Jurnal Hexagro. Vol. 10. No. 1. February 2026 P-ISSN: 2459-269E-ISSN: 2686-3316
DOI: 10.36423/hexagro.v10i1.881

# RAW MATERIAL INVENTORY PLANNING USING THE MRP (MATERIAL REQUIREMENT PLANNING) METHOD FOR POTATO CHIPS PRODUCTS (CASE STUDY OF CV. CITA MANDIRI, BATU CITY, EAST JAVA)

**Briyan Nomianta[1], Tirta Yoga[1*]**

[1] Agricultural Faculty, University of Brawijaya, Ma;ang

*Correspondence: tirtayoga@student.ub.ac.id

Submitted: 31st January 2022; Revised: 23th December 2025; Published: 28th February 2026

***ABSTRACT***

*CV. Cita Mandiri is a small- and medium-sized agroindustry company that produces and markets processed snacks, including chips, sticks, opaque snacks, and fruit juice. This study aims to determine the planning of raw material inventory and forecast the company's production amount. The method of selecting respondents is purposive sampling using a key informant, such as the company's owner. Analysis using the forecasting method optimizes future raw material availability, while MRP (Material Requirement Planning) minimizes the company's pricing. The results showed that the forecasting method using moving averages was using the POM QM application for Windows version 3, MAD (Mean Absolute Deviation) 15,6, MSE (Mean Squared Error) 530,3, and MAPE (Mean Absolute Percent Error) 0,11. It is known that the results of forecasting data were obtained one year earlier, from January to December 2022, for a total production of 258.52 Kg so that the company can plan well in meeting the supply of raw materials*

***Keywords:*** *Forecasting, Material Requirements Planning (MRP), Inventory*

**ABSTRAK**

CV. Cita Mandiri merupakan perusahaan agroindustri berskala kecil dan menengah yang memproduksi dan memasarkan produk olahan makanan ringan atau camilan berupa keripik, stik, opak dan sari buah. Penelitian ini bertujuan untuk mengetahui perencanaan persediaan bahan baku dan peramalan jumlah produksi perusahaan. Metode penentuan responden yaitu *purposive sampling* dengan teknik *key informant,* yaitu pemilik perusahaan. Analisis menggunakan metode peramalan berfungsi untuk optimalisasi ketersediaan bahan baku di masa yang akan datang dan MRP *(Material Requirements Planning)* berfungsi untuk meminimalkan harga yang dikeluarkan perusahaan. Hasil penelitian menunjukkan metode peramalan dengan moving averages dengan menggunakan aplikasi *POM QM for Windows* versi *3*, MAD *(Mean Absolute Deviation)* 15,6, MSE *(Mean Squared Error)* 530,3, dan MAPE *(Mean Absolute Percent Error)* 0,11. Diketahui hasil data peramalan diperoleh satu tahun sebelumnya pada bulan Januari sampai Desember 2022 untuk total produksi sebesar 258,52 kg, sehingga perusahaan dapat merencanakan dengan baik dalam pemenuhan persediaan bahan baku.

**Kata kunci:** Peramalan, Material Requirement Planning (MRP), Persediaan

## INTRODUCTION

Potatoes are a seasonal crop that grows as a shrub or herb. Potato tubers are easily cultivated in highland areas at altitudes of 1,300-1,500 m (Ewing, E.E., 1982). Potatoes are currently widely used as a raw material for processed snack foods and restaurants. Therefore, with increasing demand and industrial development, the demand for potato tubers is increasing. Potatoes are a raw material for various products,

including potato chips. CV. Cita Mandiri is an agro-industrial company that processes potato tubers into chips.

The company is experiencing a shortage of potato tubers due to several factors, including increasing demand for potato chips, weather, climate, and environmental conditions. Therefore, good management, including production planning, is essential.

Companies must plan their raw material inventory needs effectively, balancing availability with costs (Rangkuti, 1995). Companies must maintain good communication and cooperation with suppliers to ensure there are no shortages of raw materials (Wibowo, 2007).

According to Heizer (2010), inventory is a quantity of materials or goods available for use at any time, either now or in the future. Therefore, inventory control activities are necessary. According to Fahmi (2015), inventory control is a very important management tool in the business world because, without proper inventory management, businesses face challenges in meeting consumer needs for the goods and services they produce. Without good control, companies must be careful in determining the amount of inventory to be used in the production process, because it will cause losses due to costs that should not be borne by the company, such as factory operational costs, construction costs, costs of loss, and costs of product damage due to long-term storage. Inventory control is a managerial function (Handoko, 1984).

