

Analysis Of Optimal Production Capacity Determination To Improve Operational Efficiency At Prune Home Baked

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Article Information		Abstract
Submission date	4 February 2026	Research aim : Aiming to determine and analyze the optimal production capacity in improving operational efficiency at Prune Home Baked through the application of Stopwatch Time Study. Design/Method/Approach : A quantitative descriptive approach is applied in this research. The research object is Prune Home Baked as a small-scale bakery business. Data were collected through direct observation and time measurement of each production work element, including weighing, mixing, shaping, frying, and packaging. Standard time was calculated using performance rating adjustment and allowance determination. Production capacity analysis was conducted by comparing effective working time with standard time. Research Finding : The research indicates that the actual production capacity is still below market demand due to the absence of standardized work time measurement. The shaping process was identified as the bottleneck in the production flow. The determination of standard time provides a more accurate basis for workforce allocation and capacity planning. Theoretical contribution/Originality : This research contributes to the application of work measurement and capacity planning theory in small-scale manual production-based SMEs, particularly in the bakery sector. Practitioner/Policy implication : The findings are expected to help Prune Home Baked improve operational efficiency by optimizing workforce allocation and reducing production gaps without requiring additional capital investment. Research limitation : The study is limited to one SME and focuses only on manual production activities without integrating digital production monitoring systems. Keywords : Production Capacity, Operational Efficiency, Time Study, Standard Time, SME.
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1. Introduction

The Production capacity planning remains a critical issue in small-scale manufacturing businesses, particularly those relying on manual production processes. Inaccurate estimation of production time often leads to discrepancies between demand and actual output, resulting in delivery delays and operational inefficiencies. Many small enterprises still rely on experience-based judgment rather than systematic work measurement to determine production targets. This condition highlights the urgency of implementing standardized time measurement as a foundation for effective capacity management[1].

Previous studies emphasize that work measurement techniques significantly contribute to productivity improvement in manufacturing systems. Research shows that structured time study methods can enhance operational performance by identifying inefficiencies and optimizing work elements [2]. Other findings indicate that the application of performance evaluation in production systems allows companies to establish realistic standard times and improve overall output efficiency [3]. Furthermore, integrating ergonomics and productivity analysis has been proven to support more balanced production system design [4]. Capacity planning research also demonstrates that improper workload control may lead to mismatches between demand and production capability, particularly in small and medium-sized enterprises (SMEs) [5]. In addition, workforce allocation based on time measurement results has been shown to improve productivity without requiring additional capital investment [6].

However, most previous studies were conducted in medium- and large-scale manufacturing industries with relatively advanced production systems. Empirical implementation in manually operated SMEs, particularly small food production businesses, remains limited. The majority of existing research focuses on productivity improvement in general manufacturing contexts rather than specifically analyzing actual production capacity and workforce allocation based on Stopwatch Time Study in small-scale enterprises.

This study differs from previous research by focusing on a manually operated bakery SME, namely Prune Home Baked, and integrating Stopwatch Time Study with practical capacity calculation to determine actual output standards and labor requirements. The novelty of this research lies in its empirical application of standard time determination and workforce reallocation analysis in a small-scale production setting, providing practical recommendations tailored to SME operational characteristics.

Therefore, this study aims to analyze actual production capacity, determine standard time using the Stopwatch Time Study method, and formulate optimal workforce allocation recommendations to improve operational efficiency at Prune Home Baked. This article is structured as follows: Section 1 presents the introduction, Section 2 explains the research methodology, Section 3 discusses the results and analysis, and Section 4 concludes the findings and managerial implications.

1.1. Statement of Problem

Based on the issues described in the introduction, Prune Home Baked faces challenges in managing its production capacity due to the absence of standardized working time and systematic work measurement. Production targets are determined based on estimation rather than accurate time study data, resulting in inconsistencies between planned and actual output. This condition makes it difficult to determine actual production capacity, evaluate workforce performance, and allocate labor effectively. Consequently, the business is at risk of experiencing production delays during high demand periods or operational inefficiencies due to improper workforce allocation.

