Contents list avaliable at Directory of Open Access Journals (DOAJ)

JUTIN : Jurnal Teknik Industri Terintegrasi

Volume 8 Issue 2 2025, Page 2112-2119

ISSN: 2620-8962 (Online)

Journal Homepage: https://journal.universitaspahlawan.ac.id/index.php/jutin/index

Analysis of Productivity Using The American Productivity Center (APC) and Root Cause Analysis (RCA) Method (Case Study: Shodiq Samarinda Tempe Factory)

Dwi Tika Sariyani[1] ✉, Dutho Suh Utomo[1], Yudi Sukmono[1]

(1) Industrial Engineering Study Program, Faculty of Engineering, Mulawarman University

DOI: 10.31004/ jutin.v8i2.45264

✉ Corresponding author:
[tikadwi2730@gmail.com]

Article Info

Keywords:
Productivity;
Tempe Industry;
American Productivity Center (APC);
Root Cause Analysis (RCA)

Abstract

Productivity is one of the components that must be owned by a company to achieve its goals. This study was conducted at Shodiq Tempe Factory which has constraints in maximizing input to achieve optimal output. The purpose of this study was to analyze the level of factory productivity using the American Productivity Center (APC) method. The results of the lowest productivity index calculation were in period 4, which was -1.737%. Then some input productivity that decreased were labor input in period 2 (-23.062%), material input in period 4 (0.623%), and energy input in period 4 (-12.367%). Based on the analysis of the productivity calculation, improvements were made to the decline in productivity using the Root Cause Analysis (RCA) method. From the RCA analysis, several causes were obtained, namely lack of worker discipline, weak supervision, work fatigue, the addition of unnecessary workers, rising soybean prices, poor quality raw materials, contamination of raw materials, energy waste due to the use of electrical equipment and machines that were not properly controlled.

1. INTRODUCTION

Understanding industry in the narrow sense that is all busyness economy human beings who process goods raw or material standard So goods half So or goods So or So more stuff tall its benefits. Definition industry in a broad sense that is all busyness man inside economy in nature productive and in the form of commercial for fill up interest alive (Putri et al., 2020). In general, company tempeh part big run by the company industry domestic and business small and medium enterprises. Micro, Small and Medium Enterprises (MSMEs) have strategic role and position in economy in Indonesia. MSMEs play a role in create field work and move wheel the Indonesian economy and distribute results development economy. MSMEs are one of the type a resilient business to shock

Received 15 March 2025; Received in revised form 18 March 2025 year; Accepted 26 March 2025
Available online 10 April 2025 /

and crisis. This is proven around 1997 to 1999 where Indonesia experienced crisis monetary but UMKM actually survive and even grow (Sudrartono et al., 2022).

Productivity is ratio between the output produced by a company to number of inputs used during the production process in range time certain. The ratio of output to input is furthermore called with mark productivity (Wahyuni, 2017). Productivity is size performance including effectiveness and efficiency. Effectiveness refers to the ability for reach purpose, while efficiency refers to the ability for reach goals This use source minimum power and get maximum output. Measurement productivity company will become runway in make policy repair productivity in a way overall in the business process. Some indicator measurement identified productivity through various source related libraries with productivity, can considered by management industry for put it in to in system measurement productivity (Nyoko et al., 2020).

Measurement productivity is steps to be taken done by the company in effort increase productivity. Cycle known productivity with the term MEPI (Measurement, Evaluation, Planning, Improvement) is a closed loop that intersects related, not can separated One with others (Wahyuni, 2017). In general special There is a number of factors that can influence level productivity namely market, change, company (organization), people, reward, information, technology, condition economy (Nugroho, 2021).

One of the method measurement productivity is American Productivity Center (APC) is a method measurement index total productivity in monitor productivity from which company results measurement the detailed consisting of from results index productivity, index profitability, and index repair price (Wulandari & Ernawati, 2021). APC model can know results measurement level productivity with use period basic and evaluate return results from measurement productivity as well as influencing factors to ups and downs productivity. In terms of theoretical benchmark size profit no appropriate for made into guidelines for know existence increase and also decline productivity (Handoyo, 2010).

The APC method takes into account in a way comprehensive regarding business processes good based on size physique and also finance, based on center American productivity suggests size productivity based on relationships profitability with productivity and improvement price. The APC method is used for process or analyze data in the form of quantity data power work, amount energy electricity, amount of material, amount of capital, amount results output, and price sell product as well as expenditure cost for power work, energy, material each period set. profit from size productivity proposed by the APC method, namely produce three size productivity, including indexes productivity, index profitability, and index repair price (Muhartono et al., 2020).

