



Research Article

## Identification of Operational Performance in Service Operations through the Evaluation of Waiting Time and Technician Performance at AHASS Workshops

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### ABSTRACT

This study aims to evaluate the operational performance of AHASS motorcycle service workshops, where technicians' working hours and service speed are critical to ensuring service quality and operational efficiency. The workshop performance was assessed using the Overall Equipment Effectiveness (OEE) framework, combined with the Six Big Losses approach, to identify the main sources of time loss and formulate improvement strategies. Data were collected through field observations, interviews with technicians and workshop managers, and historical service records. Technician operational data were analyzed to calculate the OEE components, namely availability, performance, and quality, while Six Big Losses analysis and a Fishbone Diagram were applied to identify the root causes of inefficiencies. The results show that OEE values ranged from 82.49% to 87.15% during the observation period, with the highest value in April, and some months remained slightly below the world-class benchmark. Although the quality component consistently remained above 99%, decreases in availability and performance were the main factors reducing overall OEE. Breakdown losses were the largest contributor to inefficiency, accounting for 267.52 hours (37.37%) of total losses, followed by reduced speed losses at 24.75% and idling and minor stoppages at 22.44%. This study extends the application of OEE and Six Big Losses from the manufacturing sector to motorcycle service operations and provides practical insights for improving technician scheduling, optimizing service workflows, and supporting continuous performance improvement in service-based industries. These findings support data-driven decision-making.

## 1. INTRODUCTION

The technician's ability to work quickly and efficiently is crucial to providing high-quality services in motorcycle service workshops (Rahmad et al., 2023). This efficiency reflects how effectively technicians manage their time and maintain the quality of the vehicles they service in accordance with operational standards. Technical efficiency is an essential factor in ensuring that the maintenance process runs smoothly within the allotted service time (Ariawan et al., 2025). When inefficiencies are not properly identified and addressed, they can lead to idle time, reduced technician performance, and extended service duration, ultimately lowering customer satisfaction and overall effectiveness (Setiawan et al., 2024).

These challenges emphasize the importance of conducting a comprehensive evaluation of work performance to

identify areas that require improvement. To systematically assess and classify performance losses, several studies have applied the Six Big Losses framework. This approach categorizes inefficiencies into six major types, namely breakdown losses, setup and adjustment losses, idling and minor stoppages, reduced speed, process defects, and yield losses, providing a clear foundation for performance analysis and improvement (Suseno & Aji, 2022). Meanwhile Wahid et al., (2022) demonstrated that the Overall Equipment Effectiveness (OEE) method provides a quantitative approach to measure availability, performance, and quality as the main indicators of operational efficiency. Their research proved that OEE is effective for identifying effectiveness losses in manufacturing processes, but the human-related dimension of efficiency has not been fully considered. Combining OEE and Six Big Losses, therefore, enables organizations



to measure operational effectiveness comprehensively and identify the root causes of inefficiency.

Although OEE and Six Big Losses were initially developed in the manufacturing sector to evaluate machine effectiveness, recent studies show that these methods can be adapted to service-based and human-centered work processes. Facchinetti & Citterio, (2022) demonstrated that OEE can be used to evaluate employee performance in telecommunication service companies, confirming that it is not limited to machine measurement. Luozzo et al., (2021) developed an OEE-based approach separating human contributions from technical aspects, emphasizing that operator variability, including procedural accuracy, working speed, and learning curves, influences operational effectiveness. These findings were reinforced by Luozzo et al., (2023), who linked human factors with OEE parameters, supporting the validity of OEE for assessing technician performance, service workflows, and human-based operational effectiveness.

The analysis is strengthened by integrating the Fishbone Diagram (cause and effect diagram), which identifies the root causes of inefficiencies through six aspects: human, machine, method, material, measurement, and environment (Ramadhina et al., 2025). The combination of these three approaches provides a systematic way to analyze performance losses, enabling a more detailed understanding of operational issues and improvement opportunities (Marfinov & Pratama, 2020).

Therefore, this study evaluates technician performance and customer waiting time at AHASS motorcycle service workshops using the OEE and Six Big Losses frameworks integrated with the Fishbone Diagram. This approach provides a comprehensive assessment of service efficiency and identifies key operational inefficiencies. The findings contribute theoretically by extending OEE and Six Big Losses applications to service industries, and practically by offering recommendations to improve technician effectiveness, workflow, and customer satisfaction.