1.2. Research Objectives

The objective of this study is to improve the efficiency and effectiveness of production capacity management at Prune Home Baked through the implementation of the Stopwatch Time Study method. This research aims to determine the standard time for each production process in order to obtain accurate standard output and identify the actual production capacity of the business. By applying systematic work measurement, this study also seeks to analyze the optimal workforce allocation needed to meet production demand. Furthermore, this research is expected to reduce the risk of production delays and operational inefficiencies caused by inaccurate time estimation and unbalanced workload distribution.

2. Method

This research uses a quantitative descriptive approach. Quantitative descriptive research is a method that describes research variables as they actually occur, supported by numerical data obtained from real operational conditions. The study was conducted through direct observation and interviews for approximately one month, with production data collected during the observation period under normal working conditions.

The subject of this research is Prune Home Baked, while the object of research is the production process and workforce performance in producing bakery products. Data were collected using the Stopwatch Time Study technique by measuring each work element repeatedly to obtain accurate cycle time data.

Data analysis was carried out through several stages. First, the observed time data were calculated to obtain average cycle time. Second, cycle time was adjusted using performance rating to determine normal time. Third, allowance factors were added to calculate standard time. Fourth, standard time was used to determine standard output and actual production capacity. Finally, an analysis of workforce requirements was conducted by comparing production demand with calculated production capacity to formulate optimal labor allocation recommendations.

3. Results and Discussion

3.1 Results

The production process at Prune Home Baked focuses on the manufacturing of untir-untir products. In determining production capacity, Prune Home Baked still experiences difficulties due to the absence of standardized time measurement for each work element. Production targets are often based on estimation, which may lead to inefficiencies and inaccurate workforce allocation. The following is the time observation data for the untir-untir production process obtained through direct time study.

Table 1. Result test Untir-untir Production Time Observation Data

Operator	Work Element	Obs 1 (Min)	Obs 2 (Min)	Obs 3 (Min)	Obs 4 (Min)	Obs 5 (Min)	Average (Min)
Vany	Weighing	15	11	13	10	12	12,2
	Mixing	30	35	34	38	32	33,8
	Forming	46	50	55	48	58	51,4
	Frying	14	15	13	16	18	15,2
	Packaging	3	5	4	4	5	4,2
	TOTAL AVERAGE TIME						116,8
Dyah	Weighing	16	14	10	11	13	12,8
	Mixing	33	32	34	35	40	34,8
	Forming	44	46	47	50	45	46,4
	Frying	13	12	16	15	17	14,6
	Packaging	5	4	3	4	5	4,2
	TOTAL AVERAGE TIME						112,8
Parti	Weighing	18	15	16	19	14	16,4
	Mixing	35	33	36	38	34	35,2
	Forming	50	53	47	50	52	50,4
	Frying	15	14	14	13	16	14,4
	Packaging	5	5	3	5	5	4,6
	TOTAL AVERAGE TIME						121

From the time observation data presented in Table 1, the total average cycle time required to complete one unit of product is 116.9 minutes. The forming process requires the longest average time (49.4 minutes), indicating that this stage significantly influences overall production capacity. Meanwhile, the packaging process requires the shortest time (4.3 minutes). The total combined time of all operators is 350.6 minutes, with an average production time per operator of 116.9 minutes per unit.

3.1.1 Cycle Time Observation Results (minutes)

The cycle time calculation is based on the observation results of all production work elements, namely Weighing, Mixing, Dough Forming, Frying, and Packaging, observed for each operator (Vany, Dyah, and Parti). The cycle time for each element is obtained by dividing the total observation time ($\sum X_i$) by the number of observations (n).

