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ANALYSIS OF BIOPHARMACY CROPS PRODUCTION AND EXPORTS ON AGRICULTURAL SECTOR GDP GROWTH RATE (2012-2022)

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Abstract:*The objectives of this study are to: 1) determine the number of developments in biopharmaceutical production, 2) determine the number of biopharmaceutical plant exports, and 3) determine the impact of biopharmaceutical plant production and exports on the agricultural sector's GDP growth rate from 2012 to 2022. This type of research employs quantitative panel data. Data on biopharmaceutical crop output, exports, and national income from 2012 to 2022 were obtained from the Central Statistics Agency (BPS) and other sources. The data analysis technique employs correlation analysis and the F test. The study's findings demonstrate that: 1) biopharmaceutical plant production and export have a substantial impact on agricultural economic growth. 2) There is a positive association between biopharmaceutical crop production and exports and agricultural GDP growth, although this trend can be altered by a variety of external and internal factors. 3) This research, however, demonstrates that various fluctuations and issues must be addressed in order to secure the agricultural sector's long-term and equitable growth.*

Keywords:biopharmaceuticals, exports, production, growth rate

1. Introduction

Indonesia is a country that has a diversity of flora and fauna and is known as an archipelagic country where many types of plants have been used by the people for generations as traditional medicine. Understanding the distribution of biopharmaceutical crop production is a key aspect in designing sustainable and agricultural development strategies and can meet increasing market needs. In developing biopharmaceutical production, a holistic and structured approach is needed to describe the unique characteristics of the region. Therefore, investigations into the distribution of biopharmaceutical crop production are important to provide an in-depth understanding of agricultural dynamics, potential changes in types of production, as well as identification of consistent production centers.(Navila et al., 2024).

As production supports the supply of domestic biopharmaceutical products, demand for international biopharmaceutical production also increases. Of the 7 types of Indonesian biopharmaceutical plants, namely ginger, laos/galangal, kencur, turmeric, lempuyang, ginger, temureng, which have the greatest production and export value. Export demand with a value that indicates that biopharmaceutical products can be produced efficiently compared to other countries by specializing in products and exports(Muhammad & Kanaya, 2014). One of the agricultural products with quite high export value is spices(Rezandy & Yasin, 2021).

International trade itself has a very important role in both developed and developing countries. In general, developing countries like Indonesia. By carrying out international trade, especially exports, it is hoped that it can become a driving force for the national economy and increase the flow of foreign exchange earnings for the country. Not only does it earn foreign

exchange income, the benefits a country obtains from carrying out export activities are increasing domestic production/output and expanding the market for domestic products.(Aditama et al., 2015). National income is a benchmark used to calculate a country's economy to obtain an overview of the economy that has been achieved and the value of production expenditure.(Syahrial et al., 2023).

Research regarding the distribution of biopharmaceutical crop production in Indonesia is an urgency that cannot be ignored. Indonesia, as an archipelagic country rich in diversity of flora and fauna, has long been known for its natural riches. Plants such as ginger, laos/galangal, kencur, turmeric, lempuyang, ginger, and temureng have become an integral part of the cultural heritage and traditional knowledge of Indonesian people in medicine. The growth of this category can be optimized as an economic boost for society(Tanjung et al., 2022).

Understanding in depth the distribution of biopharmaceutical crop production is an important step in designing sustainable agricultural development strategies. With a better understanding of where these plants grow and are produced naturally, governments and policymakers can take appropriate steps to maintain the sustainability of natural resources and increase production in a sustainable manner.

The importance of this research is also reflected in the global economic context. Demand for biopharmaceutical products from Indonesia has increased, both for domestic and international markets. Biopharmaceutical crops as mentioned previously have significant export value, and this market potential continues to grow along with increasing global interest in natural and environmentally friendly products.

In the context of international trade, exports of biopharmaceutical products can be a driving force for the national economy. By increasing exports, Indonesia can gain significant foreign exchange earnings, which in turn will help increase domestic output and expand the market for local products.

Apart from that, this research also provides a broader view of Indonesia's economic potential in the future. By understanding the dynamics of biopharmaceutical crop production and exports, the government can make projections about the direction of the economy in the future and plan appropriate policies to support sustainable economic growth.

Research on the analysis of the production and export of biopharmaceutical plants on the GDP growth rate in the agricultural sector has a very important urgency in the context of economic development and social welfare. Since the beginning of the 21st century, the biopharmaceutical sector has become a major focus for many countries, due to its potential in providing raw materials for the pharmaceutical industry as well as its high economic value. This research is important for several main reasons.