## 2. METHOD

### 1. Research Framework

This study primarily uses OEE and Six Big Losses methodologies as analytical tools. Although AI integration is not applied in this research, it is recommended for future studies to enhance data analysis through real-time monitoring, predictive analytics, and pattern recognition within the OEE framework. The combination of OEE and AI would allow real-time monitoring, predictive analysis, and pattern recognition, providing more accurate performance evaluation compared to conventional methods. AI integration could also assist in identifying hidden performance trends, predicting potential downtime, and optimizing technician scheduling. This enhancement

would support data-driven decision-making and offer deeper insights into operational efficiency in motorcycle service workshops.

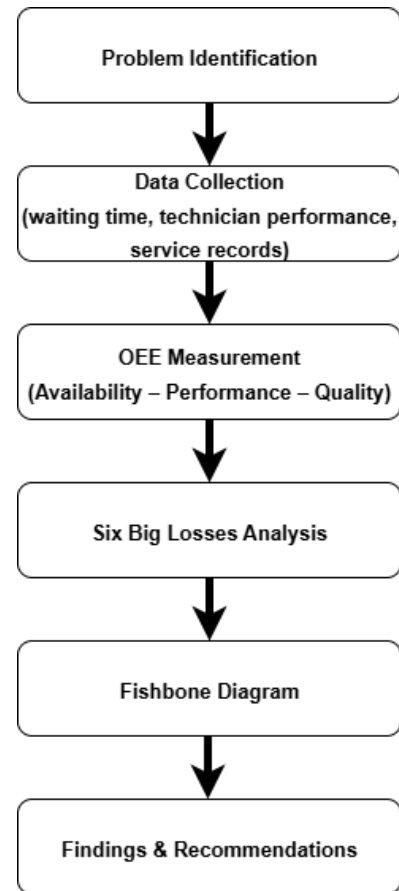


Fig 1. Research Flow Diagram

### 2. Overall Equipment Effectiveness

Overall Equipment Effectiveness (OEE) is a technique used to evaluate how well a machine or system operates by considering multiple factors during the evaluation process. It provides a precise and measurable framework that supports continuous improvement, monitors operational performance, and helps identify underlying issues (Tammya & Herwanto, 2021). Availability, performance, and quality are the three main interrelated indicators that make up OEE (Hadi Ariyah, 2022).

Availability calculates the percentage of actual operating time that differs from the planned time, detecting losses brought on by delays or equipment failure. By contrasting the actual processing speed with the ideal benchmark, performance evaluates how effectively the operation operates. The proportion of services rendered without flaws or requiring rework is a measure of quality. The overall equipment effectiveness (OEE) value indicates the final level of effectiveness, which is determined by each of these factors (Vianty et al., 2022). Businesses can methodically prioritize the steps necessary to improve operational effectiveness by using OEE assessment. In order to maximize overall performance and effectiveness,

this strategy helps organizations to pinpoint important areas that need improvement, allocate resources more effectively, and put specific initiatives into action (Diemsi & Apsari, 2025). The following is the formula for calculating OEE:

$$OEE = \text{Availability} \times \text{Performance} \times \text{Quality} \quad (1)$$

With the following breakdown of each component:

#### 1. Availability

Availability is the ratio of operating time to loading time (Sofiana et al., 2022). Loading time refers to the total time technicians are scheduled to work, excluding breaks, while operating time is the actual productive time after subtracting delays, errors, and interruptions. This indicator reflects how effectively technicians utilize their allotted time.

$$\text{Availability} = \frac{(\text{Operating Time})}{(\text{Loading Time})} \times 100\% \quad (2)$$

#### 2. Performance

Performance is calculated by multiplying the number of units processed by the optimal cycle time and dividing the result by the actual operating time (Hartono & Hadi, 2022). This metric displays the technician's effectiveness in relation to the optimal service time standard. When the performance value is high, the technician may finish the service on time or nearly on time; when it is low, the service process is slowed down or inefficient.

$$\text{Performance} = \frac{(\text{Processed amount}) \times (\text{ideal cycle time})}{(\text{Operating Time})} \times 100\% \quad (3)$$

#### 3. Quality

Quality is defined as the proportion of effectively processed, defect-free items to all products produced (Syarifudin et al., 2022). The percentage of job outputs that satisfy quality criteria is displayed by this indicator. limited numbers suggest issues with the quality of the process outcomes, whereas high values show a limited amount of defective items.

