# Impact of Cost Structure on Indonesia Food Industry Value Added

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**Submission date:** 22-Oct-2024 04:53PM (UTC+0700)
**Submission ID:** 2404131188
**File name:** 22_Okt_2023_Impact_of_Cost_Structure.pdf (406.87K)
**Word count:** 5351
**Character count:** 30047

*SIJDEB*, 8 (2), 2024, 147-158
ISSN: 2581-2904, e-ISSN: 2581-2912
DOI: https://doi.org/10.29259/sijdeb.v8i2.147-158
Received: 22nd May 2024; Revised: 26th June 2024; Accepted: 15th June 2024

**SRIWIJAYA INTERNATIONAL JOURNAL OF DYNAMIC ECONOMICS AND BUSINESS**
**http://ejournal.unsri.ac.id/index.php/sijdeb**

# Impact of Cost Structure on Indonesia Food Industry Value Added

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**Abstract:** The food industry is a consistently growing sector, even in challenging economic conditions, driven by population growth and increased demand. Recognizing its importance, the Indonesian government has identified the food and beverage industry as a key sector in its Industry 4.0 roadmap. However, challenges such as reliance on imported raw materials and high labor absorption rates persist. This study analyzes the impact of cost structure on the value-added in Indonesia's food industry from 2017 to 2021, using data from Indonesia Statistics on large and medium industries. The Panel Data Regression results reveal that raw material costs and fixed capital costs positively and significantly affect value-added. These findings suggest that effective cost management, innovation, and the use of advanced technology are crucial for optimizing value-added in this sector.

**Keywords:** Food Industry, Cost Structure, Value Added

## Introduction

The food industry is an industry that always grows even in difficult economic conditions. Population growth is a potential demand for the growth of the food industry. As a country with a population of 278,752,361 people in 2022 with an average population growth of 1.17 percent, the existence of the food industry is important. Indonesia's food industry contributes significantly to the creation of value-added and the growth of the non-oil and gas processing industry sector in Indonesia. The Gross Domestic Product of the food industry contributed an average of 27.74 percent to the GDP of the processing industry sector and 5.66 percent to Indonesia's GDP in the period 2010-2019 (before the COVID-19 Pandemic and the period 2020-2022 (during the COVID-19 Pandemic) contributed an average of 34.42 percent to the processing industry and 6.59 percent to Indonesia's GDP (Statistics Indonesia, 2022a; Statistics Indonesia, 2022b).

This reflects the resilience of the food sector in the face of unexpected economic challenges. During the pandemic, the food industry has also transformed with a rapid increase in food e-commerce, the development of products in line with health trends, and improvements in food processing to maintain safety and quality. Despite challenges such as changing consumer trends and changing regulations, Indonesia's food industry has great potential to continue to grow and become an important pillar of the country's economy. (Echegaray, 2021).

The COVID-19 pandemic has had a significant impact on the Indonesian economy, notably affecting the manufacturing sector, which plays a crucial role in creating value-added and employment (Budi & Mahardhika, 2020; Susilawati et al., 2020). Overall, Indonesia's food industry is a key driver of economic growth, providing employment and contributing significantly to GDP and GRDP. With an emphasis on food safety, product innovation, and international market expansion, the sector holds great potential for continued contribution to the Indonesian economy.

In the last decade, the industry has experienced rapid growth, playing a significant role in job creation, increasing economic contributions, and meeting consumer needs. Therefore, understanding the cost structure and value-added in Indonesia's food industry is essential to identifying factors that affect its performance and developing strategies to enhance the sector's competitiveness in an increasingly global market (Urata & Baek, 2020; Yanikkaya & Altun, 2020; Yu & Luo, 2018).

The Indonesian government has designated the food and beverage industry as one of the featured industries in the Industrial Development Road Map and the Industry 4.0 scheme. The primary goal is to position the national food and beverage industry as a major force in ASEAN (ASEAN F&B Powerhouse). The question that arises is how prepared the Indonesian food industry is to become a leading industry. Indicators of this readiness include the industry's performance, particularly in terms of cost structure, labor productivity, and value-added (Constantinesucu et al., 2019; Kee & Tang, 2016; Tian et al., 2022).

