the Province of North Sumatra (table 1). Based on table 1, it shows that the harvested areas for horticultural crops that are mostly cultivated by farmers in these two districts include shallots, chilies, potatoes, cabbage, Chinese cabbage, and tomatoes. In addition to planting in monoculture, farmers do farming by intercropping several types of horticultural crops in 1 (one) farm. Simalungun and Karo districts have also filled markets outside the province and even for exports.

| Regency/City       | Shallots | Chili | Potato | Cabbage | Chinese cabbage | Tomato |
|--------------------|----------|-------|--------|---------|-----------------|--------|
| Nias               | –        | 102   | –      | –       | –               | –      |
| Mandailing Natal   | 51       | 544   | 19     | 28      | 91              | 111    |
| Tapanuli Selatan   | 4        | 505   | –      | –       | 88              | 132    |
| Tapanuli Tengah    | –        | 68    | –      | –       | –               | –      |
| Tapanuli Utara     | 87       | 1333  | 67     | 121     | 148             | 109    |
| Toba Samosir       | 56       | 283   | 5      | –       | 22              | 57     |
| Labuhan Batu       | –        | 28    | –      | –       | –               | –      |
| Asahan             | 6        | 210   | –      | –       | 507             | –      |
| Simalungun         | 390      | 3110  | 1628   | 2456    | 602             | 760    |
| Dairi              | 407      | 2894  | 737    | 795     | 58              | 375    |
| Regency            | Population | 2011 | 2016 | 2017 | 2018 |
|-------------------|------------|------|------|------|------|
| Karo              | 532        | 6478 | 3306 | 3540 | 2632 |
| Deli Serdang      | 36         | 531  | –    | –    | 124  |
| Langkat           | –          | 674  | –    | –    | 48   |
| Nias Selatan      | –          | 335  | –    | –    | 10   |
| Humbang Hasundutan| 186        | 974  | 246  | 319  | 189  |
| Pakpak Bharat     | 4          | 194  | –    | 1    | 10   |
| Samosir           | 255        | 260  | 782  | 386  | –    |
| Serdang Bedagai   | 12         | 186  | –    | –    | 132  |
| Batu Bara         | 18         | 948  | –    | –    | 13   |
| Padang Lawas Utara| 17         | 56   | –    | –    | 13   |
| Padang Lawas      | 2          | 221  | –    | –    | 40   |
| Labuhan Batu Selatan|           | 211  | –    | –    | 49   |
| Labuhan Batu Utara| 2          | 57   | –    | –    | –    |
| Nias Utara        | –          | 123  | –    | –    | –    |
| Nias Barat        | –          | 57   | –    | –    | –    |
| Kota Sibolga      | –          | –    | –    | –    | –    |
| Kota Tanjung Balai| 1          | 36   | –    | –    | 22   |
| Kota Pematang Siantar|           | –    | –    | –    | 32   |
| Kota Tebing Tinggi| 6          | 10   | –    | –    | 16   |
| Kota Medan        | 5          | 23   | –    | –    | 280  |
| Kota Binjai       | –          | 66   | –    | –    | 66   |
| Kota Padangsidimpuan| 5        | 137  | –    | –    | 71   |
| Kota Gunungsitoli | 1          | 62   | –    | –    | –    |
| North Sumatera    | 2083       | 20716| 6790 | 7646 | 5201 |

Geographically, Karo Regency is between 2º50’ – 3º19’ North Latitude and 97º55’-98º38’ East Longitude with an area of 2,127.25 Km² or 2.97 percent of the area of North Sumatra Province. Karo Regency is located in the Bukit Barisan range and most of its territory is highland. Two active volcanoes are located in this region, making it prone to volcanic earthquakes.

Karo Regency is at an altitude of 200 - 1,500 meters above sea level. In the north, it is bordered by Langkat Regency and Deli Serdang Regency, to the south with Dairi Regency and Samosir Regency, to the east with Deli Serdang Regency and Simalungun Regency, and to the west with Nangroe Aceh Darusalam Province. Karo Regency is located at an altitude of 280-1,420 meters above sea level (masl) with an area ratio as follows: Altitude area 280-500 masl covering an area of 46,462 hectares (21.84%), an altitude area of 500-1,000 masl covering an area of 84,892 hectares (39.91 %), Altitude area 1,000-1,400 masl covering 70,774 ha (33.27%), altitude area> 1,400 masl covering 10,597 ha (4.98%). When viewed from the angle of slope/slope of the soil, Karo district has a slope of places, among others: Flat 2% (23,900 Ha); Sloping 2 - 15% (74,919 Ha) Sloping 15 - 40% (41,169 Ha), Steep 40% (72,737 Ha) [10].

