

# SCIENTIFIC ARTICLE

*"IMPROVING PRODUCTIVITY IN THE AREA OF PRODUCTION IN THE COMPANY REPROAVI BALANCED THROUGH THE IMPLEMENTATION OF STUDY METHODS AND TIMES."*

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## Summary

The study methods and time is carried out to determine the standard time of each of the operations, ie measuring the total time needed to perform an operation, and analyze what downtimes are to take action, and resolve these problems. It is also important to set the times of each operation and have standardized the process, leading to big savings, generates less waste and effort for workers. (Garcia Criollo)

You need to apply one or more techniques for performing a time study, in order to get to get the kind or standard of work we have measured time, there are several techniques for estimating historical data, stopwatch time study. The stopwatch time study is to determine exactly what the time a worker employed in an operation, it is necessary to take a limited number of observations. (Palacios Acero)

Once you have defined and registered all details of the operations of a process, the next thing you have to realize is the timing of the operation. To make this process you should use the timer, clock precision to measure very small fractions of time. (Palacios Acero)

The use of methods of measuring time and method allows companies or organizations identify problems or interference, you have, to thereby improve are either processes or human talent. Increasing productivity is very important in organizations, there are many factors to take into account to achieve increased productivity and control of the production process, so it is necessary to perform a time study to determine standard times and standardize processes.

With a time study and methods, a time reduction would be obtained and improve productivity; generating more production in less time and allows us to control the production process, while reducing the effort made by workers (Gutiérrez Pulido)

An increase in labor productivity occurs when output grows at a higher rate than labor input; also when the quantity produced decreases, but the work units down at a higher rate; also when the factor applied work is the same and increases the volume produced: or, if smaller units of work and the level of production is held apply. The opposite situation (a reduction of the average product) occurs when the output decreases while the work factor

increases, remains constant or decreases with less intense (Gutiérrez Pulido)

### Keywords

Study methods and times, Productivity Increase

## 1. Introduction

A study of methods and times applicable to the production area balanced (Reproavi) help with problems that arise in either machine or human talent can develop better methods of work that contribute to human talent to earn higher profits for companies or decrease resources generating lower costs.

The study is conducted to operators that are directly related to the production process, measuring times and operators, the problems are determined in the production area balanced (Reproavi).

The study methods and time is analyzed, every problem and solutions are taken, making changes in working methods. Which leads to an increase in productivity.

## 2. Tools and Methods

The tools and methods used to improve productivity in the production area of the company Reproavi balanced by implementing the study of methods and times listed below.

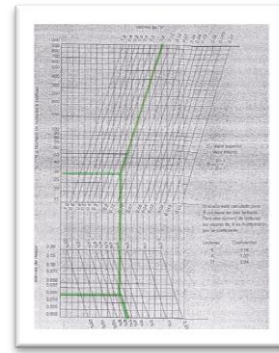
### Survey Process

For removal process was used a board, attached a sheet in which each operation is detailed.



### Abacus Lifson

For taking readings we proceed by Lifson abacus to calculate how many observations will be necessary.



### Timer

Is to determine exactly what the time a worker employed in an operation, it is necessary to take a limited number of observations.



## 3. Methodology

### Division elements

The division of the task has been executed, taking into account that the order is made by mixing stops, stops entering and leaving the mixing machine bags balanced on a stop 44 sacks produced 45.45 kg.

**Total time observed results of all areas of production**

TOTAL TIME OBSERVED RESULTS OF ALL AREAS OF PRODUCTION	
AREAS OF PRODUCTION	OBSERVED TIME (MIN)
WEIGHING THE AREA MACRO INGREDIENTS	7
AREA MICRO WEIGHING THE INGREDIENTS	3
WEIGHING THE AREA PALM OIL	8
PACKING AREA	17

Table 1 Total time observed results in all areas of production

The production is performed in parallel, ie, the processes of each area operate independently of each other, the production in the weighing area of palm oil is the most time taking therefore has taken the most time and this 8 min and the time of the area of palm oil was obtained 17 min as shown in Table 2.

OBSERVED TIME	
AREAS OF PRODUCTION	OBSERVED TIME (MIN)
WEIGHING THE AREA PALM OIL	8
PACKING AREA	17
<b>TOTAL</b>	<b>25</b>

Table 2. Observed Time

For a stop in which 44 bags get balanced, time has seen a total of 25 minutes, ie it takes this time to get 1 stop (44 sacks balanced).

**Total results normal time all areas of production**

TOTAL RESULTS NORMAL TIME ALL AREAS OF PRODUCTION	
AREAS OF PRODUCTION	NORMAL TIME (MIN)
WEIGHING THE AREA MACRO INGREDIENTS	9
AREA MICRO WEIGHING THE INGREDIENTS	4
WEIGHING THE AREA PALM OIL	11
PACKING AREA	22

Table 3. Total Results of normal time all production areas

NORMAL TIME	
AREAS OF PRODUCTION	NORMAL TIME (MIN)
WEIGHING THE AREA PALM OIL	11
PACKING AREA	22

Table 4. Normal Time

The result of the total normal time is 33 minutes; this time is greater than the time observed here have been taken into account supplements each operator, then the time increases depending on the conditions of each operator station.

**Daily production stops**

In the area of production of the company Reproavi balanced in the production process is carried out stops.

In the area of production of balanced one works five days a week, 12 months a year on a working day of eight hours daily production is performed by stops, 1 stop is 44 sacks balanced, sacks balanced with a weight of 45.45 kg, the weight has a lower limit ranging from 45.20 and an upper limit goes up to 45.45 kg

OBSERVED TIME	
AREAS OF PRODUCTION	OBSERVED TIME (MIN)
WEIGHING THE AREA PALM OIL	8
PACKING AREA	17
<b>TOTAL</b>	<b>25</b>

It is calculated as a function of time observed the number of stops that are made in the day and 8 hours of working time, taking into account that the 8 hours of working time is 480 minutes per day (data that is used in the calculation).