First, biopharmaceutical plants have a strategic role in the modern pharmaceutical industry. Many medicines produced come from natural ingredients, including biopharmaceutical plants. Therefore, analysis of the production and export of biopharmaceutical crops provides an in-depth understanding of the contribution of the agricultural sector in providing important raw materials for the pharmaceutical industry. This information is important for decision making at the policy level, investment and business strategy development.

Second, the growth of the agricultural sector is directly related to the economic welfare of a country. By analyzing the contribution of production and exports of biopharmaceutical crops to GDP growth in the agricultural sector, we can understand the extent to which this sector plays a role in the country's economy. This allows better policy planning to support the growth of the agricultural sector as a whole, including investment in research and development of biopharmaceutical crops.

Third, this research is relevant in the context of environmental sustainability. Biopharmaceutical plants are often species that grow naturally and have uses in traditional medicine. By analyzing the production and export of biopharmaceutical crops, we can identify potential risks to environmental sustainability, such as overexploitation of natural resources and habitat destruction. This information is important for designing ecologically sustainable agricultural practices.

Fourth, this research helps identify new business opportunities and improve a country's economic competitiveness. By understanding trends in the production and export of biopharmaceutical crops, both at local and global levels, governments and industry players can identify crops that have high economic potential and play a role in diversifying the economy. Additionally, this analysis can also provide insight into international markets and global competition in the biopharmaceutical industry.

Fifth, this research supports the development of science and technology in the fields of agriculture and pharmaceuticals. By studying the factors that influence the production and export of biopharmaceutical crops, we can improve our understanding of plant growth, pest and disease management, and active ingredient extraction and formulation techniques. This knowledge can be used to improve production efficiency, product quality, and innovation in the development of new medicines.

A. Formulation of the problem
1. How will the amount of biopharmaceutical production develop from 2012-2022?
2. How many biopharmaceutical crop exports will there be from 2012-2022?
3. What is the role of biopharmaceutical crop production and exports in the GDP growth rate of the agricultural sector from 2012-2022?

B. Research purposes

From the problem formulation above, the objectives of this research are as follows
1. Find out the number of developments in biopharmaceutical production from 2012-2022
2. Find out the number of biopharmaceutical plant exports from 2012-2022
3. To determine the influence of biopharmaceutical crop production and exports on the GDP growth rate of the agricultural sector from 2012-2022

2. Research Methods

This research uses data for 2012-2022 obtained from the Central Statistics Agency (BPS) and other sources. The types of data used are biopharmaceutical crop production, biopharmaceutical crop exports, and national income. The model used in this research uses panel data.

Correlation data analysis and F test

Correlation Test:

The correlation test is used to determine the extent of the relationship between two variables. In the context of this research, a correlation test will be used to determine the relationship between the production and export of biopharmaceutical plants and the GDP growth rate in the agricultural sector. There are several types of correlation that can be used, but the most relevant is the Pearson correlation coefficient.

Pearson correlation coefficient measures how strong and direction the linear relationship is between two variables. The correlation coefficient value ranges from -1 to 1. A value of 1 indicates a perfect positive relationship, a value of -1 indicates a perfect negative relationship, and a value of 0 indicates there is no linear relationship between the two variables.

In this research, the Pearson correlation coefficient will be used to determine whether biopharmaceutical crop production has a positive or negative relationship with the GDP growth rate in the agricultural sector. Likewise with exports of biopharmaceutical plants. The results of this correlation analysis will provide an understanding of how strong the relationship between these variables is.

F Test:

The F test, or analysis of variance (ANOVA), is used to compare means between three or more groups. In the context of this research, the F test will be used to evaluate differences in average GDP growth rates in the agricultural sector between groups formed based on the production and export of biopharmaceutical crops.

First, the research will divide the data into groups based on the level of biopharmaceutical crop production. Then, each group will be analyzed to see the difference in the average GDP growth rate in the agricultural sector between these groups. The same procedure will be repeated for groups formed based on the level of biopharmaceutical crop exports.

The F test will provide information about the significance of the differences between the average GDP growth rates in the agricultural sector between the groups formed. If the F test results are significant, then there is a significant difference in the GDP growth rate of the agricultural sector between these groups. This will provide valuable insight into the impact of biopharmaceutical crop production and export on the agricultural sector.