Simalungun Regency is geographically located between 020 36’- 030 18’ North latitude and between 980 32’ - 990 35’ East Longitude with an area of 4 372.5 km² at an altitude of 0 - 1,400 meters above the surface with a slope of 0-15%. The average temperature in Simalungun in 2015 was 25.7°C, with the lowest temperature being 21.8°C and the highest temperature being 30.7°C. Based on its geographical
position. Simalungun Regency has boundaries: North - Serdang Bedagai Regency; South - Toba Samosir Regency; West - Batubara Regency and Asahan Regency; East - Karo Regency. Simalungun Regency is the third largest district after Mandailing Natal and Langkat Regencies in North Sumatra.

Based on natural conditions and the location of these two regencies, it is very suitable for the development of horticultural crops, both vegetables, and fruits. Having an altitude of medium to high plains and close to the capital of North Sumatra Province, generally horticultural commodities from these two districts fill the market in the provincial capital and even outside the province.

3.2. Characteristics of respondents
Research activities were carried out in 2 (two) regencies in North Sumatra with 53 respondents interviewed. Most of the farmers cultivated chilies, tomatoes, potatoes, and carrots both by monoculture and by intercropping 2-4 commodities in one land in the last 6 months. The highest number of farmers based on the cultivated commodity is those cultivating chili plants in monoculture with the number of cultivated chili plants (33 people), Potatoes (2 people), Carrots (2 people), Chili and Tomatoes (8 people), Chili, Tomatoes and Potatoes (3 people), Chili and Carrots (2 people), Tomatoes and chilies (2 people), Chili, Tomato, Potatoes, and Carrots (1 person). Based on the age distribution of respondents interviewed, most of them were aged 25-36 years (29 people), aged 36-45 years (11 people), aged 46-55 years (10 people), and > 56 years (3 people).

Most of the farmers still cultivated chili plants as their main crops. The choice of chili commodity as the main commodity is because many chili plants were cultivated both as intercropping with other horticultural crops as well as by intercropping farmers with food crops such as upland rice. One of the efforts in sustainable agriculture is intercropping, which aims to optimize narrow land and increase agricultural productivity and increase the amount of income. Selection of plant combinations can be based on differences in plant root systems, plant needs for nutrients and sunlight, or methods of pest control [11]. According to [9], monoculture farming on relatively small land is less profitable, crop failure means very large losses. Polyculture with the right cropping system can overcome the losses due to crop failure of one type of commodity.

Farmers also cultivate a lot of kinds of chili plants that have a long harvest life, namely temper, it is a local variety, which according to farmers' information with these variety has a long life, low prices of chilies can be covered by a period of a long duration of harvest. The development of intercropping or intercropping vegetables in the highlands and lowlands has now become one of the main choices for farmers with small farming land to overcome the risk of failure in their farming [11].

Other prime commodities cultivated by farmers such as tomatoes, potatoes, carrots. All these crops are always needed by the market every day so that this commodity is not difficult to sell before the Covid-19 pandemic.

3.3. Impact of the Covid-19 Pandemic on vegetable farmers
The impact of Covid-19 on horticultural farming, especially the availability of agricultural inputs. Most farmers said that the impact of the Covid-19 pandemic affected the purchase of agricultural inputs in their areas. Nearly 92% of respondents said that the availability of production inputs was difficult and only 8% of respondents said it was not difficult. From the number of respondents who expressed their opinion that the difficulty in agricultural inputs was 49% of farmers stated that it was due to high prices and 43% because production inputs were not available in the market. According to Siche [12], there are three groups most vulnerable to being affected by the Covid-19 outbreak, namely poor people, farmers, and children. The existence of farmers in vulnerable groups is a unique phenomenon because they are producers of foodstuffs on which everyone depends. During this pandemic, small farmers do not have access to a large market, so their agricultural products are only sold in moderation at local markets at low prices. Besides, the increasing price of other necessities, including the price of agricultural inputs, also increases the vulnerability of farmers.