Table 2. Cycle Time Calculation result

Operator	Work Element	$\sum X_i$ (Minutes)	n	Cycle Time (Minutes)
Vany	Weighing	61	5	12,2
	Mixing	169	5	33,8
	Forming	257	5	51,4
	Frying	76	5	15,2
	Packaging	21	5	4,2
	TOTAL	584		116,8
Dyah	Weighing	64	5	12,8
	Mixing	174	5	34,8
	Forming	232	5	46,4
	Frying	73	5	14,6
	Packaging	21	5	4,2
	TOTAL	564		112,8
Parti	Weighing	82	5	16,4
	Mixing	176	5	35,2
	Forming	252	5	50,4
	Frying	72	5	14,4
	Packaging	23	5	4,6
	TOTAL	605		121

Based on Table 2, the longest cycle time occurs in the dough forming element, while the shortest is in packaging. The total cycle time per unit is 116.8 minutes (Vany), 112.8 minutes (Dyah), and 121.0 minutes (Parti), indicating that dough forming is the dominant process and potential production bottleneck. Dyah shows the lowest total cycle time (112.8 minutes), indicating relatively higher work efficiency compared to the other operators.

3.1.2 Performance Rating

The determination of the performance rating factor was conducted using the Westinghouse System's Rating method. This method evaluates four qualitative aspects that influence normal time, namely Skill, Effort, Condition, and Consistency. The performance rating results for each work element and operator are presented in Table 3.

Table 3. Performance Rating (Westinghouse Method)

Work Element	Aspect	Amount
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	Skill	Effort	Condition	Consistency	
A1	Super Skill	Excellent	Fair	Perfect	
	(A1)	(B2)	(E)	(A)	0,24
	0,15	0,08	-0,03	0,04	
B1	Excellent	Good	Fair	Perfect	
	(B2)	(C1)	(E)	(A)	0,14
	0,08	0,05	-0,03	0,04	
C1	Super Skill	Excellent	Fair	Perfect	
	(A1)	(B1)	(E)	(A)	0,26
	0,15	0,1	-0,03	0,04	
D1	Excellent	Good	Fair	Perfect	
	(B1)	(C1)	(E)	(A)	0,17
	0,11	0,05	-0,03	0,04	
E1	Super Skill	Good	Fair	Perfect	
	(A1)	(C1)	(E)	(A)	0,21
	0,15	0,05	-0,03	0,04	
A2	Super Skill	Excellent	Fair	Excellent	
	(A2)	(B2)	(E)	(B)	0,21
	0,13	0,08	-0,03	0,03	
B2	Excellent	Excellent	Fair	Excellent	
	(B2)	(B2)	(E)	(B)	0,16
	0,08	0,08	-0,03	0,03	
C1	Super Skill	Excellent	Fair	Perfect	
	(A1)	(B1)	(E)	(A)	0,26
	0,15	0,1	-0,03	0,04	
D2	Super Skill	Excellent	Fair	Perfect	
	(A1)	(B2)	(E)	(A)	0,24
	0,15	0,08	-0,03	0,04	
E2	Super Skill	Good	Fair	Perfect	
	(A1)	(C1)	(E)	(A)	0,21
	0,15	0,05	-0,03	0,04	
A3	Excellent	Excellent	Fair	Perfect	
	(B1)	(B2)	(E)	(A)	0,2
	0,11	0,08	-0,03	0,04	
B3	Excellent	Good	Fair	Perfect	
	(B2)	(C1)	(E)	(A)	0,14
	0,08	0,05	-0,03	0,04	
C3	Good	Excellent	Fair	Perfect	
	(C1)	(B1)	(E)	(A)	0,16
	0,05	0,1	-0,03	0,04	
D3	Super Skill	Good	Fair	Perfect	0,19

	(A2)	(C1)	(E)	(A)	
	0,13	0,05	-0,03	0,04	
	Excellent	Good	Fair	Perfect	
E3	(B2)	(C1)	(E)	(A)	0,14
	0,08	0,05	-0,03	0,04	

Based on Table 3, most work elements have performance rating values above the standard level. A rating value greater than zero indicates that the operator works at a pace higher than normal performance. Therefore, the observed cycle time must be adjusted to obtain the normal time. This performance rating factor serves as the basis for calculating normal time so that the results more accurately reflect actual operator performance.

