Research Article

Standard Time Calculation Of Tempe Production Process Using Snapback Time Study Method (Case Study: Tn Group Home Industry)

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Abstract: In Indonesia, soybeans are consumed mostly in the form of traditional foods, tempe is not consumed as a raw food but in the form of cooked tempe and served as a delicacy or a side dish, often fried, boiled, steamed or roasted. The process of making tempe takes a long time compared to making tofu, so it becomes a problem that must be analyzed. Therefore, the researcher will calculate the process of making tempe to find out the standard time needed to make tempe. The research was carried out in one of the home industries in Bandung, Indonesia called the TN Group. At this time, the number of employees working at the TN Group is 18 people with 4 working hours per day. Every day the TN Group spends 1 quintal of soybeans to produce 150 packs of tempeh, each weighing 6 ounces of tempeh, selling for Rp. 6,000. with the production per day. 30 datas were collected using the snapback time study or repetitive timing method. By separating the types of work, we can calculate the cycle time, normal time, and standard time for each work process performed by workers by taking into account the adjustment factor and the allowance factor. From the calculation of the total standard time, the standard time for the new production process is 2 hours 44 minutes.

Keywords : standard time, time study, snapback time study method, tempe

1. Introduction

Tempe is a widely consumed Indonesian traditional fermented food, which is principally made with soybeans. In Indonesia, soybeans are consumed mostly in the form of traditional foods, consisting of fermented and non-fermented products. Commercially fermented soybeans include tempe, soy sauce and soy paste. Tempe is not consumed as a raw food but in the form of cooked tempe and served as a delicacy or a side dish, often fried, boiled, steamed or roasted.
Tempe is produced mostly by small household industries with a production range of 10 kg–4 metric tons of tempe per day.4 It is estimated that there are more than 100 000 tempe producers spread out in the provinces of Indonesia (Astuti, 2000; Aras, 2019). The process of making tempeh consists of the process of boiling, soaking, breaking or milling, and fermentation. These processes are generally standardized processes that have been taught from generation to generation. There is no standard process for tempe making, which is one of the reasons why there is a lot of variation in tempe making from one region and one producer to another. So far, they have not made many innovations in an effort to accelerate the production process and increase the quality and quantity of tempe production produced.

One of the important steps in the process of making tempe which determines the quality of tempe is the fermentation process. Currently the fermentation process is carried out by mixing the yeast with soybeans, then wrapping it in plastic and placing the soybeans that have been mixed with the yeast on storage / ripening shelves for 2 days. In the storage process during fermentation, the resulting tempeh is also determined by the surrounding weather conditions (temperature and humidity). So that when the weather is not supportive, such as rain or cloudy, the resulting tempeh results are less good than when the weather is hot / sunny. (Master, 2020).

The process of making tempe takes a long time compared to making tofu, so it becomes a problem that must be analyzed. Therefore, the researcher will calculate the process of making tempe to find out the standard time needed to make tempe. The research was carried out in one of the home industries in Bandung, Indonesia called

the TN Group. At this time, the number of employees working at the TN Group is 18 people with 4 working hours per day. Every day the TN Group spends 1 quintal of soybeans to produce 150 packs of tempeh, each weighing 6 ounces of tempeh, selling for Rp. 6,000. with the production per day, business selectors want to increase production by knowing the standard time of the tempe-making process before making improvements to the business.

2. Methodology

3.

The measurement of work time is aimed at obtaining the standard time for completion of work, namely the time it takes a normal worker to complete a job that is carried out in the best work system (Sutalaksana et al, 1979). Measurement of working time is a measurement taken to find out the time it takes an operator to complete a job. (Wignjosoebroto, 2000) Measurement of direct working time is a measurement of work carried out directly in the workplace to be studied. (Wignjosoebroto, 2000)

The stopwatch time study or work measurement with the first stop clock was introduced by Frederick W. Taylor in the 19th century. This method is very good when applied to jobs that are short and repetitive. (Kumar, 2006)

Data were collected using the snapback time study or repetitive timing method. The tools for measuring the working time needed are a stopwatch, observation sheets and writing instruments. With this method, when the first measurement of the time the first work element is finished, the display on the stopwatch immediately returns to zero, then the same for the second, third observation and so on. The object of research is the operator in each element of the work at each workstation. Time measurement is done in each processing process of tempe as much as 30 data, the amount is considered representative enough to represent the actual condition. The method used for data processing is using statistical tests to measure the data suffeciency test and data uniformity test with a 10% accuracy level and 95% confidence level.