The results of interviews with farmers who expressed the opinion that the price of production inputs which was difficult in their location caused the price of agricultural inputs increased, ranging from <5%
to > 15%. The biggest opinion is that the increase in the price of agricultural inputs reached 6-10% (figure 2).

![Figure 1](image1.png)

**Figure 1.** The response of farmers to the availability of agriculture inputs during the Covid-19 pandemic.

![Figure 2](image2.png)

**Figure 2.** Farmers' opinions on the increase in the price of agricultural inputs during the Covid-19 pandemic.

The results of farmer interviews regarding their activities during the Covid-19 pandemic showed 98.2% of the farmers were worried about carrying out their farming activities and 1.8% of respondents said they were not too worried. Farmers are worried about doing activities in the fields and in purchasing agricultural production goods/facilities for their farming needs. This worry affects the production of their farming. Some farmers say their concern in carrying out their farming activities has an impact on the production they get, but some say it doesn't affect their production (figure 3).
Observation of the impact of the Covid-19 pandemic on the marketing of agriculture products showed that the Covid-19 pandemic has a very strong influence on the marketing of farmers' products (figure 4). As many as 46.4% of respondents answered that the Covid-19 pandemic caused restrictions on entry to other areas and 26.8% answered that marketing decreased due to markets being closed in several regions so that marketing of products was very difficult. 23.3% stated that transportation costs increased due to restrictions on transportation between regions/provinces.

The imposition of transportation and economic restrictions will disrupt the current food system in Indonesia. It is estimated that 80 percent of consumers in developing countries, especially urban areas, rely on the market or from other places for their food sources so that the imposition of social and transportation restrictions will disrupt the food distribution process [13].
During the Covid-19 pandemic of observation in June and August 2020, it was shown that several commodities experienced an increase in prices, namely red onions (10-50%), ginger (50-100%), tomatoes (50-70%), pe onions (> 100%). On the contrary, several commodities experienced a decline in prices such as chilies (5-100%), potatoes (> 15%), carrots (10-20%), and other vegetables such as cabbage, long beans, etc. (50-80%). The causes of the increase in commodity prices during the Covid-19 pandemic, among others: 1) Lack of availability of goods, the price increases; 2) Lack of crops; 3) Changes in public interest; 4) Import restrictions so that commodities do not enter; and 5) Some commodities are said to increase immunity so that the demand for these commodities increases, while the cause of some commodities decreasing in price is due to, among others: 1) Public purchasing power has decreased significantly during the Covid-19 pandemic; 2) The harvest at the farm level is also abundant; 3) the commodity is abundant and there is no transportation outside the city and the difficulty in marketing; 4) There are fewer buyers because the restaurants are closed; and 5) less market demand. The results showed that during the Covid-19 pandemic the income of horticultural farmers generally decreased, especially those of chilies, potatoes, carrots, and vegetables such as cabbage. Only farmers who grow commodities that can increase immunity such as ginger and fruit vegetables such as tomatoes. Besides, shallot farmers also increase their income due to the limited number of shallots in the North Sumatra market due to restrictions on transportation from outside North Sumatra and several shallots centers have not to harvest.