Hernæs et al. (2023) emphasize the significance of labor as a crucial factor in output production and underscore the influence of worker age composition on labor productivity. An increase in the number of elderly workers positively impacts labor productivity, as older and more experienced workers tend to be more efficient, although they often command higher wages. This increase in labor demand positively affects wage costs and overall productivity. Börsch-Supan et al. (2021) further explore labor productivity, highlighting its multifaceted determinants, including the substantial influence of worker age.

In the context of industrial companies, Dragunov & Shenshinov (2020) investigate strategies to enhance labor efficiency and productivity, focusing on innovation. Their findings suggest that increased investment in innovative technology leads to higher labor productivity. Basit & Fasirah Irwan (2017) provide insights into the capital structure of industrial product firms, identifying a reliance on equity financing. They suggest that incorporating debt financing can mitigate agency problems and offer tax benefits, although exceeding the optimal level of debt can adversely affect company performance.

This study aims to fill the research gap by providing an in-depth analysis of the Indonesian food industry's cost structure and value-added, offering new insights into the factors driving performance in this critical sector. The contribution of this research lies in its comprehensive evaluation of the industry's readiness to become a leading force in ASEAN, along with practical policy implications for both government and businesses to support growth, innovation, and competitiveness in the food industry.

## Literature Review

### *Production Costs*

Production is a process in which goods and services called inputs are converted into goods and services called outputs. The process of changing the form and factors of production into production is called the production process. Production is the process of converting inputs into outputs. Production includes all activities to create or add value to the use of a good/service. In simple terms, production is an effort made to create and increase the usefulness of an item to fulfill needs. The production function is the interaction between input and output (Hitomi, 2017).

Production costs are all expenses that must be borne by producers to produce a production. Production costs are all expenditures made by the company to obtain factors of production and raw materials that will be used to create the goods that the company produces. To produce goods or services, production factors such as raw materials, labor, and capital are needed. Raw material costs are costs associated with the purchase or utilization of raw materials or raw materials used in the production process. In the food industry, this could include ingredients such as vegetables, meat, wheat, sugar, and other ingredients used in food manufacturing. Raw material cost analysis involves calculating how much it costs the company to purchase or process raw materials into finished products (Rostiana et al., 2022).

Labor costs include all costs associated with wages and compensation provided to workers involved in the production process. This includes salaries, benefits, incentives, and related costs such as health insurance and pension contributions. Capital costs include costs associated with the use of capital or investment in the company. This includes interest payable on loans, dividends payable to shareholders, and depreciation costs of production equipment and facilities. Cost of capital analysis helps companies determine the costs associated with the use of capital and how these costs affect profitability.

Research Cunha et al. (2018) In the industry, production processes must focus on optimizing output, meeting market demand, and minimizing costs. Traditionally, companies make these decisions independently, first establishing lot size plans and then using that information to determine the timing and quantity of raw material purchases.

Cunha et al. (2018) inputs from the manufacturing sector increased the share of value-added exports from 1985 to 1995, but this share declined from 1995 to 2005. This pattern did not significantly change the value added from primary sector inputs. Instead, there was a noticeable shift in value-added from manufacturing to the services sector. This trend was observed in almost all industries and countries. A potential explanation is that manufacturing has become commoditized, with many countries adopting low-productivity manufacturing jobs, reducing markups and labor costs.

### *Value-Added*

The theory of industry value-added is a concept that quantifies the extent to which an industry or economic sector can generate value-added within its production process. Industrial value added is computed by subtracting the value of output produced by the industry from the value of inputs or raw materials employed in the production process. This concept aids in comprehending the relative contributions of various industries to a country or region's economy. Industries capable of generating substantial value-added within an economy typically serve as primary drivers of economic growth, job creation, and increased national income (de Soyres & Gaillard, 2019; Durongkaveroj, 2023).

To calculate industry value added, one computes the disparity between production value and intermediate costs, encompassing expenses related to raw materials, auxiliary materials, and other factors used in product manufacturing. Key determinants of value-added include raw material prices, sales prices, and the efficiency levels of labor and raw materials. A higher selling price, when efficiency and raw material costs remain constant, results in greater value-added. The relationship between value-added and production value is positive, while intermediate costs have a negative impact.