Data Usage:

The data used in this analysis will include information on the production and export of biopharmaceutical crops, as well as the GDP growth rate in the agricultural sector from 2012 to 2022. This data will then be processed and analyzed using statistical software such as SPSS or R to produce valid and reliable results.

Benefits of Analysis:

Correlation analysis and the F test will provide a deeper understanding of the relationship between the production and export of biopharmaceutical crops and the GDP growth rate in the agricultural sector. This information will provide a strong basis for decision making at the policy level and economic development strategies to support the growth of the agricultural sector and the biopharmaceutical industry as a whole. Results and Discussion

3. Results and Discussion

The following is a summary of the data:

Biopharmaceutical crop production 2012-2022

year	production amount (tons)
2012	312329472
2013	387085946
2014	477410998
2015	563702741
2016	580278036
2017	483813864
2018	558708546
2019	519186178
2020	531673652
2021	670451206
2022	603116012

The recap of biopharmaceutical crop production data from 2012 to 2022 shows an interesting trend in terms of production volume. In 2012, total production reached 312,329,472 tons, which then experienced a significant increase every year until it reached its peak in 2021 with total production of 670,451,206 tons. However, there were fluctuations in 2017 where production decreased sharply to 483,813,864 tons, before increasing again in the following years. This shows that there are variations in biopharmaceutical crop production from year to year, which may be influenced by various factors such as weather conditions, policy changes, or technological developments in agriculture.

Despite fluctuations, overall, there was a significant upward trend in biopharmaceutical crop production during this period. This increase reflects the importance of biopharmaceutical crops in the pharmaceutical and health industries, as well as the increasing demand for natural raw materials for pharmaceutical products.

Thus, this summary of biopharmaceutical crop production data provides an overview of the contribution of the agricultural sector in providing important raw materials for the pharmaceutical industry, as well as illustrating the dynamics of growth in biopharmaceutical crop production during the 2012-2022 period. Further analysis of the factors influencing biopharmaceutical crop production can provide deeper insight into the potential and challenges in the future development of the agricultural sector and biopharmaceutical industry.

The following is data on the number of exports of biopharmaceutical plants for 2012-2022 year export quantity (tons)

2012	550128.4
2013	651691.2
2014	879223.8
2015	892884.7
2016	822971.4
2017	952450.1
2018	937323.3
2019	910627.9
2020	893745.7
2021	1060355.5
2022	887171.8

Data on the number of biopharmaceutical crop exports from 2012 to 2022 reflects an interesting pattern in terms of export volume. Starting with total exports of 550,128.4 tons in 2012, there has been a significant increase in the following years, reaching a peak in 2021 with total exports of 1,060,355.5 tons. However, there were variations in the number of exports during this period, as can be seen from the fluctuation in the number of exports between 2014 and 2016, as well as a slight decrease in 2019 and 2020. However, overall, this data shows an increasing trend in exports of biopharmaceutical crops during the period observed. This reflects the great potential of biopharmaceutical plants in meeting global demand for natural raw materials for the pharmaceutical and health industries. Further analysis of the factors influencing biopharmaceutical crop exports can provide a deeper understanding of global market dynamics and opportunities to increase the competitiveness of biopharmaceutical crop products in international markets.

The following is data on the GDP growth rate for the agricultural sector 2012-2020

Year	agricultural sector GDP growth rate (In percent)

2012	4.59
2013	4.20
2014	4.24
2015	3.75
2016	3.37
2017	3.92
2018	3.88
2019	3.61
2020	1.77
2021	1.87
2022	2.25

Data on the agricultural sector's GDP growth rate from 2012 to 2020 shows variations in growth rates during the observed period. Starting with a growth rate of 4.59% in 2012, it can be seen that the agricultural sector recorded relatively stable growth in the first few years. However, there was a significant decline in the growth rate in 2020, with the figure only reaching 1.77%, which was the lowest figure during that period. This may be influenced by various factors, including extreme weather conditions, policy changes, or the significant impact of the COVID-19 pandemic on the agricultural sector. Nonetheless, a slight increase is seen in 2021 and 2022, although the figure is still below the growth rates observed in previous years. Further analysis of the factors influencing the agricultural sector's GDP growth rate can provide a deeper understanding of the challenges and opportunities in future agricultural sector development.