According to Rovianty (2007), inventory control is one of a sequence of activities closely related to each other in all of the company's production operations, as planned in advance, including time, quantity, and cost. According to Handoko (2000), an inventory system is a set of policies and controls that monitor inventory levels and determine the level that must be maintained. This system aims to determine and ensure the availability of the right resources, in the right quantity and at the right time. Inventory systems and models aim to minimize total costs by optimally determining what to order, how much, and when. One method for analyzing problems in raw material inventory planning is MRP (Material Requirements Planning). MRP is a scheduling method proposed for further analysis regarding capacity inventory and balance using capacity requirement planning (Gaspersz, 2004). Therefore, in a well-planned company, inventory levels must be considered. Forecasting techniques with MRP

calculations are one method that can be used; they are used for inventory planning to achieve optimal costs.

## RESEARCH METHODS

### Research Location and Time

The location was selected purposively. The researcher had previously conducted a site survey to assess the general condition of the CV. Cita Mandiri, a company in the Junrejo District, Batu City. The reason for this research was that the company has development potential, both in terms of economic viability and product quality, and that its products are considered safe for consumption. This research was conducted from February to May 2017.

### Respondent Selection

The method used to select respondents was purposive sampling using key informant techniques. The goal was to obtain direct and indirect data, including primary and secondary data from reliable sources that could provide clear and complete information. The respondent was the owner of CV. Cita Mandiri.

### Data Collection Method

Data collection included primary and secondary data. Primary data was collected through interviews and observations with the owner of CV. Cita Mandiri. This data collection aimed to obtain information on the company's image, company profile, product composition, number of working hours, telephone costs, labor costs, administrative costs, transportation costs, and so on. Meanwhile, secondary data were collected from various sources, including literature, photographs, drawings, documents, and notes. The secondary data expected to support the research include potato chip production data from January to December 2016 and the company's raw material price list.

### Data Analysis

#### *Descriptive Analysis*

Descriptive analysis is used to obtain a systematic, factual, and accurate picture of the phenomena being investigated, including their characteristics and relationships (Sugiyono, 2006). This analysis is conducted by describing the collected data, ensuring that the data is objective so that its meaning can be further examined. Descriptive analysis was conducted by collecting data from previous periods at CV. Cita Mandiri. This analysis is necessary to support the raw material inventory planning process; the collected data will serve as a reference**.**

#### *Raw Material Demand Forecasting*

Demand forecasting is the main stage in raw material inventory

planning. For example, the forecasting process involves obtaining past data from the company to generate future estimates. For example, data on the number of items needed to make potato chips was collected for forecasting from January to December 2017. Demand data processing was performed using POM QM for Windows 3 software.

***Material Requirement Planning (MRP) Method***

According to Heizer (2010), the gross material requirements plan (GMRP) shows the total demand for an item after deducting inventory on hand and scheduled invoices, and determines when it should be manufactured and shipped to meet demand by a specific date. The MRP method was conducted manually because the quantity of raw materials required to make potato chips is uncertain. The data files required to determine the MRP method include a list of required materials, lead time for receiving orders or delivery times, inventory data, and purchasing data. The analysis of the raw material requirements plan in this study used the Lot-for-Lot (LFL) and Economic Order Quantity (EOQ) techniques.

## RESULT AND DISCUSSION

### Company Production Activities

CV. Cita Mandiri produces potato chips at a limited daily rate due to the price of the potato tubers. This is to reduce the company's total costs. The company charges around IDR 12,000 per kilogram of potatoes for processing into finished potato chips. The following are the stages of the company's production process, as shown in Figure 1.