2. METHODS

In this study, it explains how productivity analysis uses the American Productivity Center (APC) method at the Shodiq Tempe Factory. The purpose of this study is to determine the level of productivity at the Shodiq Tempe Factory. This is done to find out how the factory's productivity level is in optimizing the input it has because this factory has never calculated factory productivity before. Therefore, the output obtained is not optimal. In this study, the productivity measurement model uses the American Productivity Center (APC) method. The Root Cause Analysis (RCA) method with a fishbone diagram is used as a proposal to determine the factors that can affect the company's productivity level.

APC Method

The APC method is used to calculate the productivity level of output and input data for each period through several stages such as calculating the Rate On Asset (ROA) using profit data, working capital, and assets. Input costs per unit of labor, material, and energy are calculated or determined directly, while capital input is calculated or determined based on total depreciation plus relative profit to total assets (fixed assets plus working capital) used (Beatrix & Dewi, 2019). So that the capital input for a certain period is:

$$\text{Capital input} = \text{Depreciation for the period} + \frac{\text{ROA}}{\text{current assets in use}}$$

Return on Asset (ROA) in the base period can be determined as follows:

$$\text{ROA} = \frac{\text{Profit in base period}}{\text{fixed price + working capital in base period}}$$

The benefits of measuring productivity using the American Productivity Center (APC) model can produce three measures of productivity, namely the productivity index, the profitability index and the price improvement index (Beatrix & Dewi, 2019). The relationship between these measures is shown in the following formula.

$$\text{Index Productivity (IP)} = \frac{\text{Profitability Index (IPF)}}{\text{Price improvement index (IPH)}}$$

Root Cause Analysis (RCA)

Productivity evaluation is an activity that is used as a comparison between the actual conditions (from measurement results) with those that should be in accordance with standards that can be seen from other places or in accordance with what is set or planned (Wulandari & Ernawati, 2021). This method works by reviewing the causes of failure from the most basic things and then grouping each cause to make it easier to find out the main cause of the failure (Haq & Purba, 2020). The workflow of the Root Cause Analysis (RCA) method consists of several steps that must be taken:

1. Define Problem
   This step is step the first thing to do, before looking for the cause and other things, is to define the problem first to make it easier to take the next steps.
2. Collecting Data
   Data collection can be done by taking direct data (primary data), reviewing existing data that comes from several treatments that have occurred (secondary data), and can also be done by interviewing parties involved in the problem. Data that must be known include: how long the problem has existed, and the impact felt by the problem.
3. Identification Possible Causes
   Describes the sequence of events that led to the problem, under what conditions the problem occurred, and whether there were other problems that arose along with the main problem.
4. Identify Root Causes
   This step is a step that must be done very carefully and critically. To be able to find out the root of the problem, there are several tools that can be used such as: 5 Whys, fishbone diagram (fishbone/ishikawa diagram).
5. Propose and Implement Solutions
   After the four previous steps have been obtained, the final step that must be taken is to propose a solution that can be implemented effectively and efficiently.

3. RESULTS AND DISCUSSION

Index Productivity

Table 1. Productivity Index at constant prices

Description	Jul G=A/A	Ags H=B/A	Sep I=C/A	Oct J=D/A	Nov K=E/A	Dec L=F/A
Labor	100	76,938	99,852	79,745	98,651	85,183
Material	100	99,947	99,883	99,377	100,013	99,932
Energy	100	100,754	99,029	87,633	98,260	99,534
Capital	100	100,358	97,575	101,984	95,855	98,183
Total input	100	98,265	99,377	98,263	99,006	98,527

Based on results calculations in Table 1 above output and input values on the index productivity number index maximum namely capital of 101,984 in the period to 4 while number index maximum that is power Work of 76,938 in period 2. So that obtained mark decline index lowest total productivity there is in period 4 (October) namely by -1,737%.,

Index Profitability

Table 2. Profitability index based on current prices

Description	Jul G=A/A	Ags H=B/A	Sep I=C/A	Oct J=D/A	Nov K=E/A	Dec L=F/A
Labor	100	76,938	108,937	85,596	118,171	101,728
Material	100	94,149	97,029	98,399	102,669	98,551
Energy	100	100,754	108,040	95,162	117,703	118,868
Capital	100	100,357	106,453	110,745	114,821	117,253
Total input	100	94,179	99,674	99,864	106,045	102,404

Based on table 2 above results calculation of output and input on index profitability number index maximum that is energy amounting to 118,868 in the period to 6 while number index maximum that is power

Work of 76,938 in period 2. So that obtained mark decline index lowest total profitability there is in period 2 (August) namely by -5,821%.