Study Vaidya et al. (2018) highlights Industry 4.0, enabling intelligent, efficient, effective, personalized production at reasonable costs. With faster computers, smarter machines, smaller sensors, and cheaper data storage and transmission, more and better machines and products can be produced. Industrial advancements can enhance value-added for the industry.

The research conducted by Autor & Salomons (2018) many technological innovations replace workers with machines, yet this does not always reduce overall labor demand due to four balancing mechanisms: direct impacts on industrial production itself; inter-industry input-output effects; shifts between industries; and effects stemming from final demand. By analyzing harmonized data across countries and industries over four decades, this study measures automation alongside changes in Total Factor Productivity (TFP) across various nations. The findings indicate that automation tends to replace jobs and diminish the value-added contributed by labor in the industries that implement it (direct effects).

### *Hypothesis*

Based on the background and problems described in this study, the following hypothesis is formulated. The null hypothesis (H0) states that the variables of labor costs, raw material costs, and fixed capital costs have no significant effect on value added in the food industry. Conversely, the alternative hypothesis (H1) states that variable labor costs, raw material costs, and fixed capital costs have a significant effect on value added in the food industry.

## Methods

The scope of this research is to examine and analyze the cost structure and value-added in the food industry in Indonesia. The data utilized is sourced from the Indonesia Statistics for large and medium industry classifications, based on ISIC 3-digit codes for 8 food

industry sectors spanning the years 2017 to 2021 . The 3-digit food industry consists of several distinct sectors: Industry 101 (Meat Processing and Preservation Industry), Industry 102 (Fish and Aquatic Life Processing and Preservation Industry), Industry 103 (Fruits and Vegetables Processing and Preservation Industry), Industry 104 (Vegetable and Animal Food Oils and Fats Industry), Industry 105 (Dairy, Dairy Products and Ice Cream Processing Industry), Industry 106 (Grain, Flour and Meal Processing Industry), Industry 017 (Other Food Industry), and Industry 108 (Pet Food Industry). To address these issues, this study employs both qualitative descriptive and quantitative descriptive methods. Qualitative descriptive analysis involves calculating growth percentages, averages, and contributions to total industry output. Quantitative analysis utilizes Panel Data Regression to examine the impact of cost structure and value-added in the food industry. In the panel data regression, various model selection tests are conducted including the Chow test, Hausman test, and Lagrange Multiplier test. The Chow test is employed to select the best model between the Common Effect Model and Fixed Effect Model. The Hausman test determines the best model between the Fixed Effect Model and Random Effect Model. Finally, the Lagrange Multiplier test is used to decide between the Common Effect Model and Random Effect Model for identifying the optimal model (Gujarati & Porter, 2013).

The quantitative analysis model applied is multiple linear regression, represented by the following equation:

$$LNVA_{it} = \alpha + \beta 1 LNLC_{it} + \beta 2 LNRM_{it} + \beta 3 LNFC_{it} + e_{it} \quad \text{.....(1)}$$

Description: VA is value-added in the food industry, LC is the cost of wage labor in the food industry, RM is the cost of raw materials in the food industry, FC is fixed capital in the food industry, *i* is 3-digit food industry, *t* is the period 2017-2021, *e* is the error term.

## Findings

Table 1. **Food Industry Cost Components (in billion Rupiah)**

| Cost Components | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Labor Cost | 40.13 | 44.59 | 46.85 | 44.81 | 49.23 |
| Raw Material Costs | 970.78 | 969.31 | 999.03 | 979.93 | 1,208.41 |
| Fixed Capital Costs | 5.66 | 1.97 | 2.61 | 2.10 | 2.36 |
| Other Costs | 100.42 | 62.46 | 122.98 | 86.87 | 74.69 |
| Total Cost | 1,116.99 | 1,078.34 | 1,171.46 | 1,113.71 | 1,334.68 |