$$\text{Quality} = \frac{(\text{Amount produced}) - (\text{Amount Defect})}{(\text{Amount Product})} \times 100\% \quad (4)$$

When a company's OEE value reaches world-class standards, which are greater than 85%, it is considered to be at its ideal. This cutoff point denotes sustained high-quality output, low downtime, and great productivity (Alkaf et al., 2025). An important metric in attempts to enhance operational performance and efficiency is the

OEE value, which shows the overall effectiveness of a system or process (Nurardisa, A. I., & Winursito, 2025).

**Table 1.** Ideal Value of OEE Calculation

Description	Value
Availability	90%
Performance	95%
Quality	85%
OEE	85%

### 3. Six Big Losses

Efficiency is a metric that reflects how well resources, including time, labor, and equipment, are utilized in a process to provide services that are timely, reliable, and of high quality. Measuring efficiency helps identify areas for improvement, optimize resource use, and enhance overall operational performance (Ahdiyat & Nugroho, 2022).

The Six Big Losses methodology is frequently used to pinpoint the causes of declining operational efficiency. Breakdown losses, setup and adjustment losses, minor stoppages and idle time, decreased speed, process faults, and yield losses are the six categories into which this framework divides losses (Prasmoro et al., 2025).

The primary reasons for deteriorating operational performance can be methodically identified and analyzed using this paradigm. The findings from this analysis provide a solid foundation for designing and implementing focused improvement measures, which aim to enhance efficiency, optimize resource utilization, and ultimately raise overall operational performance across the workshop (Prasmoro & Fauzi, 2024). To measure each loss and evaluate its effect on total service efficiency, the following formulas are used.

#### 1. Breakdown Losses

Breakdown losses refer to time losses caused by unexpected failures or breakdowns during service operations, such as unprepared technicians, equipment malfunctions, or sudden adjustments required during the service process. These unplanned interruptions reduce operating time and directly affect availability due to inefficient utilization of working hours. The following formula is used to calculate breakdown losses:

$$\text{Breakdown Losses} = \frac{(\text{Total Downtime})}{(\text{Loading Time})} \times 100\% \quad (5)$$

#### 2. Setup and Adjustment Losses

Setup and adjustment losses occur when a technician needs time to prepare or adjust equipment before starting the service. This waiting period reduces overall operational efficiency, and can be calculated using the following formula:

$$\text{Setup and Adjustment Losses} = \frac{(\text{setup and adjustment})}{(\text{Loading time})} \times 100\% \quad (6)$$

### 3. Idle and Minor Stoppage

This loss happens when there is a prolonged delay in the service, such as when a line of cars or technicians waits for their turn. This time still lowers work effectiveness, even for a brief period of time. The following calculation can be used to determine idle and minor stoppage losses:

$$\text{Idle and Minor Stoppage} = \frac{(\text{Available Time}) - (\text{Active Time})}{(\text{Loading Time})} \times 100\% \quad (7)$$

### 4. Reduced Speed

When technicians work more slowly than the standard cycle time, their effectiveness decreases, leading to delays in completing services. To meet service time goals and maintain operational efficiency, it is critical to recognize and minimize reduced speed, as it directly impacts overall performance and customer satisfaction. To determine reduced speed, use the following formula:

$$\text{Reduced Speed} = \frac{(\text{Ideal Time}) - (\text{Active Time})}{(\text{Ideal Time})} \times 100\% \quad (8)$$

### 5. Defect in Process

Defect in process is a loss brought on by service outcomes that fall short of quality requirements. This condition increases work time and decreases efficiency, as defective results often require rework or adjustments, yet it is still fixable. The following formula can be used to calculate process defects:

$$\text{Defect in Process} = \frac{(\text{Total Rework}) - (\text{Ideal Cycle Time})}{(\text{Loading Time})} \times 100\% \quad (9)$$

### 6. Yield Losses

At the start of the work process, when the service outcomes are not yet completely steady, yield losses take place. This condition occurs because the process has not yet reached an ideal workflow, rather than due to a failure to meet quality standards. These initial inefficiencies may temporarily reduce effectiveness but can usually be improved as the process stabilizes. Yield losses can be calculated using the following formula:

$$\text{Yield Losses} = \frac{(\text{Initial Defective Output})}{(\text{Operating Time})} \times 100\% \quad (10)$$

At AHASS workshops, the Six Big Losses are used to identify inefficiencies in the service process and support performance measurement through Overall Equipment Effectiveness (OEE). This approach helps the workshop implement

targeted improvements to enhance operational efficiency and service quality.