Index Price Improvement

Table 3. Price improvement index

Description	Jul	Ags	Sep	Oct	Nov	Dec
Labor	1	1	1,091	1,086	1,198	1,198
Material	1	0.942	0.971	0.99	1,027	1,027
Energy	1	1	1,091	1,086	1,198	1,198
Capital	1	1	1,091	1,086	1,198	1,198
Total input	1	0.958	1,003	1,016	1,071	1,071

From the results calculation index productivity based on price constant and index profitability based on applicable prices so can determined index the improvements that are ratio between index profitability (IPF) and index productivity (IP) or IPH = IPF / IP. For index repair Prices at Shodiq Tempe Factory experience increase and decrease for each period. Although index repair price experience increase and decrease, but no influential big to index productivity and index profitability.

Analysis Root Causes of the Problem with the Root Cause Analysis (RCA) Method

Productivity and profitability identification is carried out on indices that often experience a decrease in the index below the base period (below 100). From the initial calculation results, several inputs were obtained that often experienced a decrease in productivity and profitability, such as labor input, material input, and energy input. The following are the results of the fishbone diagram based on productivity results from the July - December 2023 range at the Shodiq Tempe Factory as can be seen in Figure 1 below.

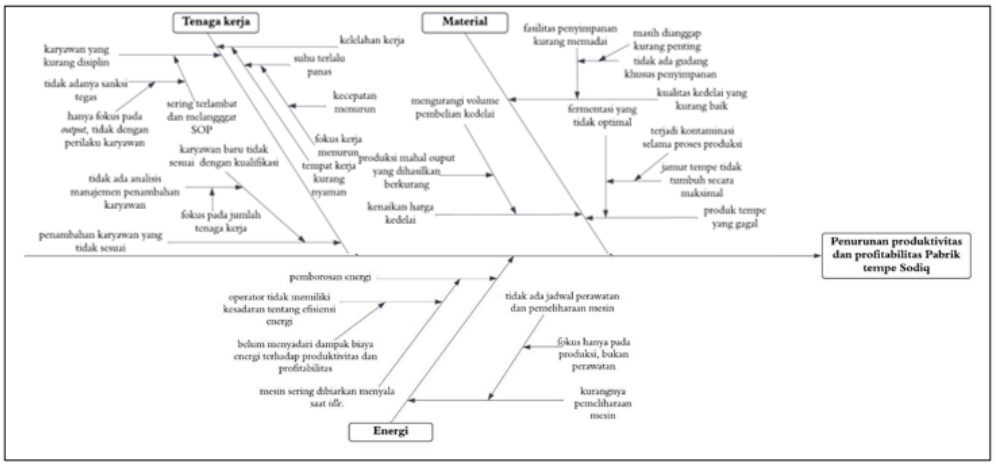

Figure 1. Fishbone diagram of productivity decline

1. Labor

   The decline productivity and profitability consequence factor power Work can due to lack of discipline of workers. Often workers come late no in accordance with the specified hours, too Lots chat with colleague work, and not comply the rules that have been set. Attitude no discipline This impact on accuracy time settlement products, so that can reduce the output produced. Furthermore, no existence sanctions for workers who violate can cause problem serious in operational factory. Without existence sanctions, workers tend lost motivation and sense of responsibility answer for give performance best. Problem other is addition amount employees who do not required. This action only will increase cost wages without offset by a significant increase in output, so that productivity precisely decreased. In addition, fatigue employees can also become factor inhibitor productivity. Workers who feel tired will tend work more slow, more often make errors, and less focus in finish tasks them. As a result, the production target become difficult achieved because time work that becomes no efficient.

2. Material
   The decline productivity and profitability in use of materials can caused by several factors, especially increase price and quality material standard soybeans which are often less than optimal. The increase price This generally due to scarcity soybeans, which occurs during harvest time not yet arrive or because farmer experience fail harvest. Situation this make the suppliers forced raise price material standard soybeans. As a result from improvement price said, the factory sued for more efficient in expenditure, which often results in a reduction amount purchased soybeans. In addition, the price Tempeh is also predicted will rise as step for adapt with increase cost material standard. Quality material less than standard good to be too problem, because can result in product the resulting tempeh no perfect. Often times, the problem quality this arise from damage during the shipping process. Contamination material standard during production is other factors that can reduce productivity as well as profitability at Shodiq Tempe Factory. If the material standard like soya bean or contaminated yeast, production process automatic disturbed, so that results obtained reduced and quality tempeh also follows decreased. In addition, storage material standard soybeans that are not adequate can lower quality soybeans. In the storage process, soybeans at risk experience rotten and moldy consequence condition humid place. This is leading to an increase waste and need discarded, which in turn will contribute to the decline productivity.
3. Energy
   The decline productivity and profitability consequence height cost energy caused by various factors, especially waste energy. One of the reason main is use equipment electricity like fan wind, water engines, and engines separator skin that often left alone light up although no currently used, consequences negligence in turn off tool this is. Of course result in improvement cost energy that is not need. Additionally, use intensive water machine every day without turn off tool after its use also contributes to waste energy. The big water machine need operation repetitive every time the water replacement process for boiling done. In addition to that, often machine separator skin soya bean still light up moment no also used to be other exacerbating factors problem waste energy. All these issues lead to increased energy costs, which unfortunately are not offset by increased production output. This situation leads to a decline in both productivity and profitability.