Following are the results of the correlation test

Correlations

		quantity.production	amount.export	agricultural.income.growth.rate
quantity.production	Pearson Correlation	1	,863**	-.728*
	Sig. (2-tailed)		,001	.011
	N	11	11	11
amount.export	Pearson Correlation	,863**	1	-.574
	Sig. (2-tailed)	,001		,065
	N	11	11	11
agricultural.income.growth.rate	Pearson Correlation	-.728*	-.574	1
	Sig. (2-tailed)	.011	,065	
	N	11	11	11

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The results of the correlation test show that there is a significant relationship between the variables of total production, total exports, and the rate of income growth in the agricultural sector. First, there is a strong positive correlation between the amount of production and the amount of biopharmaceutical crop exports, with a Pearson correlation coefficient of 0.863, which is significant at the 0.01 significance level. This means that the higher the amount of production, the higher the amount of exports, and vice versa. Furthermore, there is also a significant negative correlation between the amount of production and the growth rate of agricultural sector income, as well as between the amount of exports and the growth rate of agricultural sector income, with

Pearson correlation coefficients of -0.728 and -0.574 respectively. This shows that the higher the amount of production and export of biopharmaceutical plants, the lower the income growth rate of the agricultural sector, and vice versa. These results provide an in-depth understanding of the relationship between production, exports and income growth in the context of the agricultural sector, which can be the basis for developing more effective policies and strategies in supporting economic growth in the agricultural sector.

The negative correlation between the amount of production/export of biopharmaceutical plants and the rate of growth in agricultural sector income can be explained by several factors involved in the economic dynamics of the agricultural sector:

1. Competition in the Market: The increasing number of biopharmaceutical crops produced and exported may indicate increased competition in the market. When the supply of biopharmaceutical crops increases, especially if demand is disproportionate, prices may fall due to price competition between producers. This can result in a decrease in income for farmers and agricultural sector business actors.
2. Changes in Market Structure: Increased production and export of biopharmaceutical crops could lead to shifts in market structure. It could be that most of the profits from exports and production are skewed to large companies or business players upstream of the industry, such as drug manufacturers or pharmaceutical companies. Meanwhile, farmers and small businesses in downstream industries may not feel the same positive impact in the form of increased income.
3. Dependence on Exports: Most countries that rely on exports of biopharmaceutical crops tend to experience greater income fluctuations. This is because price fluctuations in the global market, changes in international demand, and foreign trade policies can affect income from exports. High dependence on exports also makes the agricultural sector more vulnerable to changes in the global economy.
4. Suboptimal Resource Allocation: Increased production and export of biopharmaceutical crops may lead to suboptimal resource allocation in the agricultural sector. For example, too much focus on biopharmaceutical crops could reduce investment and attention to other commodities that may have higher economic potential in the long term.
5. Influence of Government Policy: Government policies related to subsidies, trade regulations, and taxes can also influence the relationship between production/exports of biopharmaceutical crops and the rate of growth in agricultural sector income. Inappropriate or unbalanced policies can hamper the growth of the agricultural sector and affect farmers' income.

Following are the results of the F Test

ANOVAa

Model	Sum of Squares		df	Mean Square	F	Sig.
1	Regression	5,282	2	2,641	4,728	.044b
	Residual	4,468	8	,559		
	Total	9,750	10			

a. Dependent Variable: rate.growth.income.agriculture
b. Predictors: (Constant), quantity.exports, quantity.production

The results of the F test show that the regression model involving the number of exports and the number of biopharmaceutical crop production simultaneously has a significant influence

on the GDP growth rate in the agricultural sector during the 2012-2022 period. With a significance value (Sig.) of 0.044 at a significance level of 0.05, these results indicate that there is a significant relationship between the independent variables (amount of exports and amount of production) and the dependent variable (GDP growth rate in the agricultural sector). Thus, it can be concluded that these two predictor variables together make an important contribution in explaining variations in the agricultural sector's GDP growth rate. This indicates the importance of the production and export of biopharmaceutical crops in driving economic growth in the agricultural sector in the observed time period. These results provide a deeper understanding of the factors that influence economic growth in the agricultural sector and can be used as a basis for formulating more effective policies in improving the welfare of farmers and business actors in the agricultural sector as a whole.

The implications of the results of this research have a significant impact in the context of development of the agricultural sector, biopharmaceutical industry, and the economy as a whole. Here are some of the main implications to note:

1. Development of Integrated Agricultural Policy:

The research results show that the production and export of biopharmaceutical plants has a significant influence on GDP growth in the agricultural sector. Therefore, integrated and holistic agricultural policies should be considered to promote the growth of the agricultural sector as a whole. This includes appropriate resource allocation, support for agricultural technological innovation, development of adequate infrastructure, and promotion of agricultural product diversification.