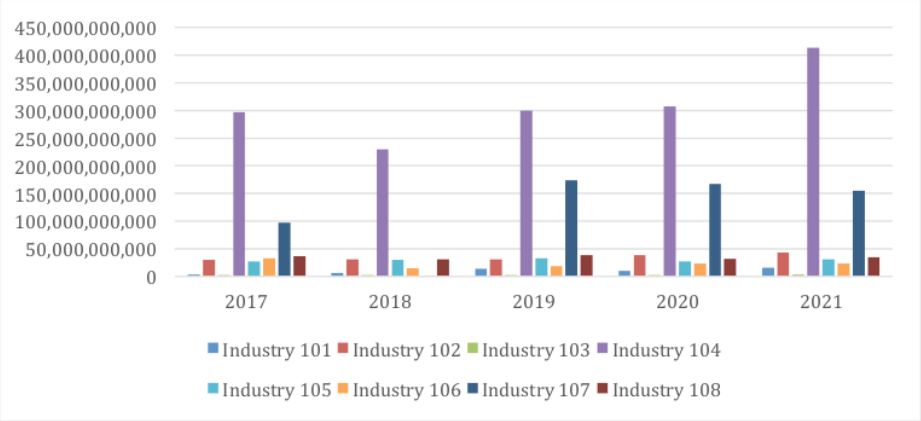
Source: Statistics Indonesia, Indonesia Manufacturing Industry Indicators, 2023

In 2021, the cost structure of various sectors within Indonesia's food industry highlights the significant reliance on raw materials. Industry 101 shows a dominant contribution from raw material costs, accounting for 85.80% of total costs, with labor and capital costs being minimal at 2.92% and 0.15%, respectively. Similarly, Industry 102 has raw material costs at 80.71%, with higher labor costs of 9.19% and capital costs at 1.63%. Industry 103 displays a more balanced cost structure, though raw materials still dominate at 71.65%, followed by significant labor costs of 11.96% and capital costs at 2.08%. Industry 104 is overwhelmingly driven by raw material costs, which comprise 95.63% of the total, with minimal labor and capital costs of 1.96% and 0.07%, respectively.

In Industry 105, raw material costs are lower relative to other sectors, at 63.35%, while labor costs are 8.22%, reflecting the complexity of dairy processing. Industry 106 has raw material costs at 90.64%, with very low contributions from labor (2.39%) and capital (0.02%). Industry 107 and Industry 108 also show a heavy reliance on raw materials, at 75.58% and 93.54%, respectively. Labor costs in the other food industry are significant at 10.30%, whereas the animal food industry shows labor costs of 2.67%. Capital costs in both industries remain low at 0.25% and 0.07%, respectively.

Overall, the analysis indicates that raw material costs are the predominant expense across all food industry sectors in Indonesia, underscoring the importance of these inputs in production. Labor costs, though secondary, are notable in specific industries like fruits and vegetables processing and other food industries, indicating more labor-intensive operations. Capital costs are minimal across the board, suggesting that investments in machinery and infrastructure are relatively low compared to expenditures on raw materials and labor.

Figure 1. **Value-Added of Food Industry 2017-2021**




Source: Statistics Indonesia, Indonesia Manufacturing Industry Indicators, 2023

Based on data regarding the value-added of the food industry in Indonesia from 2017 to 2021, it can be seen that there are significant fluctuations in the value-added of various industries. Industry 104 (Vegetable and Animal Food Oils and Fats Industry) consistently has the highest value added among all the industries analyzed. In 2017, its value added amounted to 297.32 billion rupiah. Although it decreased in 2018 to 229.84 billion rupiah, the value increased dramatically again in 2019 to 299.36 billion rupiah. This upward trend continued until 2020 with an added value of 306.96 billion rupiah and reached its peak in 2021 with a value of 413.33 billion rupiah. This shows that Industry 104 not only has the highest value added but also shows a strong upward trend, signaling stability and high growth potential within the sector.

The reasons for the increase and dominance of Industry 104 include high market demand for edible oil and animal fat products, innovation and production efficiency, strong exports, as well as government policies that support the agriculture and edible oil processing sectors. In contrast, Industry 103 (Fruits and Vegetables Processing and Preservation Industry) has the lowest value added among all industries analyzed. In 2017, its value added was only

IDR 2.72 billion and experienced a slight decline in 2018 to IDR 2.46 billion. Although there was a slight increase in 2019 to 2.78 billion rupiah, the added value decreased again in 2020 to 2.22 billion rupiah. In 2021, the added value of Industry 103 increased again to 3.69 billion rupiah.

