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OPTIMIZATION OF GAS STATIONS SERVICES PERFORMANCE IN YOGYAKARTA CITY TO IMPROVE COMPANY WORK PRODUCTIVITY

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ABTSRACT

Pertamina gas stations have an important role in the national economy. Optimizing performance in this sector is very necessary to improve Pertamina's internal performance, optimize state revenue, and increase customer satisfaction. At the motorcycle Pertalite filling work station, long queues often occur. This study aims to evaluate the current fuel filling work method, so that optimization analysis and improvement proposals can be carried out. The methods used are time study and MOST. The results of the time study from observations of 300 respondents from 15 gas stations in Yogyakarta are that the average working time of respondents is 33.78 seconds with a normal time of 33.19 seconds and a standard time of 44.85 seconds. While the results of processing using MOST obtained a TMU value of 810 if converted into seconds to 29.16 seconds. Furthermore, an analysis and improvement proposal were carried out which gave a working time result of 19 seconds, with a normal time of 18.62 seconds and a standard time of 25.19 seconds. Things that need to be improved in the process of filling Pertalite fuel for motorbikes are to prepare the motorbike with the seat and tank already open in 1 queue before the work station, make payments during the filling process, and move the motorbike immediately after the filling process is complete (closing the tank and seat is done outside the work station).

Keywords: MOST, Time Study, Optimalisasi, Gas Station

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1. INTRODUCTION

Public Fuel Filling Stations or abbreviated as gas station have an important role in the economy both for the community as a means of transportation and for the government as a source of state revenue. From the perspective of the community as users, complaints are still often found on the service system and long queues. Therefore, a performance evaluation needs to be carried out so that improvement efforts can be determined to increase customer satisfaction. Meanwhile, from the government's perspective, Pertamina has an important role in the country's economy. Quoted from the Pertamina website (Santoso, 2021), during the 2021 pandemic, Pertamina contributed IDR 126,7 trillion. Of course, this figure will increase as economic activities start to move again after the pandemic. Based on Pertamina's large contribution to the country, the government needs to pay attention to services, so that continuous improvements are obtained.

The object of this research is Pertamina gas stations located in the Yogyakarta City area. Based on information obtained from the website (Mypertamina), there are 17 gas stations in the area. Furthermore, all gas stations will be saturated samples for observation, calculation, and performance evaluation objects. Furthermore, the object of research is specifically focused on the Pertalite fuel filling unit for motorcycles, because this unit often has long queues. From this research, an effective work process sequence will be sought in refueling by minimizing and eliminating unnecessary movements, so that the most optimal standard time and standard time are obtained. Thus, the refueling time becomes more efficient, the number of queues can be minimized, and the number of service outputs in a unit of time becomes more optimal.

In this study, a work measurement analysis was conducted. Work measurement is the identification of the time needed by workers to complete a job. Zandin (2021) in his book MOST Work Measurement Systems said that work measurement is very important for a company because it can increase productivity and reduce waste. In this study, an analysis was carried out using time study. From this time study analysis, work time (cycle time), normal time, and standard time were obtained (Martis et al, 2021). Furthermore, a movement analysis was carried out with a movement study using Therblig and flow processing chart (FPC). The results of the movement analysis were continued with MOST analysis to find repetitive movements, eliminate complicated work, and simplify work (Ganorkar, Lakhe, Agrawal, 2019).

Until now, research related to gas station performance is still very limited. Research that has been done includes minimizing queues, policy flows, and customer satisfaction. In this study, a breakdown of movement elements will be carried out using time study and therblig when refueling, both movements carried out by consumers and by gas station operators. The results of this movement element breakdown will then be used as a reference for calculating process time using the Maynard Operation Sequence Technique (MOST) method. Furthermore, the researcher provides effective movement proposals, which will then be used to calculate the proposed process time. From the results of the calculation of the initial process time with the proposed process time, the amount of improvement that can be made will be known. Furthermore, the proposed improvement movement can be used as a reference for making SOP policies at Pertamina gas stations.