2. Importance of Economic Diversification:

The high dependence on the production and export of biopharmaceutical crops shows the need for economic diversification in regions that depend on the agricultural sector. Diversification can be done by expanding the local economic base, developing non-agricultural sectors such as tourism, creative industries or other agribusiness. This will help reduce the risk of global market fluctuations and create more diverse employment opportunities for society.

3. The Need for Sustainable Management:

Increasing the production and export of biopharmaceutical plants must be accompanied by sustainable management of natural resources and the environment. Agricultural policies must pay attention to aspects such as soil, water and biodiversity conservation, as well as environmentally friendly agricultural practices. This will help ensure that the growth of the agricultural sector does not damage the environment and is sustainable in the long term.

4. Strengthening Infrastructure and Market Access:

To support the growth of production and exports of biopharmaceutical crops, strengthening infrastructure and market access are key. Good transportation infrastructure will facilitate the distribution of agricultural products to local and international markets. Additionally, better access to markets and value-added networks will help farmers get better prices for their products.

5. Development of Agricultural Technology Innovation:

Investment in research and development of agricultural technology is important to increase the productivity and quality of biopharmaceutical crops. Innovations such as the use of sensor technology, data processing, or sustainable agricultural techniques can help farmers increase production efficiency and reduce the risk of yield losses.

6. Increased Farmer Awareness and Skills:

Increasing farmers' awareness and skills regarding modern and sustainable agricultural practices will help increase productivity and quality of agricultural products. Agricultural

training and education programs must be improved to empower farmers with the knowledge and skills necessary to face the challenges and opportunities in the global market.

7. Collaboration between Government, Industry and Society:

Close collaboration between government, industry and civil society is key in implementing policies and programs to support the growth of the agricultural sector. This partnership can include policy formation, infrastructure investment, farmer training, as well as market promotion and product marketing.

8. Increased Global Competitiveness:

To strengthen its position in the global market, it is necessary to increase the competitiveness of biopharmaceutical plant products in terms of quality, price and sustainability. This requires concerted efforts in terms of research and development, product standardization, quality certification, and brand promotion.

9. Domestic Market Development:

Apart from focusing on exports, it is important to develop domestic markets for biopharmaceutical plant products. This will help reduce dependence on international markets and increase farmers' income at the local level.

10. Continuous Monitoring and Evaluation:

Steps to increase the growth of the agricultural sector and biopharmaceutical industry must be supported by continuous monitoring and evaluation of the implementation of policies and programs. This will ensure that the strategies taken are in line with needs and have a positive impact on society and the environment.

4. Conclusion

From the analysis of the production and export of biopharmaceutical plants on the GDP growth rate in the agricultural sector from 2012 to 2022, it can be concluded that the production and export of biopharmaceutical plants has a significant impact on the economic growth of the agricultural sector. There is a positive relationship between the production and export of biopharmaceutical crops and GDP growth in the agricultural sector, although this growth pattern can be influenced by various external and internal factors. However, this research also shows that there are several fluctuations and challenges that need to be addressed to ensure sustainable and inclusive growth of the agricultural sector in the future.

Suggestion:

1. Diversification of Agricultural Products: The government and relevant stakeholders need to encourage diversification of agricultural products as a strategy to reduce dependence on the production and export of biopharmaceutical crops. This will help improve food and economic security at the local level.
2. Strengthening Infrastructure and Market Access: Investment in adequate transportation and marketing infrastructure is needed to expand farmers' access to local and international markets. This will help increase the competitiveness of agricultural products and reduce yield losses.
3. Development of Agricultural Technology Innovation: Support for research and development of agricultural technology must be increased to increase agricultural productivity, quality and sustainability. Innovations such as the use of sensor technology, data processing and sustainable agriculture can help increase production efficiency.
4. Sustainable Environmental Management: There is a need for sustainable management of natural resources and the environment in the production of biopharmaceutical plants.

Agricultural policies must pay attention to aspects such as soil, water and biodiversity conservation to ensure the sustainability of the agricultural sector.

Collaboration between Government and Industry: Close collaboration between government, industry and civil society is needed to implement policies and programs that support the growth of the agricultural sector. This partnership must be based on transparency, community involvement, and a common goal of improving the welfare of farmers and agricultural sector business actors.

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