Suggested Improvements

Several suggestions for improvement that can be provided based on the results of the root cause analysis of the problems at the Shodiq Tempe Factory can be seen in Table 4 below.

Table 4. Proposed improvements

Factor	Root of the problem	Suggested improvements
Labor	Lack of discipline employee	Apply system reward and punishment and use board presence colored red or green
	Fatigue employee	Give time get enough rest between work and improve environment Work
	Additions employees who do not should	Do evaluation moreover formerly with capacity production actual and provide training moreover formerly
Material	Ascension price material standard soya bean	Interweaving contract still with Supplier soybeans and optimize material standard to be more economical
	Quality less soybeans Good	Inspect quality soya bean before accepted, provide place storage more soybeans adequate, and implement FIFO system
	Product tempeh fail	Always guard cleanliness during production with use sarong hand moment touch in a way direct with products and do inspection tool routinely
Energy	Waste energy	Create SOP for use tools and energy
	Lack of maintenance machine	Do evaluation machine every Sunday or month

1. Improvement Proposals for Labor Factors
   For problems with labor input, namely lack of worker discipline, weak supervision, work fatigue, and the addition of unnecessary workers, here are some appropriate proposals.
   a. Implement a reward and punishment system, provide incentives for employees who are diligent, punctual, and achieve production targets. Provide sanctions for workers who are often late, undisciplined, or do not work according to SOP.

b. Control the number of employees according to production needs, before adding new employees, evaluate whether it is really necessary.
c. Prevent employee fatigue by arranging working hours with a rotation system so that workers do not experience excessive fatigue. Provide adequate rest and ensure a comfortable work environment.

2. Improvement Proposals for Material Factors
   For problems with material input, namely increasing soybean prices, poor quality raw materials, and failed tempeh products, here are some appropriate proposals.
   a. Reduce the impact of increasing soybean prices by establishing long-term contracts with suppliers to get more stable prices. Find alternative suppliers with local farmers to get soybeans at more competitive prices.
   b. Ensure the quality of raw materials is maintained, check the quality of soybeans before receiving them from suppliers. Improve the quality of raw material storage, use closed shelves or containers so that soybeans are not exposed to moisture or pests. Implement the First In, First Out (FIFO) system so that old soybeans are used before new soybeans.
   c. Preventing failed tempeh products can be done by reducing contamination of raw materials during production, implementing strict sanitation procedures in the production area. Conduct routine inspections of production equipment to avoid contamination from machines or the work environment.
3. Suggested Improvements for Energy Factors
   For problems with energy input, namely energy waste due to the use of electrical equipment and machines that are not properly controlled, here are some appropriate suggestions.
   a. Increase awareness and supervision of energy use, create special SOPs regarding the use of electricity and energy in production. Tighten energy supervision to ensure that machines are turned off when not in use.
   b. Optimize the use of electrical machines and equipment, turn on the automatic timer on the soybean skin separator machine so that it is not on continuously. Ensure that fans and water machines are turned off after use.
   c. Reduce electricity consumption with energy-saving technology, switch to more energy-efficient equipment, such as LED lights and electricity-saving machines.

4. CONCLUSION

Based on study related with measurement productivity with at the Shodiq Tempe Factory period July 2023 to December 2023, it is known that Total productivity fluctuates at every the period , but productivity lowest by -1.737% in period 4 (October), in period 2 (August) it had level productivity power very low work that is by -23.062%, period 4 (October) has level material productivity is very low that is by -0.623%, period 4 (October) has level productivity very low energy that is amounting to -12.367%, in period 5 (November) had level very low capital productivity that is by -4.145%

Proposed improvements to increase factory productivity based on analysis of the Root Cause Analysis (RCA) method, namely implementing a reward and punishment system, providing incentives for employees who are diligent, punctual, and achieve production targets, controlling the number of employees according to production needs, establishing long-term contracts with suppliers to get more stable prices, preventing contamination of raw materials during production by implementing strict sanitation procedures in the production area, improving the quality of raw material storage, and optimizing the use of machinery and electrical equipment.

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