Despite the increase in the last year, the overall value added of Industry 103 remains the lowest, indicating that the industry faces challenges in increasing its value added. The causes of Industry 103's low value-added and fluctuations include limited infrastructure, seasonal influences, limited market demand, and lack of innovation and technology in processing and storage.

In addition, some additional observations and analysis show that Industry 101 (Meat Processing and Preservation Industry) experienced a significant increase in value added from IDR 3.79 billion in 2017 to IDR 15.73 billion in 2021, indicating increased demand and improvements in processing and distribution techniques. Industry 102 (Fish and Aquatic Life Processing and Preservation Industry) shows stable value-added with a sharp increase in 2020 and 2021, indicating growth in export and domestic markets and innovation in processing and preservation methods. Industry 105 (Dairy, Dairy Products and Ice Cream Processing Industry) shows stability in value-added, although slight fluctuations indicate challenges in the market or supply chain. Industry 106 (Grain, Flour and Meal Processing Industry) experienced significant fluctuations with a drastic decline in 2018, possibly due to changes in raw material prices or issues in the supply chain. Industry 107 (Other Food Industry) showed extreme fluctuations indicating market volatility or dependence on external factors such as trade policies or changes in consumer demand. Industry 108 (Pet Food Industry) shows a stable trend with value added ranging from 30 to 38 billion rupiahs.

Table 2. **Model Testing**

| **Chow Test** | | | |
|---|---|---|---|
| Effects Test | Statistic | d.f. | Prob. |
| Cross-section F | 1.122148 | -7,29 | 0.3764 |
| **Hausman Test** | | | |
| Test Summary | Chi-Sq. Statistic | Chi-Sq. d.f. | Prob. |
| Cross-section random | 0.852072 | 3 | 0.8370 |
| **Lagrange Multiplier Test (LM)** | | | |
| Null (no rand. effect) | Cross-section | Period | Both |
| Alternative | One-sided | One-sided | |
| Breusch-Pagan | 0.022335 | 0.703421 | 0.725756 |
| | (0.8812) | (0.4016) | (0.3943) |

Source: Data Processing, 2024

In the process of selecting the most appropriate model, several tests are conducted, including the Chow Test, Hausman Test, and Lagrange Multiplier Test. The Chow test is used to determine whether the selected model is Pooled Least Square/Common Effects or Fixed Effects. The Chow Test results show that the probability value of F is greater than the alpha value (0.0000 < 0.3764), so in accordance with the test criteria, the selected model is Common Effects. Furthermore, the Hausman Test is conducted to determine whether the Fixed Effect Model or Random Effect Model is more appropriate to use. Based on the Hausman Test, the significance value is greater than the alpha value (0.8370 > 0.05), so the Random Effect Model is better. Then the Lagrange Multiplier test is carried

out to determine whether the right model is the Random Effect Model or the Common Effect Model. The Breusch-Pagan method is used in this test to test the significance of Random Effect based on the residual value of the OLS Method. The test results show that the Breusch-Pagan probability value of 0.8812 > alpha value. Thus, the best model chosen for panel data estimation is the Common Effect Model.

Table 3. **Statistical Results of Common Effect Model Estimation**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 4.865113 | 4.950955 | 0.982661 | 0.3323 |
| LNLC | -0.167541 | 0.570600 | -0.293623 | 0.7707 |
| LNRM | 0.782612 | 0.302102 | 2.590550 | 0.0137 |
| LNFC | 0.187872 | 0.015009 | 12.51710 | 0.0000 |
| R-squared | | 0.574186 | | |
| Adjusted R-squared | | 0.538701 | | |
| S.E. of regression | | 1.081313 | | |
| F-statistic | | 16.18131 | | |
| Prob (F-statistic) | | 0.000001 | | |

Source: Data Processing, 2024

Labor costs do not have a significant influence on the value added of the food industry in Indonesia during the 2017-2021 period. Within the cost component, the contribution of labor costs only ranged from 2-3% during the observation period. This is due to low labor wages in the food industry, so it does not have a significant impact on increasing the added value of the industry.

The variable cost of raw materials has a positive and significant effect on the value added in the food industry. Raw material costs in the food industry are the largest contributor to the cost component, accounting for more than 60-90% of total costs. Increasing raw material costs can encourage companies to focus on improving the quality of their products. They may look for high-quality raw materials that are more expensive, but which can also produce products with better taste and quality. This can help their products compete with similar products in the market and attract more customers. Rising raw material costs can serve as a driver for innovation and quality improvement in the food industry, which in turn can lead to better and more valuable products for consumers, and ultimately increase value-added in the industry.