3.1.3 Determination of Allowance

Based on operational data at Prune Home Baked, the total working time per day is 8.30 hours or 498 minutes. The total rest and allowance time provided by management is 60 minutes per day.

$$\begin{aligned}\text{Working Time} &= 8.30 \text{ jam} \times 60 \text{ menit} \\ &= 498 \text{ menit}\end{aligned}$$

$$\begin{aligned}\text{Allowance Percentage} &= 60 \text{ Menit} : 498 \text{ menit} \times 100\% \\ &= 12,04\%\end{aligned}$$

Based on the calculation, the required allowance percentage for workers at Prune Home Baked is 12.04% (0.120). This allowance value is subsequently used as an adjustment factor in calculating the final Standard Time for each work element.

3.1.4 Normal Time Calculation

Following the determination of the performance rating using the Westinghouse System's Rating method, the next stage is the calculation of Normal Time (NT). Normal Time is obtained by multiplying the observed Cycle Time (CT) by the performance adjustment factor.

As an illustration, the Normal Time for the Weighing element performed by Vany is calculated as follows :

$$\begin{aligned}W_n &= WS \times P \\ &= 12,2 \times (1 + \text{Performance Rating}) \\ &= 12,2 \times 1,24 \\ &= 15,1\end{aligned}$$

The complete Normal Time calculation results for all operators and work elements are summarized in Table 4.

Table 4. Normal Time Calculation Results

Operator	Work Element	Cycle Time (Min)	Allowance	Normal Time (min)
Vany	Weighing	12,2	0,24	15,1
	Mixing	33,8	0,14	38,5
	Forming	51,4	0,26	64,8
	Frying	15,2	0,17	17,8
	Packaging	4,2	0,21	5,1
Dyah	Weighing	12,8	0,21	15,5
	Mixing	34,8	0,16	40,4
	Forming	46,4	0,26	58,5
	Frying	14,6	0,24	18,1
	Packaging	4,2	0,21	5,1
Parti	Weighing	16,4	0,2	19,7
	Mixing	35,2	0,14	40,1
	Forming	50,4	0,16	58,5
	Frying	14,4	0,19	17,1
	Packaging	4,6	0,14	5,2

Based on Table 4, the Normal Time values are higher than the observed Cycle Time due to performance adjustments. This reflects the correction of observed time to represent normal working conditions. The resulting Normal Time provides a more objective measurement of operator performance and serves as the fundamental basis for determining Standard Time and subsequent production capacity analysis.

3.1.5 Standard Time Determination

After obtaining the Normal Time (NT), the next step is determining the Standard Time (ST) by incorporating the allowance factor. Standard Time represents the time required by an operator to complete a task under normal working conditions, including rest and unavoidable delays.

An example calculation for the Weighing element performed by Dyah is:

$$\begin{aligned}
 WS &= waktu\ normal \times \frac{100\%}{100\% \times allowance\%} \\
 &= 15,1 \times \frac{100\%}{100\% \times 12,04\%} \\
 &= 13,31
 \end{aligned}$$

The complete Standard Time results are presented in Table 5.

Table 5. Normal Time Calculation Results

Operator	Work Element	Normal Time (Min)	Allowance (%)	Standard Time (Min)
Vany	Weighing	15,1	0,120	13,31
	Mixing	38,5	0,120	33,89
	Forming	64,8	0,120	56,97
	Frying	17,8	0,120	15,64
	Packaging	5,1	0,120	4,47
	Total			124,28
Dyah	Weighing	15,5	0,120	13,62
	Mixing	40,4	0,120	35,51
	Forming	58,5	0,120	51,42
	Frying	18,1	0,120	15,92
	Packaging	5,1	0,120	4,47
	Total			120,95
Parti	Weighing	19,7	0,120	17,31
	Mixing	40,1	0,120	35,30
	Forming	58,5	0,120	51,42
	Frying	17,1	0,120	15,07
	Packaging	5,2	0,120	4,61
	Total			123,72

Based on Table 5, the Standard Time values are higher than the Normal Time due to the inclusion of allowances. This adjustment ensures that the calculated time reflects realistic working conditions. Standard Time serves as the final reference for determining production capacity and evaluating operational efficiency at Prune Home Baked.

3.1.6 Standard Output and Production Capacity

After determining the total Standard Time required to complete one unit of product, the next step is calculating the daily production capacity (Standard Output). The Standard Output is obtained by dividing the effective daily working time by the total Standard Time per unit.