### Table 2. Tomato farming analysis in Karo Regency in 2019-2020.

| No | Items | Cost (IDR) | 2019   | 2020   |
|----|-------|------------|--------|--------|
| I  | Cost (A+B+C+D+E+F) | 186,694,453 | 187,312,453 |
| A  | Production Input | 105,995,000 | 106,595,800 |
| a  | Seeds | 1,980,000 | 1,980,000 |
| b  | Fertilizer | 32,411,800 | 32,411,800 |
| c  | Stake | 8,424,000 | 8,424,000 |
| d  | Rope | 1,350,000 | 1,350,000 |
| e  | Harvest basket/bamboo basket | 5,850,000 | 5,850,000 |
| f  | Mulch | 5,200,000 | 5,200,000 |
| g  | Pesticides | 50,780,000 | 51,380,000 |
| B  | Labor | 59,300,000 | 59,300,000 |
| C  | Tools | 7,617,200 | 7,617,200 |
| D  | Land Lease | 8,000,000 | 8,000,000 |
| E  | Depreciation | 343,750 | 343,750 |
| F  | Interest Rate (6%) | 5,437,703 | 5,455,703 |
| II | Revenue | 234,000,000 | 327,600,000 |
|   | R/C ratio | 1.25 | 1.75 |
| III| Benefit | 47,305,548 | 140,287,548 |
|    | B/C ratio | 0.25 | 0.75 |
The farming analysis of several vegetable commodities in Karo district in 2019 and 2020 are as shown in tables 2, 3, and 4. Based on the analysis of the three vegetable commodities cultivated by farmers in Karo Regency, it shows that farmers’ income is strongly influenced by the price of vegetables prevailing at the farm level. In the tomato commodity, there has been an increase in the price of tomatoes during the Covid-19 pandemic, this is probably because people consume tomatoes as fruit for juice which is useful for increasing body immunity. For chili and potato commodities, based on farm analysis
data in 2019 and 2020. The farmer income has decreased since Covid-19 pandemic. This is due to an increase in the price of plant production facilities and a decrease in selling prices at the farmer level. Collector traders who usually collect agricultural products and sell them outside the province in During the Covid-19 pandemic, there tends to be a tendency to withhold buying agricultural products from farmers due to transportation restrictions and people's purchasing power has also decreased due to consumers being afraid to shop in the market and reducing people's livelihoods in the city, resulting in reduced purchasing power of agricultural products for these two commodities.

3.4. Policy implications
The current impact of Covid-19 has affected the existence of the agricultural sector, including horticultural crops. The impacts that may affect the agricultural sector for the next few years, namely:

3.4.1. Market prices of horticultural products. When an appeal to the public is issued to maintain distance, limit travel, avoid crowds, close entertainment venues, and other protective practices to slow the spread of Covid-19, the impact on consumers is a reduction in buying food from outside the home so that the number of consumer needs for horticultural products is also in the market increasingly limited. This situation will create abnormal markets and transactions supported by perishable horticultural products so that it will affect the stability of supply and demand for goods and services of horticultural products. To overcome the fear of consumers to market, the government can facilitate a market that is supported by online sales and the opening of restaurants with an online system. The use of internet applications for the shopping system is expected to absorb horticultural products. Efforts to increase cooperation with platforms for buying and selling agricultural products online are urgently needed. In the era of globalization, business competition is no longer in the form of price and product competition. Companies that have reliable supply chain management will survive and win the competition in the market.

3.4.2. Supply chain is slowing down and shortages. As a result of the closure in several areas which are red zones, transportation to and from some areas to supply horticultural products to the market is also disrupted. Besides, the reduction in the activity of food factories/industries that use horticultural products to slow the spread of the virus has also been affected. Efforts are made in the form of granting transportation permits for areas that are specifically closed to carry agricultural products so that agricultural products do not disappear in the market. Besides, considering that horticultural products are easily damaged, in areas that are centers of horticultural products, warehouses for storing horticultural products are also facilitated with cold storage devices. Government efforts are needed to increase agricultural exports when the harvest is abundant.

3.4.3. Farmers' health. The information reported regarding Covid-19 gives the worries to farmers to leave the house. Prevention and protection recommendations must be a serious concern of the government and public awareness to be vigilant. The government calls on the public to take reasonable precautions to limit the spread of disease and its effects on farming and livelihoods. Another solution that is important to do is to monitor food prices starting from the producer (farmer) level to consumers so that food production continues to run optimally even in the current pandemic conditions. The government can re-activate farmer resilience systems from the village level with the help of village cooperatives. Several regions in Indonesia have implemented a cooperative system to control prices at the farm level so that the price obtained by farmers is not much different from the market price. Addressing horticultural product stockpiling is not recommended because it could cause bigger problems for the agricultural sector amid Covid-19. The government also needs to re-map commodity stocks in each region to map the direction of national food distribution. Availability of production inputs, price stability, and market certainty will create sustainability of farming and production.
4. Conclusions

- The vegetable horticultural commodity that is mostly cultivated by Karo and Simalungun Regencies is chili which is grown in monoculture or intercropping with other horticultural crops such as potatoes, tomatoes, and other vegetable crops.
- The Covid-19 pandemic has had a major impact on North Sumatra horticultural farming, including a decrease in farmer income due to an increase in fertilizer and pesticide prices (89.3%), concerns about activities due to the pandemic (98.2%), limited transportation for marketing between provinces (23.2 %), restrictions on regional transportation (46.4%), and restrictions on selling time on the market (26.8%). Various government policies towards farmers during a pandemic must be implemented immediately.

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