Several studies related to gas stations that have been conducted previously, such as research conducted by Pangestu and Soesanto (2023), that the policies implemented at Pertamina have a significant impact, both on income, operational efficiency, the environment, and social relations with the community and stakeholders. Hanggara & Putra (2020) studied the number of queues, queue times and utility values resulting in proposals for improvements by adding servers to each fueling lane and increasing the number of operators on each server. Research by Astuti, et al (2022) focused on time study and FPC obtained a distance optimization of 13.50 meters and an optimization of transportation time of 70.50 seconds in one production cycle with proposed layout improvements to reduce distance and process time. Research by Lumbantobing, Purbasari, and Siboro (2018) and Yuamita and Nurraudah (2022) analyzed movements with MOST and made improvements by eliminating unnecessary movements to reduce process time and increase productivity.

The purpose of this study is to evaluate the way the fuel filling process is currently running, so that optimization and improvement analysis can be carried out. With these improvements, it is expected to improve the company's performance both materially (profit) and non-materially (consumer satisfaction).

2. RESEARCH METHODOLOGY

Data Adequacy Test

Data adequacy test is used to determine the amount of data collection that should be done. Data adequacy test formula (Walpole, 1990):

$$N' = \left[\frac{\frac{k}{s}\sqrt{N\sum X^2 - \left(\sum X\right)^2}}{\sum X} \right]^2$$

With:

N' = theoretical data amount
N = amount of observation data
k = level of confidence
s = degree of accuracy

Time Study

Time study is used to determine company standards by taking into account the sample time of employee performance (Heizer et al, 2017). From the time study, the average working time, normal time, and standard time are determined.

$$\text{Average observed time} = \frac{\text{Sum of times recorded to perform each element}}{\text{Number of observations}}$$

$$\text{Normal time} = \text{Average pbserved time X Prformance rating factor}$$

$$\text{Standard time} = \frac{\text{Total normal time}}{1 - \text{Aloowance factor}}$$

Performance rating factor in this case is the adjustment factor used to maintain operator performance so that it can be said to be normal. There are several methods that can be used. In this study the Westinghouse method was used. The Westinghouse method considers four factors in assessing operator performance, namely skill, effort, working conditions, and consistency.(Sutalaksana, 2006). The four aspects are then given a level of assessment, namely perfect, excellent, good, average, fair, and poor. Each level has characteristics shown in table 1.

Table 1. Assessment Westinghouse

SKILL			***EFFORT***		
+ 0,15	A1	Superskill	+ 0,13	A1	Superskill
+ 0,13	A2		+ 0,12	A2	
+ 0,11	B1	Excellent	+ 0,10	B1	Excellent
+ 0,08	B2		+ 0,08	B2	
+ 0,06	C1	Good	+ 0,05	C1	Good
+ 0,03	C2		+ 0,02	C2	
0,00	D	Average	0,00	D	Average
- 0,05	E1	Fair	- 0,04	E1	Fair
- 0,10	E2		- 0,08	E2	
- 0,16	F1	Poor	- 0,12	F1	Poor
- 0,22	F2		- 0,17	F2	
CONDITION			***CONSISTENSY***		
+ 0,06	A	Ideal	+ 0,04	A	Ideal
+ 0,04	B	Excellent	+ 0,03	B	Excellent
+ 0,02	C	Good	+ 0,01	C	Good
0,00	D	Average	0,00	D	Average
- 0,03	E	Fair	- 0,02	E	Fair
- 0,07	F	Poor	- 0,04	F	Poor

Allowance is needed by operators to be able to work well, taking into account personal needs, eliminating fatigue, and unavoidable things so that the determination of standard time represents actual conditions (Annisa, 2020). The following is a table of allowance determination according to the guidelines from the ILO (International Labor Office) (1992):

Table 2. Determination *ILO Allowance*

	Variables / Factors	*Allowance*	Variables / Factors	*Allowance*
A	Consistent Allowance		Noise Level	
	Personal Allowance	5	Continously	0
	General Fatigue Allowance	4	A bit noisy	2
B	Variable Allowance		Noisy	5
	Standing Allowance	2	Very Noisy	7
	Abnormal Allowance Position:		Mental Pressure	
	- A bit odd	0	Quite a Complex Process	1
	- Improper (hunchback)	2	Complex or wide attention span	4
	- Very Improper (Lying Down, Stretching)	7	very complicated	8
Using Muscle Power or Strength (Lifting, Pushing)			Monoton	
	5	0	Low	0
	10	1	Currently	1
	15	2	Tall	4
	20	3	Boredom	
	25	4	A bit bored	0
	30	5	Bored	2
	35	7	Very bored	5
	40	9	Attentive	
	45	11	Good Enough Work	0
	50	13	Good or Difficult	2
	60	17	Very Good or Very Difficult	5
	70	22	Atmospheric Conditions (0-100%)	
Bad Lighting				
Slightly below recommended		0		
Far below		2		
Totally inadequate		5		