## 3. RESULT AND DISCUSSION

### 1. Operational Data

Tables 2 and 3 offer crucial information for evaluating the Six Big Losses and computing Overall Equipment Effectiveness (OEE) during AHASS service sessions. To assess the quality component, Table 2 shows monthly service amounts for paid, free, and repeated services, which provide an overview of service outcomes. Performance and availability are determined by working days, optimum service time, available time, and active time, all of which are listed in Table 3. Together, these statistics support the analysis of technician productivity and service performance, facilitate the classification of service losses, and help identify the main sources of inefficiencies that affect operational effectiveness.

**Table 2.** Monthly Service Number Data

Month	Monthly Service Amount (Free)	Monthly Service Amount (Paid)	Rework Service
January	292	134	3
February	272	112	0
March	270	171	0
April	310	143	2
May	278	137	2

**Table 3.** Workshop Operational Hours Data

Month	Working days	Ideal Time (Hours)	Available Times (Hours)	Active Time (Hours)
January	24	546.70	630	551.33
February	21	473.60	551.25	494.25
March	24	529.20	630	577.98
April	23	528.50	603.75	580.92
May	24	522.20	630	573

After collecting the required data, Overall Equipment Effectiveness (OEE) was calculated to evaluate operational efficiency through three key components: availability, performance, and quality. The Six Big Losses analysis was then used to identify the main sources of inefficiency, including breakdowns, setup and adjustment delays, reduced speed, minor stoppages, and quality defects. The integration of OEE and Six Big Losses provides a comprehensive evaluation of service performance and technician productivity, supporting operational optimization and performance improvement.

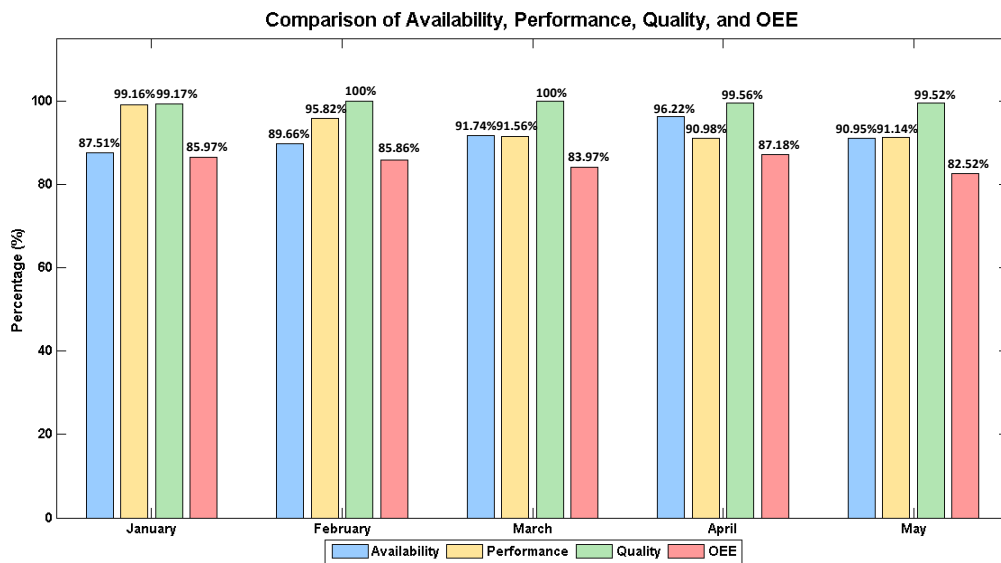
## 2. OEE Calculation

The OEE values calculated from the operational data are presented in Table 4. During the five-month observation period from January to May, OEE values ranged between 82.49% and 87.15%, with the highest value recorded in April at 87.15% and the lowest in May at 82.49%. Availability increased from January to April and reached

its highest level at 96.22% in April, before declining in May. Performance values ranged from 90.98% to 99.16%, while the quality component consistently exceeded 99% throughout the observation period. Overall, the workshop's operational performance remained close to the world-class OEE benchmark of 85%.