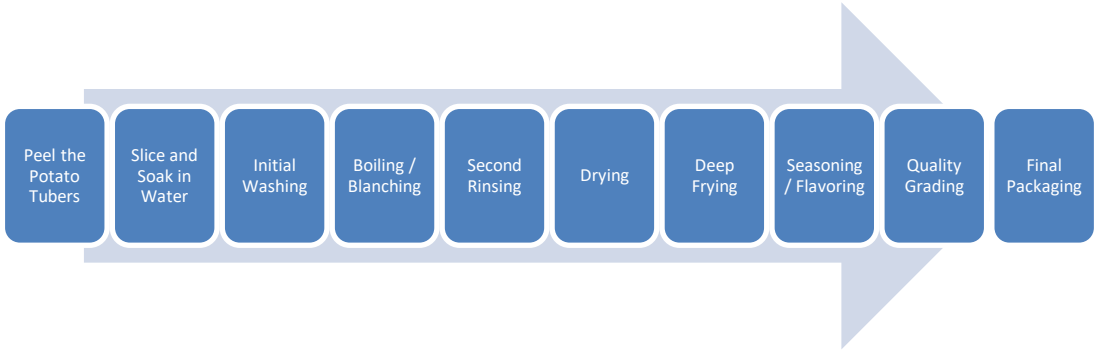


Figure 1. Process Flow for Making Potato Chips

### Potato Chip Raw Material Inventory Planning System at CV. Cita Mandiri

*Potato Chip Raw Material Planning*

The raw material inventory planning at CV. Cita Mandiri uses personal assumptions or basic guidelines for ordering raw materials, i.e., four times a month. This ordering frequency is handled by the company owner using company vehicles. A drawback of the company's system is that inventory costs, including raw-

material ordering and purchasing costs, are not controlled. Another drawback is the uncertain availability of potato tubers due to poor planning. The company cannot accurately estimate the available raw materials and the order quantity.

**Potato Chip Production Pattern**

Potato chip sales are based on potato chip production during a specific period. Potato chip production cannot be guaranteed for each production period due to the uncertainty of market demand. The fluctuating production pattern follows the type of order preferred during certain months, such as religious holidays, Independence Day, and other important holidays, leading to increased production. The following presents the potato chip production process at CV. Cita Mandiri for the last year of 2016 in Figure 2.

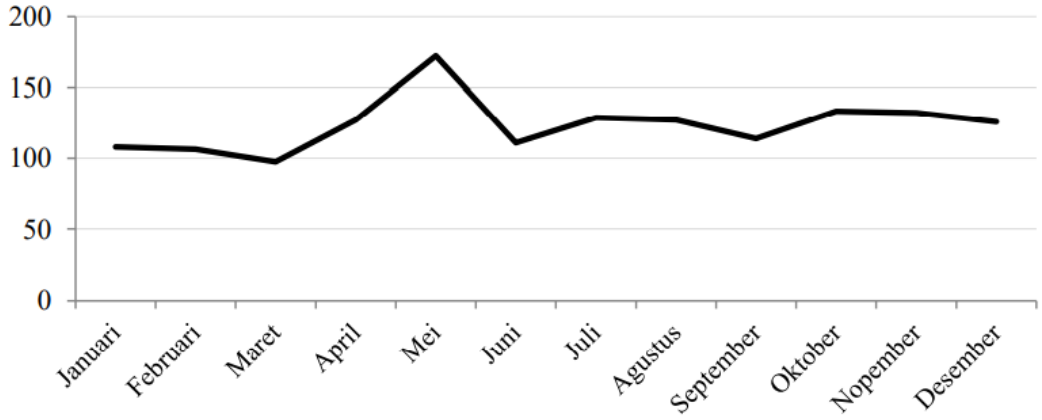


Figure 2. Potato Chips Production Pattern per kg (2016)

Based on the production pattern above, it can be concluded that production fluctuated from January to December 2016. The highest production increase occurred in May 2016, at 172.5 kg. Meanwhile, the lowest production increase occurred in March, at 97.5 kg.

**Determining Product Structure (Bill of Materials)**

The initial step in inventory planning using the MRP system is determining the product structure of potato chips. Figure 3 illustrates the product structure of potato chips

As seen in Figure 3, the planning of raw material requirements for potato chips at CV. Cita Mandiri is planning for items at levels 1 and 2. The raw materials at level 1 are supporting materials used in the production of potato chips.