Uniformity Test

The data uniformity test is conducted to ensure that the data obtained comes from the same system and is between the control limits (upper control limit and lower control limit). Data uniformity test is needed to separate data that has different characteristics compared to the others, the different data will come out of the control limit in this uniformity test. Lower control limits and upper control limits can be calculated by:

$$UCL = \overline{\overline{X}} + Z_t.\sigma_x$$

$$LCL = \overline{\overline{X}} - Z_t.\sigma_x$$

$$Z_t = Z\left[1-\left[\frac{1-\beta}{2}\right]\right]$$

Sufficiency Test

Sufficiency test is conducted to find out whether the data taken when measuring process time is sufficient or not, then the next stage of the process measurement should be done until the total number of measurements is sufficient for the desired accuracy level and confidence level. Data is declared sufficient if the result is N' > N. The data exhaustion test can be done with the following calculations:

$$N' = \left[\frac{Z_t \Big/ \alpha\sqrt{N\left(\sum X_i^{\,2}\right)-\left(\sum X_i\right)^2}}{\sum X_i}\right]^2$$

After the data sufficiency test and data uniformity test have been carried out, the next stage is to make a flow chart of the tempe production system. At this stage, a flow chart is developed with the corporation's current production system, as it is displayed in Figure 1. In the flow chart, there are 4 workstations where each activity is carried out at a predetermined place to simplify the work process.

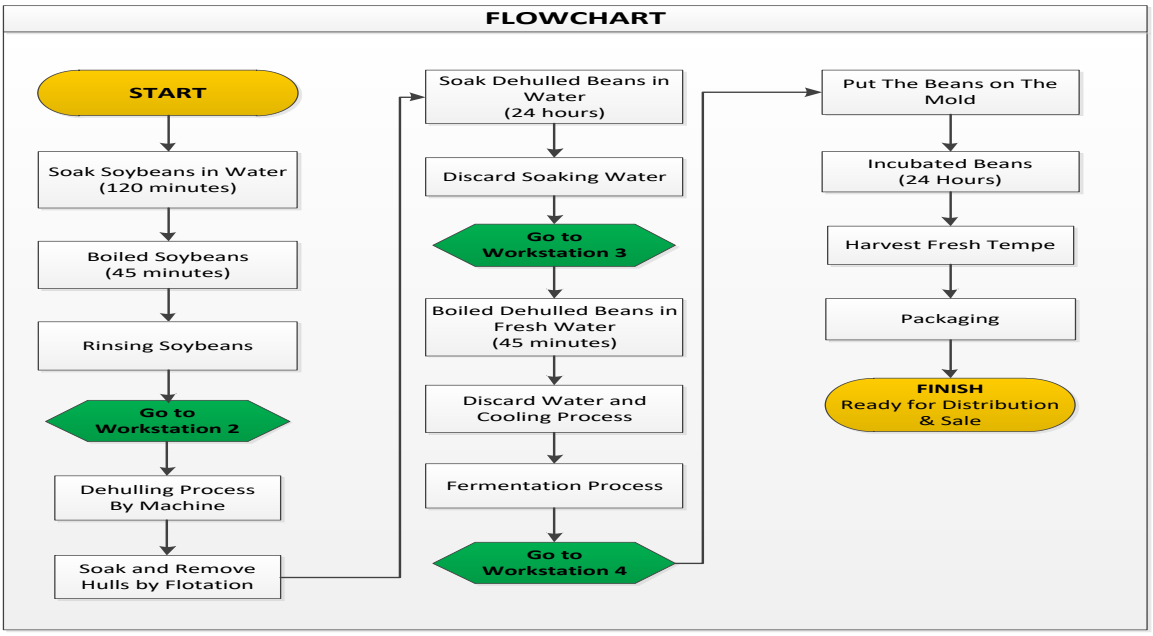

Figure 1. Flow Chart Diagram of Tempe Production Process

The process of making tempe requires a long time, especially in the soaking and incubation processes. Both processes are very important to produce good quality tempe so that this process cannot be eliminated. It can be seen from the flow chart that in the production process there are several processes that are carried out by tools or machines. Because to calculate the standard time required adjustment values and allowance values based on human needs, these processes must be classified.

Classification is carried out as in Table 1 by determining which processes are carried out by tools or machines and which processes are carried out by workers. After the classification is done, we can begin to calculate the standard time for each process element whose process is carried out directly by humans.

Table 1 Grouping or Classification Process

Process Elements	Description Process	workers	non-workers
Soak Soybeans in Water	Put the soybeans in a container then given clean water and soak for 2 hours		✔
Boiled Soybeans	After soaking, the soybeans are boiled for 45 minutes		✔
Rinsing Soybeans	Rinse the soybeans that have been boiled with clean water	✔	
Dehulling Process	Dehulling soybeans using a dehulling machine to separate the beans from the		✔
Soak and Removes Hulls by Flotation	Soak the dehulled beans to separate the beans from the hulls, the hulls will float on	✔	
Soak Dehulled Beans in Water	Soak the cleaned beans again in fresh water for about 1 day		✔
Discard Soaking Water	discard the soaked beans	✔	
Boiled Dehulled Beans in Fresh Water	boil the beans with fresh water for 45 minutes		✔
Discard Water and Cooling Process	discard the stew and drain the beans on the tray for	✔	
Fermentation Proces	After the beans are dry and cold, add the yeast with a ratio, 50 kg of soybeans : 8gr of yeast. Then stir well until	✔	
Put the Beans on the mold	put the soybeans on the tempeh mold and cover with	✔	
Incubated Beans	let the tempeh incubate for 2 days		✔
Harvest Fresh Tempe	tempeh ready to be harvested, cut into pieces	✔	
Packaging	The tempeh is wrapped in banana leaves and ready to be sold and distributed	✔	

4. Result

Table 2 and 3 lists the information about the performance factors and allowance factor to each original element process using the whesting house method. For example, for the soybean rinsing process, the researcher sees that the operator works carefully, he has good skills, so the symbol is Good (C1) with a value of +0.06. Then for effort,

the operator can see that the speed at work is good and can be maintained, so for the effort value given the symbol is Good (C1) with a value of +0.05.