**Table 4.** Overall Equipment Effectiveness Value Calculation Results

Month	Availability	Performance	Quality	OEE
January	87.51%	99.16%	99.17%	85.97%
February	89.66%	95.82%	100%	85.86%
March	91.74%	91.56%	100%	83.97%
April	96.22%	90.98%	99.56%	87.18%
May	90.95%	91.14%	99.52%	82.52%



**Fig 2.** Monthly Comparison of Availability, Performance, Quality, and OEE

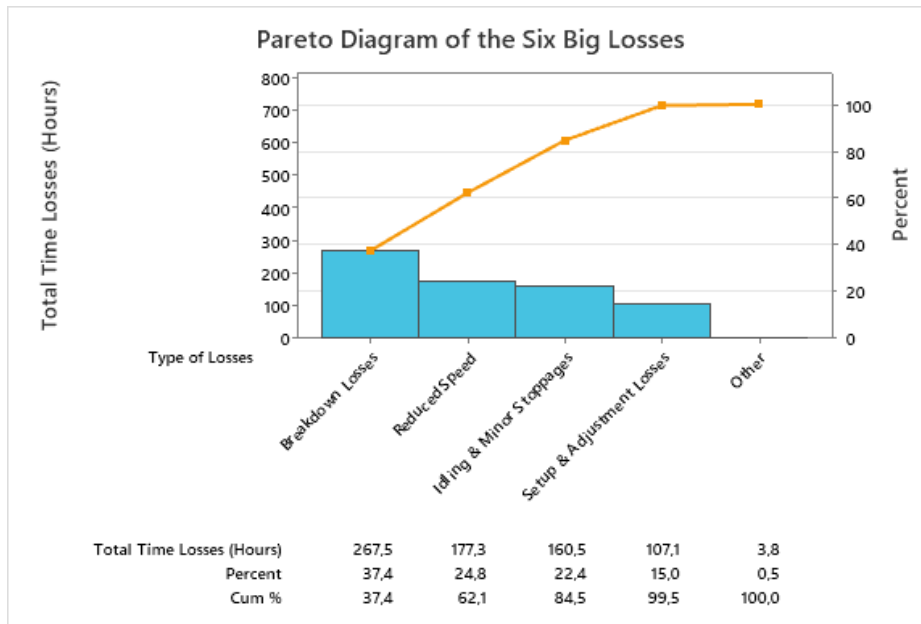
## 3. Six Big Losses Calculation

As shown in Table 5, breakdown losses were the largest contributor to inefficiency, accounting for 37.37% of total losses, followed by reduced speed losses at 24.75% and idling and minor stoppages at 22.44%. Setup and adjustment losses contributed 14.95%, while yield losses

and defects in process had minimal impact, accounting for 0.49% and 0%, respectively. Overall, the results indicate that time-related losses dominated the total performance losses in the workshop, whereas quality-related losses had a negligible effect.

**Table 5.** Six Big Losses Calculation Results

Types of Losses	Total Time Losses (Hours)	Percentage	Cumulative Percentage
Breakdown Losses	267.52	37.37%	37.37%
Reduced Speed	177.28	24.75%	62.12%
Idling & Minor Stoppages	160.51	22.44%	84.56%
Setup & Adjustment Losses	107.10	14.95%	99.51%
Yield Losses	3.78	0.49%	100%
Defects in Process	0	0%	100%