Motion Study

Motion study is an analysis of body movements in operators in completing a job, both effective movements (providing added value) and ineffective movements (not providing added value) (Sayekti, Mulyana, 2019). The purpose of motion studies is to reduce or even eliminate unnecessary movements in order to save energy, time, and costs (Lumbantobing, Purbasari, and Siboro, 2018) (Yuamita and Nurraudah, 2022).

In this study, a movement study was used with Therblig Movement elements. Therblig is a basic movement element that can be used to analyze a series of processes developed by Frank B. Gilbert. Here are 17 basic movements of therblig (Wignjosoebroto, 2008) and (Herlina, 2019):

1. Search (SH) to determine the location of an object
2. Select (ST) to determine the object
3. Holding (G) to hold an object
4. Reaching (Re) movement of hands to change places without load

5. Carrying (M) hand movement moving from place to place with a load
6. Holding to wear (H) holding without movement of the object
7. Release (RL) release the object being held
8. Directing (P) directing an object to a specific location
9. Temporary directing (PP) directs an object temporarily.
10. Check (I) to check an object
11. Assembly (A) to combine one object with another object
12. Remove the raft (DA) to separate the objects
13. Using (U) one or both hands are used
14. Unavoidable delay (UD) is a delay caused by things beyond control.
15. Avoidable delay (AD) is a delay that is either intentional or unintentional.
16. Planning (Pn) stopping for a moment to think and determine the next action
17. Rest (R) to relieve fatigue

Flow Processing Chart (FPC)

A process flow map or flow processing chart is a mapping of all activities that occur in a series of processes, using ASME symbols including operations, inspections, transportation, waiting, and storage (Wignjosoebroto, 2008). The results of the process flow map show information on the time and distance required to complete a series of work processes (Astuti, Wahyudin, Azizah,

Symbol	*Category*	*Description*
○	Operation	Material transformation, working phase, assembly, actions that produce something (not necessarily product parts but documents, for example)
⇨	Transport	Moving, material or document transport
□	Control	Inspection or quality review
D	Waiting	Temporary suspension of activities
▽	Stocking	Material or product stocking
⊡	Inter-connected activities	Composed phase

2022). The symbols used in FPC are:

Figure 1. ASME symbol

Maynard Operation Sequence Technique (MOST)

*MOST*is an activity analysis study consisting of several stages and sequences to produce normal time and standard time in the process carried out. MOST consists of 3 models (Zandin, 2021), namely:

1. *General Move Sequence Model*used to analyze spatial motion.
2. *Controlled Move Sequence Model*used to analyze the movement of objects attached to other objects.
3. *Tool Use Sequence Model*used to analyze movements involving equipment.

Each activity has different movement parameters and model sequences. Here are the MOST work measurement parameters:

Table 3. MOST Work Measurement Parameters

Activity	*Sequence Model*	*Parameters*		
General Move	A B G A B P A	A	=	Action Distance
		B	=	Body Motion
		G	=	Gain Control
		P	=	Placement
Controlled Move	A B G M X I A	M	=	Move Controlled
		X	=	Processw Time
		I	=	Allignment
Tool Use	A B G A B P * A B P A	F	=	Fasten
		L	=	Loosen
		C	=	Cut
		S	=	Surface Treat
		M	=	Measure
		R	=	Record
		T	=	Think

MOST analysis is a breakdown of activities that occur in a work process. Furthermore, each work activity will be measured based on its respective parameters and index values. The following are the stages of activity breakdown in MOST:

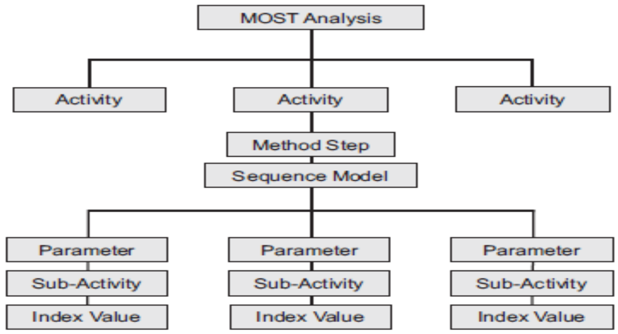


Figure 2. Instructions for filling in the MOST Index Value

The guide to filling in the index value of each parameter in the model sequence is obtained from the DATA MOST CARD from ZANDIN. Furthermore, the total value of all index values of each parameter in the model sequence is multiplied by 10 to obtain the TMU value. To convert the TMU value into time units, it can be seen as follows:

Table 4. MOST Work Measurement Parameters

1 TMU	=	0,00001 hour	1 hour	=	100,000 TMU
1 TMU	=	0,0006 minute	1 minute	=	1667 TMU
1 TMU	=	0,036 second	1 second	=	27,8 TMU

3. RESULTS AND DISCUSSION

Performance Measurement

1. Data Adequacy Test

$$N' = \left[\frac{\frac{2}{0,05}\sqrt{(300\ x\ 6.972.668) - (10.159,93)^2}}{10.159,93}\right]^2$$

$$N' = \left[\frac{40\sqrt{2.091.800.400 - 10.224.177,6}}{10.159,93}\right]^2$$

$$= \frac{40\ x\ 45.624,3}{10.159,93} = 179,62$$

The result of N' < N with N = 300 (15 gas stations x 20 respondents), so it can be concluded that the number of data collected is more than sufficient.

2. *Time Study*

Work measurement was conducted at 15 (fifteen) gas stations, with each gas station selected as many as 20 (twenty) respondents. The following is the total process time for each gas station in filling fuel for 20 respondents:

Table 5. Gas Station Service Hours

Gas Station Number	Time (Seconds)
1	739,72
2	599,07
3	735,96
4	625,5
5	620,4
6	636,56
7	653,96
8	714,3
9	600,3
10	641,6
11	752,69
12	741,97
13	879,4
14	587,7
15	630,8
Total	10.159,93

Furthermore, the data in the table will be used to calculate the average observation time, normal time, and standard time.

Table 6. Time Study Calculation

Time	Calculation
Average working time	$\text{Average observed time} = \frac{\text{Sum of the times recorded to perform each element}}{\text{Number of observations}}$ = 10159,93 : 300 = 33,87
Normal Time	Normal time = Average observed time × Performance rating factor = 33,87 x 0,98 = 33,19
Standard Time	$\text{Standard time} = \frac{\text{Total normal time}}{1 - \text{Allowance factor}}$ = 33,19 : (1 - 0.26) = 44,85

With the following performance levels:

Table 7. Performance Level

Factor	Evaluation	Score
Skill	Average	0
Effort	Average	0
Condition	Fair	-0.03
Consistency	Good	+0.01
Total		-0.02
Performance Factor		= 1 – 0.02 = 0.98

With *allowance factor* as follows:

Table 8. *Allowance Factor*

Variables/Factors	Allowance Category	*Allowance*
Consistent allowance	General fatigue allowance	4
Allowance variable	Standing Allowance	2
Use of force or muscle	< 5 pounds	0
Noise level	Noisy	5
Lighting	It's good	0
Mental stress	Quite complex	1
Monotonous level	Tall	4
Boredom	Bored	2
Attentive	Pretty good job	0
Atmosphere	Extraordinary circumstances	8
Allowance factor		26

3. THERBLIG Movement Elements and Flow Processing Chart

In this study, the decomposition of Therblig Movement elements is combined with the Processing Chart flow. The following are the results of the Therblig Movement elements and the flow processing chart:

Table 9. Therblig Elements and FPC

No	Activity	Therblig	FPC					Time (seconds)	Distance (meters)
1	Holding the motorbike handlebars	Holding	●	□	⇨	D	▽	0.3	
2	Taking the motorbike to the gas station	Carrying	○	□	➡	D	▽	4.2	1
3	Removing the motor	Release	○	□	➡	D	▽	0.5	
4	Respondents spoke with employees	Avoidable delay	○	□	⇨	◗	▽	4	
5	Select the fill button	Select	●	□	⇨	D	▽	1	
6	Reaching Nuzzle	Reaching	●	□	⇨	D	▽	0.5	
7	Holding Nuzzle	Holding	●	□	⇨	D	▽	0.3	
8	Bringing Nuzzle	Carrying	○	□	➡	D	▽	5	0.6
9	Using Nuzzle	Using	●	□	⇨	D	▽	13	
10	Holding Nuzzle	Holding	●	□	⇨	D	▽	0.5	
11	Bringing Nuzzle	Carrying	○	□	➡	D	▽	0.5	0.6
12	Removing the Nuzzle	Release	○	□	➡	D	▽	0.5	
13	Closing the motorcycle tank	Assembly	●	□	⇨	D	▽	1	
14	Covering the motorbike seat	Assembly	●	□	⇨	D	▽	0.5	
15	Holding the Motorbike	Holding	○	□	➡	D	▽	0.5	
16	Taking the motorbike out of the charging station	Carrying	○	□	➡	D	▽	1.5	1
Total								33.8	

The results of the FPC obtained that there was 1 movement included in the delay category. Furthermore, this movement will be analyzed so that it can be eliminated, so that a more optimal working time is obtained.

4. *MOST*

MOST processing was carried out on respondents with a processing time equal to the average working time of the observation, namely respondents with a working time of 33.87 seconds. This was done as a representative sample in this observation. The following is data processing using MOST analysis:

Table 10. *MOST* Analysis

No	Work Elements	Sequence Model	Frequency	ΣTMU
1	Transporting motorbikes	A6 B10 G3 A0 B0 P1 A0	2	400
2	Reaching the tank lid	A1 B0 G1 A0 B0 P0 A0	1	20
3	Turning the tank cap	A0 B0 G0 M1 X4 I1 A0	2	120
4	Transporting the tank cap	A1 B0 G1 A0 B0 P0 A0	1	20
5	Holding Nuzzle	A0 B0 G0 M1 X1 I0 A0	1	20
6	Transporting Nuzzle	A1 B0 G1 A0 B0 P1 S6 A0 B0 P0 A0	2	180
7	Removing the Nuzzle	A0 B0 G1 A0 B0 P0 A0 B0 P1 A1	1	30
8	Reaching the motorbike handlebars	A1 B0 G0 A0 B0 P1 A0	1	20
TOTAL				810

The results of processing using MOST obtained a TMU value of 810, if converted into seconds it becomes 29.16 seconds. This value is smaller when compared to the average time study value of 33.8 seconds.

Suggested Improvements

After data collection and calculation, the next step is to analyze the proposed improvements.

1. **Improvement of Fuel Refueling SOP**

   After the data collection process and observing the pattern of fuel filling activities by all respondents, there were several work activities that were inefficient and caused long process times. Therefore, the researcher proposed an SOP (Standard Operating Procedure) for the fuel filling process. SOP can provide improvements for the company and increase work safety for users (Goesman, Nurjannah, Prakoso, 2024). In order to obtain actual working time, the researcher and team carried out fuel filling using the process sequence according to the proposed SOP. The following is the proposed SOP and the working time for each stage:

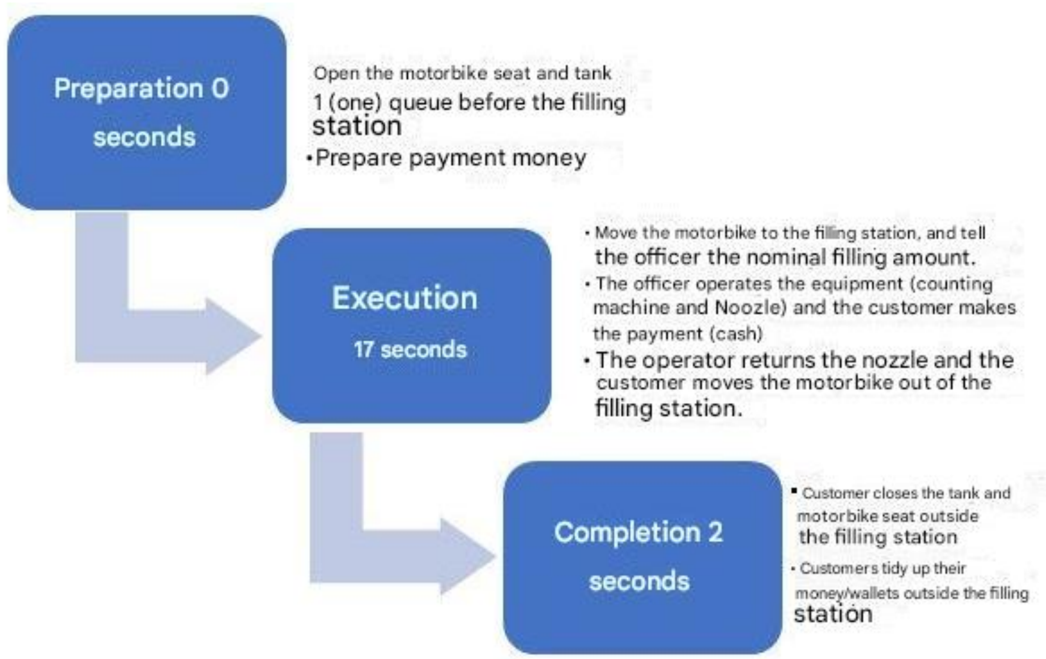


Figure 3. Improvement SOP

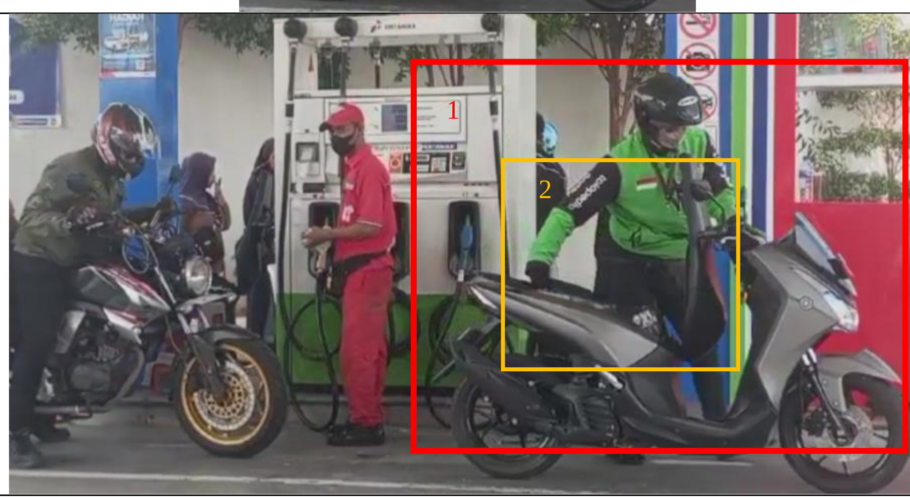
There are 3 (three) stages, namely the preparation stage, the execution stage, and the completion stage. Each stage has a sub-process and total working time. The proposed working time is 19 seconds. Then the calculation is carried out according to the steps in table 7 so that the normal time is 18.62 seconds and the standard time is 25.16 seconds.

2. Prosess Optimization

Optimization is a process carried out to determine the best solution or optimal value, both maximization and minimization (Gunantara, 2024). In this study, optimization is intended to minimize working time by optimizing activities or work processes, namely eliminating unnecessary activities and combining activities that can be done simultaneously.

In order to carry out this improvement, there needs to be socialization for the community starting by putting up posters/banners around the work station. In addition, there needs to be socialization for employees so that they can optimize their respective performance and can educate the community to carry out this improvement program. The following are the process optimization proposals in this study:

Table 11. Optimization of the Fuel Filling Processes

Instructions	Picture
1. Prepare your motorbike while you are in the queue before the fuelfilling station 2. Repare the motorbike with the seat and tank were opened	
Make payment during the fuel filling process (cash only)	
1. Move the motorbike out of he queue after the fulling process complete 2. Closing the tank and seat is done in front of the fuel fill station	

4. CONCLUSION

From the data collection process carried out at 15 gas stations with 20 respondents taken randomly from each gas station, the average working time in the process of filling Pertalite fuel for motorbikes was 33.87 seconds, the normal time was 33.19 seconds, and the standard time was 44.85 seconds. From a total of 320 respondents, a MOST analysis was conducted on respondents with working times close to the average working time of the population, and the MOST results were 810 TMU or equal to 29.16 seconds. Calculations using MOST gave better results than the results of the time study. Furthermore, an analysis of improvements to the SOP for filling fuel was carried out, with a working time of 19 seconds, a normal time of 18.62 seconds, and a standard time of 25.16 seconds.

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