Similar to findings in study Offiah et al. (2019), companies that utilize high-quality raw materials produce high-quality products. Optimal raw materials and the use of extrusion technology have rapidly transformed the food industry, offering various advantages over other processing methods. Additionally, they enhance value addition through the extrusion of food processing waste and by-products. In study Silovs (2018), the fish processing industry demonstrates that using high-quality raw materials results in superior products. Moreover, by further utilizing by-products and waste leftover after production, the industry promotes sustainable raw material practices, enhances added value, and improves profitability.

Fixed capital costs, such as machinery and equipment, can improve productivity and production efficiency. Investing in fixed capital costs, such as machinery and equipment,

plays a crucial role in enhancing productivity and production efficiency within industries. The deployment of modern equipment or more efficient technologies enables companies to produce more while maintaining or reducing costs. This increase in productivity often leads to higher added value per unit of product. By upgrading machinery and equipment, businesses can streamline operations, reduce production time, minimize waste, and potentially improve product quality. Moreover, investments in fixed capital not only boost immediate production capabilities but also lay the foundation for long-term competitiveness and sustainability. Companies that strategically allocate resources to enhance their capital base can achieve economies of scale, increase output per worker, and ultimately contribute to overall economic growth and profitability. These findings are supported by research from AlKathiri (2022), which states that developing the manufacturing industry through capital accumulation is crucial for developing countries to catch up with developed countries. Technology plays an important role in increasing manufacturing production. Good technology will encourage quality production and increase production (Attaran, 2017; Haraguchi et al., 2017; Tofail et al., 2018).

Raw material costs and capital (technology) costs play a crucial role in increasing value-added in Indonesia's food manufacturing industry and driving overall industry performance. First, raw material costs, which are often dominant in the cost structure of food manufacturing companies, directly affect the quality and quantity of production. By managing raw material costs efficiently, companies can maintain competitive selling prices in the market, increase their profit margins and expand their market share.

Second, investment in capital costs or technology opens up opportunities for increased productivity and innovation. The use of modern technology in the production process can optimize efficiency, reduce production costs per unit, and improve product quality standards. This not only enhances a company's competitiveness in an increasingly tight global market, but also provides impetus for new product development and differentiation that can attract consumer interest.

More broadly, increasing added value through effective management of raw material costs and technology investments will contribute to the growth of the food manufacturing industry in Indonesia. By improving efficiency and innovation, companies will not only be able to meet rising domestic demand, but also prepare to export their products to international markets. This not only increases income and employment in the food industry, but also strengthens Indonesia's overall economic position in the global industrial map.

## Conclusion

Indonesia's food industry plays an important role in the country's economy, with significant contributions to the Gross Domestic Product (GDP) and GDP of the manufacturing sector. Based on the research results, the labor cost variable does not have a significant effect on value added. The low contribution of labor costs is due to low labor wages so that it does not have a significant impact on value added. Raw material costs and fixed capital costs have a positive and significant influence on value added in the food industry. Raw material costs have a large contribution to total costs in the food industry in Indonesia.

Suggestions for policy implications from the results of this study are 1) The government needs to continue to support growth and innovation in the food industry, including

through tax incentives, research support, and workforce training development. 2) Companies in the food industry need to focus on operational efficiency, the use of more sophisticated technology, and product diversification to optimize added value. 3) Cost management, including raw material costs, and fixed capital, should be the main focus of companies to improve and optimize added value. 4) The government needs to maintain support for the food industry as one of the leading sectors in national economic development, especially in the context of the Industrial Revolution 4.0, and efforts to make Indonesia a major force in ASEAN in the food and beverage sector.

## Acknowledgment

The research of this article was funded by the DIPA of the Public Service Agency of Universitas Sriwijaya 2023. No SP DIPA-023.17.2.677515/2023 Digital Stamp: 3300-2302-2270-9060 on Mei 10, 2023. By Rector's Decree Number: 0334/UN9.3.1/SK/2023, on Juli 3, 2023.

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