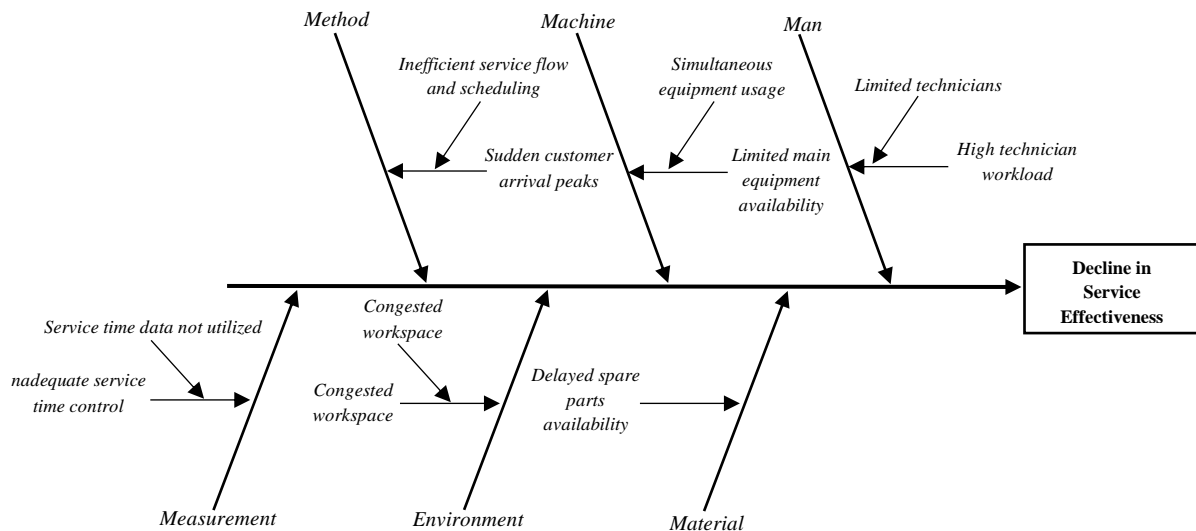


**Fig 3.** Pareto Diagram of Six Big Losses Calculation Results

**4. Fishbone Diagram**

To further examine the underlying causes of the dominant losses identified in Table 5, a Fishbone Diagram was developed and presented in Figure 4. This diagram was used to organize the possible causes of service inefficiency into six aspects: human, method, machine, material, environment, and measurement. By grouping the causes in this way, it becomes easier to understand which factors most strongly affect service performance. The analysis

shows that inefficiencies were mainly driven by human and method factors, such as technician workload and service workflow arrangements. In contrast, machine, material, and measurement factors contributed less significantly, indicating that the decline in service effectiveness was primarily influenced by human-related and procedural issues rather than technical limitations.



**Fig 4.** Causes of Declining Service Effectiveness in a Fishbone Diagram

The analysis shows that the operational efficiency of the AHASS workshop is relatively stable, with OEE values approaching the world-class benchmark in several months, although some months remained below the standard. Fluctuations in OEE are mainly driven by availability and performance, while quality remains consistently high. The

Six Big Losses analysis indicates that the largest sources of performance loss are breakdowns, reduced speed, and idling or minor stoppages, confirming that inefficiencies are primarily related to time utilization and technician performance rather than service quality.

From a 5W+1H perspective, these inefficiencies mainly occur when service demand peaks during busy workshop hours and where technicians must share limited tools and workspaces. They involve who, the service technicians, and are caused by what, including high workloads, uneven job distribution, and suboptimal service workflows. These factors explain why breakdowns, reduced speed, and idling losses dominate, and how they arise through overlapping service tasks and insufficient coordination. Therefore, improvement efforts should focus on workload-based technician scheduling, service workflow restructuring, and the implementation of consistent service time standards. In addition, adopting a digital service time monitoring system can help reduce idle time and improve service speed. Consistent with the findings of (Facchinetti & Citterio, 2022) Facchinetti & Citterio, (2022) and Luozzo et al., (2021), this study demonstrates that OEE and Six Big Losses can be effectively adapted to service operations, highlighting the relevance of structured performance evaluation even in human-centered service processes.

#### 4. CONCLUSION

This study identified the operational performance of AHASS motorcycle service workshops through the evaluation of technician performance and time-related service delays using the Overall Equipment Effectiveness (OEE) and Six Big Losses approaches. The results showed that breakdowns, reduced speed, and idling or minor stoppages were the dominant contributors to service delays and performance losses, which directly increased effective waiting time and reduced overall operational efficiency. These findings confirm that OEE and Six Big Losses can be effectively applied in service operations to quantify technician performance and identify time-based inefficiencies.

The analysis further revealed that most service delays and performance losses were caused by human and procedural factors rather than technical limitations. This indicates that customer waiting time and service efficiency depend strongly on how technicians manage their workload, coordinate service activities, and follow standardized workflows. From a practical perspective, this study provides useful guidance for workshop management in designing workload-based technician scheduling, improving service flow, and reducing waiting time caused by breakdowns, reduced speed, and idle periods. The Fishbone Diagram supported the identification of root causes of these inefficiencies, while future integration of digital systems or Artificial Intelligence (AI) could further enhance real-time monitoring, predictive analysis, and operational decision-making.

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