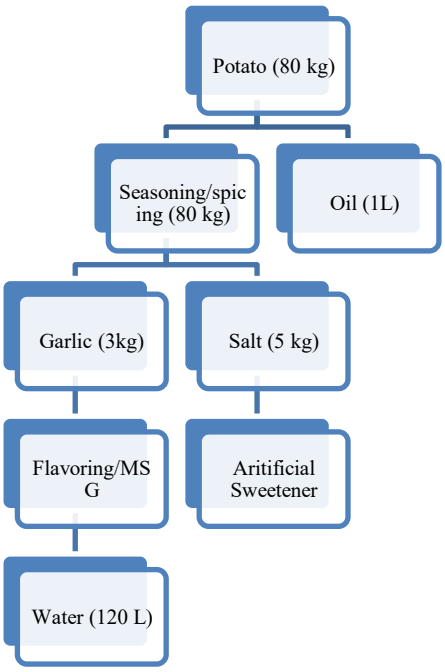


Figure 3. Bill of Materials for Potato Chip Products

Table 1. Potato Chips Product Structure

| Level of component | Component | Amount |
|---|---|---|
| 0 | Potato tuber/Kg | 80 |
| 1 | Onion Kg | 3 |
| 1 | Flavoring/set | 1 |
| 2 | Water/L | 200 |
| 2 | Salt/Kg | 5 |
| 2 | Sweetener /Set | 1 |
| 2 | Oil/L | 1 |

Source: Processed Primary Data (2022)

This includes seasoning and oil, meaning that producing 100 grams of potato chips requires 80 kg of potatoes, 3 kg of garlic, 5 kg of salt, sufficient flavoring, sufficient sweetener, 120 liters of water, and 80 kg of potatoes.

Table 1 explains that the required components for potato chip production are potato tubers, garlic, flavoring, water, salt, sweetener, and oil, all purchased independently.

**Storage Costs**

Storage costs are the costs associated with storing raw materials as stock in the company's warehouse. Storage costs are influenced by the average monthly inventory of potato raw materials. Storage costs will increase as the average quantity of potato raw materials in the warehouse increases.

CV. Cita Mandiri Company has 2 types of storage warehouses: one for fresh potatoes and one for semi-finished potato chips. The rates charged for each cost, such as lighting for potato tubers and semi-finished potato chips, are charged in IDR. 60,000 and IDR. 691.2 per month. In the warehouse, there is a large scale weighing 5 kg, so the equipment depreciation cost per month

is IDR. 83,333, and the recording cost is IDR. 13,000 week

Table 2. List of Potato Chips Storage Costs/Month

| Raw Material | Cost component | Cost (IDR) |
|---|---|---|
| Potato tuber | Lighting/month | 60,000 |
| | Equipment depreciation/year | 83,333 |
| | Recording/week | 13,000 |
| Semi-finished potato chips | Penerangan/bulan | 691.2 |
| | Penyusutan alat/tahun | 30,000 |
| | Pencatatan/minggu | 13,000 |
| Total | | 200,024.2 |

Source: Secondary Data, 2022

The storage cost in the semi-finished potato chips warehouse, including details, is that the company will incur a cost of IDR. 691.2 per month. The company has 2 tools used in the semi-finished potato chips warehouse, namely 2 small scales and 2 sollers, so the company will incur a depreciation cost of IDR. 30,000 per week. There is a company recording the cost of IDR. 13,000 per month. Therefore, the storage costs incurred at the 2 warehouses for potato tubers and semi-finished potato chips are IDR. 200,024.2 per month.

**Potato Chip Demand Forecasting**

Based on calculations using the moving-average method, the elimination method used POM QM for Windows version 3 and Microsoft Excel to obtain MAPE, MAD, and MSD error values for each method, as shown in Table 3.

Table 3. Comparison of MSE, MAD, and MAPE Values of Potato Chips

| No | Forecasting methods | Score | | |
|---|---|---|---|---|
| | | MSE | MAD | MAPE |
| 1 | Exponentia Smoothing α =0,6 | 530.3 | 15.6 | 0.11 |
| 2 | Moving Averages | 702.2 | 18.8 | 0.14 |
| 3 | Regresi Linear | 3665.0 | 138.6 | 107.7 |

Source: processed primary data (2022)

Table 3 shows the error rate of each method used to forecast potato chip production. The highest MSE among the methods was linear regression at 3665.0, and the lowest was exponential smoothing at 15.6. The highest MAPE among the methods was linear regression at 107.7, and the lowest was exponential smoothing at 0.11. Therefore, exponential smoothing has the lowest error rate, making it the preferred method for forecasting potato chip production. Forecasting was performed to predict next year's

production using data from the previous year. The results of the linear regression forecast are shown in Table 4.