The consistency of the operator is Good (C) with a value of +0.01 because from the results of the work processing time the range is not too far, it can be concluded that the operator is good enough to overcome his consistency in work. Finally, the condition of the operator is Fair (E) with a value of -0.03 due to the humid working conditions. so that the total value of the performance factor is 0.09.

The same thing to get the allowance value, we have to adjust the operator's condition with leeway factors such as energy expended, work attitude, work movement, eye fatigue, work place temperature conditions, atmosphere, and work environment conditions.

Table 2 Performance Factor for The Element Production Process of Tempe

Element Process	Performance Factor								Total
	Skill		Effort		Consistency		Condition		
Rinsing Soybeans	Good (C1)	0,06	Good (C1)	0,05	Good (C)	0,01	Fair (E)	-0,03	**0,09**
Soak and Removes Hulls by Flotation	Good (C1)	0,06	Good (C2)	0,02	Good (C)	0,01	Fair (E)	-0,03	**0,06**
Discard Soaking Water	Good (C1)	0,06	Good (C2)	0,02	Average (D)	0	Fair (E)	-0,03	**0,05**
Discard Water and Cooling Process	Good (C1)	0,06	Good (C1)	0,05	Average (D)	0	Fair (E)	-0,03	**0,08**
Fermentation Proces	Good (C1)	0,06	Good (C1)	0,05	Average (D)	0	Fair (E)	-0,03	**0,08**
Put the Beans on the mold	Good (C1)	0,06	Good (C1)	0,05	Average (D)	0	Average (D)	0	**0,11**
Harvest Fresh Tempe	Good (C1)	0,06	Good (C1)	0,05	Excellent (B)	0,03	Average (D)	0	**0,14**
Packaging	Good (C1)	0,06	Good (C1)	0,05	Good (C)	0,01	Average (D)	0	**0,12**

Table 3 Constant and Variable Allowance for The Element Production Process of Tempe

Element Process	Constant and Variable Allowance								Total
	A	B	C	D	E	F	G	Allowance For Man	
Rinsing Soybeans	7,5%	4%	0%	6%	9%	4%	8%	5%	**43,5%**
Soak and Removes Hulls by Flotation	7,5%	4%	0%	7%	10%	4%	8%	5%	**45,5%**
Discard Soaking Water	7,5%	4%	0%	7%	10%	4%	7%	5%	**44,5%**
Discard Water and Cooling Process	7,5%	4%	0%	7,5%	6%	4%	7%	5%	**41,0%**
Fermentation Proces	6%	2,5%	0%	6%	6%	4%	9%	5%	**38,5%**
Put the Beans on the mold	10%	2,5%	0%	6%	6%	2%	8%	5%	**39,5%**
Harvest Fresh Tempe	7,5%	3%	0%	19%	6%	2%	7%	5%	**49,0%**
Packaging	7,5%	3%	0%	8%	6%	2%	8%	5%	**39,0%**

The results of the estimated standard time in table 4 are the time data from one process carried out for each job. For example, for soybean rinsing, the standard time of 58.08 is the process of rinsing soybeans for one process, namely in 1 container weighing about 30kg of soybeans, while at the packaging stage the value of 11.16 is the process of wrapping one tempeh that has been cut using leaves. Then each result of the standard time needs to be converted back so that the standard time data for each process of the production of the tempe is the same.

Table 4 Time Estimated

Element Process	Time per Element Process (Second)		
	Observed Time (OT)	Normal Time (NT)	Standard Time (ST)
Rinsing Soybeans	37,13	40,48	58,08
Soak and Removes Hulls by Flotation	98,67	104,59	152,17
Discard Soaking Water	21,13	22,19	32,06
Discard Water and Cooling Process	176,90	191,05	269,38
Fermentation Proces	132,50	143,10	198,19
Put the Beans on the mold	80,30	89,13	124,34
Harvest Fresh Tempe	15,67	17,86	26,61
Packaging	7,17	8,03	11,16

5. Conclusion

The conclusion is that the result of the production process of making tempe takes quite a long time, which is about 3-4 days. 1 day for soaking and 2 days for incubation and about half a day for other processes that use tools

or machines. For a production process that uses human labor, the total is 2 hours 44 minutes. With 4 hours of work per day, the company should be able to produce more tempe, but this is not yet possible because the capacity of the production plant cannot accommodate more production. So, several things that must be done after calculating this standard time are eliminating inefficient movements or processes, then re-layout the production floor so that it can be more efficient in using the space. In addition, companies must implement the 5S system and implement efficient, comfortable, safe, healthy and effective working conditions. That way the business in the future is expected to produce good quality products and increase employee productivity so that this will be an advantage for the company.

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