Table 6. Normal Time Calculation Results

Operator	Time Per Tray (Min)	Standard Output (unit/day)	Actual Output (tray/day)	Target (tray/day)	Achievement (%)
Vany	124,28	3,86	4,11	6	68,5%
Dyah	120,95	3,97	4,26	6	71,0%
Parti	123,72	3,88	3,97	6	66,2%

Average	-	3,90	4,11	6	68,6%
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Based on Table 6, the standard production capacity per operator ranges between 3 – 4 trays per day. When compared to the company's production target of 6 trays per day, none of the operators achieve the expected output. The achievement percentage ranges from 66% to 71%, indicating a significant production gap.

This gap demonstrates that the current production capacity at Prune Home Baked is insufficient to meet demand. The relatively high Standard Time per unit directly affects daily output performance. Therefore, improvement strategies are required, such as increasing the number of operators, redistributing tasks, or enhancing efficiency in the bottleneck process to achieve the targeted production capacity.

3.2 Discussion

This study applied the Stopwatch Time Study method to determine Standard Time and evaluate production capacity at Prune Home Baked. The results show that the Standard Time is 122.99 minutes per unit, resulting in an average production capacity of 3.89 units per day per operator. This is significantly below the company's target of 6 units per day, indicating an operational inefficiency of 31.5%.

The inefficiency is mainly caused by the absence of standardized time measurement and suboptimal workforce allocation. Workload analysis shows that achieving the production target requires 1.54 operators, which must be rounded up to 2 operators. This indicates that the current labor allocation is insufficient to meet production demand.

These findings are consistent with previous studies emphasizing the importance of work measurement in improving productivity. [1] highlight that the absence of standard time leads to inefficiency in SMEs. Similarly, [2] show that time study helps identify bottlenecks, which in this study is found in the forming process. [3] also supports that standard time provides an objective basis for performance evaluation, while [4] emphasizes the importance of workload analysis in determining optimal labor needs.

In addition, [5] and [6] confirm that mismatches between capacity and workload are common in SMEs due to the lack of systematic planning. The 31.5% production gap found in this study further reinforces the need for data-based capacity planning.

Overall, this study demonstrates that integrating Standard Time determination with workforce allocation analysis provides a practical approach to improving production efficiency. These findings offer valuable insights for SMEs to optimize labor use and establish more realistic production targets.

4. Conclusion

This study aimed to determine the Standard Time and evaluate production capacity at Prune Home Baked using the Stopwatch Time Study method. The results show that the established Standard Time is 122.99 minutes per unit, resulting in an average actual production capacity of 3.89 units per day per operator. This output is significantly lower than the company's production target of 6 units per day, indicating an operational inefficiency of 31.5%. Furthermore, workload analysis reveals that achieving the production target requires 1.54 operators per workstation, which must practically be rounded up to two operators to meet daily demand.

This research contributes both theoretically and practically. From a scientific perspective, the study strengthens the application of quantitative work measurement in small-scale food production industries, particularly in integrating time standardization with workforce allocation analysis. From a practical standpoint, the findings provide a data-driven basis for operational decision-making, enabling management to determine realistic production targets and appropriate labor allocation. The novelty of this study lies in combining Standard Time determination with workforce requirement analysis to directly address production gaps in a micro-enterprise context.

Despite these contributions, this study has limitations. The analysis is limited to manual production processes and focuses on a single product line within one business unit. External factors such as demand variability, machine utilization, and production layout were not examined in detail. Future research may expand the analysis by incorporating line balancing methods, productivity improvement techniques, or simulation-based capacity planning to obtain more comprehensive operational optimization strategies.

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These three AI platforms serve as tools, such as to obtain initial references, summarize existing information, and synthesize relevant theories. It is important to note that all AI-generated content is not used directly or taken word for word, but rather has gone through an in-depth process of review, editing, and curation by the authors to ensure the accuracy, authenticity, and integrity of the information displayed.

The author remains active in interpreting, validating, and making decisions regarding each information used. Thus, the final result of this work is the result of a collaboration between the use of AI technology and the author's critical thinking.

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