Table 4. Potato Chip Production Forecast Results

| Periods (2022) | Potato Chips (Kg) |
|---|---|
| Janurary | 108 |
| February | 107,1 |
| March | 101,34 |
| April | 117,03 |
| May | 150,3 |
| June | 126,7 |
| July | 128,09 |
| Augst | 127,89 |
| September | 119,49 |
| Ovtober | 127,89 |
| November | 130,65 |
| December | 127,864 |
| Total | 258,52 |

Source: processed primary data (2022)

Table 4 shows that the forecasting data obtained one year earlier using the exponential smoothing method showed that the highest production volume was in May, at 150.3 kg of potato chips. This necessitates thorough production preparation, as the forecasted volume is high for that month. The lowest production volume is forecast for March 2022, with a total production of 101.34 kg of potato chips. This encourages the company to maximize production volume, thereby reducing the costs of producing potato chips. The company needs effective raw material inventory planning to meet increasingly ambitious production targets. And also need a marketing mix strategy to reach the target (Sundari, 2023; Murti, 2023)

## CONCLUSION

Raw material inventory planning implemented at CV. Cita Mandiri relies on the owner's assumptions and estimates of costs incurred to produce potato chips, without proper supervision and control of the company's costs. These costs include ordering, raw material purchase, and storage costs.

Forecasting results from the previous year using the exponential smoothing method show that the highest production volume was in May, at 150.3 kg of kentiang chips, while the lowest forecast was in March, at 101.34 kg of potato chips. Therefore, with forecasting analysis, the company can maximize production volume and raw material inventory for next year's planning..

**Authors declaration**

**Consent to participate**

Authors are agreed

**Consent to publication**

The authors agree to publish this data

**Conflict of interest**

The authors declare no conflict of interest

## REFERENCES

Ahmad, F., Khan, I., Nasib, M., & Sher,

A. (2022). Community-Based Activity of Nursery Raising for Improving The Livelihood of Small-Scale Farmers in District Kurram. *Jurnal Hexagro*, *6*(1), 12–21. https://doi.org/10.36423/hexagro.v6i1.871

Ahmad, F., Sundari, R. S., Ahmad, J., & Arshad, A. (2021). The financial analysis of nitrogen fertilizers and planting systems and its implications on maize agribusiness: Evidence from Peshawar, Pakistan. *Journal of Socioeconomics and Development*, *4*(1), 145. https://doi.org/10.31328/jsed.v4i1.2197

Ahmad, Z., Malik, S. M., Mehran, H., K., Ul Haq, N., & Altaf, F. (2023). Community Resilience and Innovation in Livelihood Strategies: Exploring the Drivers of Change in Mountain Agriculture in Lotkuh Valley, Pakistan. *Journal of Asian Development Studies*, *12*(4), 158–177. https://doi.org/10.62345/jads.2023.12.4.11

Bajwa, B. E., Aslam, M. N., & Malik, A. H. (2015). Food Security and Socio-Economic Conditions of Women Involved in Kitchen Gardening in Muzaffargarh, Punjab, Pakistan. *Journal of Environmental and Agricultural Sciences*, *4*, 1–5.

Ewing, E.E., & R. E. K. (1982). Limiting factors to the extension of potato into non-traditional climates. *Research for the Potato in the Year 2000*.

Fahmi, S. (2015). Pengendalian Persediaan Bahan Dengan Menggunakan Metode EQQ pada UD. Adi Mabel. *Jurnal Teknovasi*, *02*, 1–11.

Gao, D., & Lyu, X. (2023). Agricultural total factor productivity, digital economy and agricultural high-quality development. *PLoS ONE*, *18*(10 October), 1–15. https://doi.org/10.1371/journal.pone.0292001

Gaspersz, V. (2004). *Production Planning and Inventory Control* (Keempat). Gramedia.

Handoko, T. H. (1984). *Dasar-dasar Manajemen Produksi dan Operasi*. BPFE.

Handoko, T. H. (2000). *Dasar-dasar Manajemen Produksi dan Operasi. Yogyakarta*. BPFE.

Heizer, J. dan B. R. (2010). *Manajemen Operasi*. Salemba Empat.

Kadam, D. M., Bihari, B., Kumar, S., & Bishnoi, R. (2020). *Kitchen Garden for Nutritional and Livelihood Security in North Western Himalayan Region ICAR - Indian Institute of Soil and Water Conservation*. *September*. https://doi.org/10.13140/RG.2.2.18932.78729

Kashif, M., Nazeer, M. A., Mohsin, M., Salahuddin, M., & Sarwar, F. (2024). *Evaluating the Use of Kitchen Gardening in Relation To the Socio - Economic Conditions in Lahore , Pakistan*. *July 2025*, 45–53.

Khan, M. R., Arif, M., Ahmad, F., Sundari, R. S., Ahmad, J., Adiloğlu, A., Özel, E., Sukmawani, R., Astutiningsih, E. T., Meilani, E. H., Ratnasari, J., Fitriani, Latifah, E., Işik, R., Tarigan, R. T., Tarigan, R. A. N., A., A. K., Sözübek, B., Ö., M., … Akinoğlu, G. (2022). *Sustainable Agriculture Leads to Zero Hunger*. https://iksadyayinevi.com/wp-content/uploads/2022/07/SUSTAINABLE-AGRICULTURE-LEADS-TO-ZERO-HUNGER-

.pdf%0Ahttps://iksadyayinevi.com/home/sustainable-agriculture-leads-to-zero-hunger/

Mugizi, F. M. P. (2025). Extension Advice, Agricultural Productivity, and Food Security in Tanzania. *Food and Energy Security*, *14*(1). https://doi.org/10.1002/fes3.70047

Murti, N.R., Sundari, R.S., Heryadi, D.Y. (2023). Pengaruh Bauran Pemasaran terhadap Volume Penjualan Keripik Tempe. Mimbar Agribisnis: Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis. 9(2): 2570-2584

Nawab, K., Iqbal, M., Rahman, W. U., & Khan, A. (2022). Role of Agricultural Extension Services in Enhancing Kitchen Role of Agricultural Extension Services in Enhancing. *Journal of Xi'an Shiyou University, Natural Science Edition*, *18*(10), 785–804.

Pabón Trujillo, H., Triana Sánchez, M. R., Eduardo Posada, M., Isabel Peña, T., & Díaz Díaz, L. A. (2025). Cultivating Security: Comparative Analysis of Agricultural Labor Standards in Argentina and Colombia. *Ciencia Latina Revista Científica Multidisciplinar*, *9*(1), 7632–7642. https://doi.org/10.37811/cl_rcm.v9i1.16432

Rangkuti, F. (1995). Manajemen Persediaan: Aplikasi di Bidang Bisnis. *Manajemen Persediaan: Aplikasi Di Bidang Bisnis*.

Rovianty, A. N. (2007). *Analisis Peranan Material Requirement Planning Untuk Produk Kursi Benelux Pada CV Aksen Rattan Cirebon*. Universitas Widyatama.

Sugiyono. (2016). Sugiyono, Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif dan R&D, Alfabeta : Bandung, 2006, hal. 3. *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif Dan R&D*.

Sundari, R. S., Hidayati, R., Ahmad, F., & Tarigan, R. T. (2023). Consumer Behavior in Consuming Original Catfish Shredded As Nutritious Processed Fish. *Journal of Hygienic Engineering and Design*, *41*, 339–345.

Sundari, R.S. (2023). The Effect of Marketing Mix on Selling of Tempeh Snacks Home Industry. Proceeding. 2nd International Symposium on Marketing. Tekirdağ. TÜRKİYE. 3-4 November 2023. ISBN: 978-605-4265-73-2.

Upe, A., To'at, M., Mugambiwa, S. S., Huma, H., & Samad Akenbi, A. (2021). Strengthening Rice Farmers' Social Capital in Increasing Agricultural Productivity. *International Journal of Qualitative Research*, *1*(1), 48–54. https://doi.org/10.47540/ijqr.v1i1.305

Xu, H., Wang, P., & Ding, K. (2024). Transforming Agriculture: Empirical Insights into How the Digital Economy Elevates Agricultural Productivity in China. *Sustainability (Switzerland)*, *16*(23). https://doi.org/10.3390/su16231025

Wibowo, S. (2007). *Manajemen Produksi*. BPFE