This fact is very important because in the area of production is not fixed balanced order is made, so the orders vary.

$$\text{daily stops} = \frac{(\text{working time in minutes} * \text{stop})}{(\text{production time stop})}$$

$$= (480 \text{ min} * 1 \text{ stop}) / (25 \text{ min})$$

$$= 19 \text{ stops daily stops}$$

### Total production of bags in a balanced stop

The balanced production area has provided the data to a stop 44 sacks balanced is obtained. To verify this data is requested the total weight of the balanced formula.

THE BALANCED CHEMICAL FORMULA	KG
Corn Imported	550.00
Imported Soybean Cake	659.32
National Corn	596.21
Calcium Carbonate	20.17
Palm Oil	121.42
<b>Total</b>	<b>1947.11 KG</b>

Table 5. Chemical formula for balanced

Now also has the data, the chemical formula of the vitamins.

CHEMICAL FORMULA VITAMINS	KG
phosphate	11.08
Sal	6.08
lysine	3.30
methionine	4.55
threonine	2.01
Maycoad	2.00
Maxiban	1.00
Initial core	24.00
<b>TOTAL</b>	<b>54.01 KG</b>

Table 6. Chemical Formula vitamins

- The weight of the balanced formula: 1947.11 kg
- The weight of the vitamins is 54.01 kg
- Performing a sum: 1947.11 kg + 54.01 kg = 2001.12 kg

Now calculating the rule of three is found if the result provided by the balanced production area is correct.

DATA	
• Weight of the ingredients:	2001.12 kg
• Weight balanced end bag:	45.45 kg
OPERATION	
45.45 kg	→ 1 bag of balanced
2001.12 kg	→ X
RESULT	
X = 2001.12 kg * 1 bag of balanced / 45.45 kg	
x = 44.02	
<b>x = 44 sacks balanced on a stop</b>	

### Analysis of production

They calculate how many units are produced balanced sacks on the day.

$$\text{daily production stops} =$$

$$19 * 44 \text{ bags balanced producción diaria}$$

$$= 836 \text{ balanced bags}$$

### Analysis of the areas of implementation

After the diagnosis of the current situation in the area of production of the company balanced Reproavi, analyzing each area in which the production process (macro area weighing ingredients, weighing area of micro ingredients area is done weighing palm oil, packaging weighing area).

The implementation will be carried out:

- Changing methods in the area of palm oil weighing area and macro weighing ingredients, changes in these areas are made to be the areas that take more time in the production process.
- New tools to transport ingredients macro area, a car load adapted to connect a sensor with a scale to measure the weight of the corn.
- A car weighing area for palm oil.
- Relocation of workers and change the method for operators weighing area of palm oil and macro ingredients.

This implementation was based on the study of methods and times in order to increase productivity.

time increases depending on the conditions of each operator station.

### Total results

#### Observed time

TOTAL TIME OBSERVED RESULTS OF ALL AREAS OF PRODUCTION AREAS TIME (MIN)	
AREAS TIME (MIN)	TIME (MIN)
WEIGHING THE AREA MACRO INGREDIENTS	5
WEIGHING THE AREA MICRO INGREDIENTS	3
AREA OF PALM OIL WEIGHING	6,8
PACKING AREA	0,4

Table 7. Total time observed results in all areas of production, with the implementation

As each area processes operate independently of one another, take as long as it is the area of palm oil weighing more time for the Packaging Industry.

OBSERVED TIME	
AREAS	TIME (MIN)
AREA OF PALM OIL WEIGHING	6,8
PACKING AREA	17
<b>TOTAL</b>	<b>24</b>

Table 8. Observed Time

For a stop in which 44 bags get balanced, time has seen a total of 24 minutes, ie it takes this time to get 1 stop (44 sacks balanced).

#### Normal time

RESULTS TOTAL TIME NORMAL PRODUCTION AREAS	
AREAS	TIME (MIN)
WEIGHING THE AREA MACRO INGREDIENTS	5
WEIGHING THE AREA MICRO INGREDIENTS	4
AREA OF PALM OIL WEIGHT	9
PACKING AREA	22

Table 8. Total results of the normal time for all production areas, with implementation

NORMAL TIME	
AREAS	TIME (MIN)
AREA OF PALM OIL WEIGHING	6,8
PACKING AREA	22
<b>TOTAL</b>	<b>29</b>

Table 9. Normal Time

The result of the total normal time is 29 minutes, this time is greater than the observed time because there are taken into account supplements each operator, then the

### Standard time

RESULTS TOTAL TIME STANDARD PRODUCTION AREAS	
AREAS	TIME (MIN)
WEIGHING THE AREA MACRO INGREDIENTS	6
WEIGHING THE AREA MICRO INGREDIENTS	5
WEIGHING THE AREA PALM OIL	13
PACKING AREA	26

Table 10. Total results of the standard time for all production areas

OBSERVED TIME	
AREAS	TIME (MIN)
WEIGHING THE AREA PALM OIL	13
PACKING AREA	26
<b>TOTAL</b>	<b>39</b>

Table 11. Standard Time

### Productivity

After making all the necessary calculations to determine what percentage has improved which is calculated production that takes place daily with the new implementation.

The following table lists the values that were reduced with the new approaches in the area of oil palm area macro ingredients.

TOTAL TIME OBSERVED RESULTS OF ALL AREAS OF PRODUCTION AREAS TIME (MIN)	
AREAS TIME (MIN)	TIME (MIN)
WEIGHING THE AREA MACRO INGREDIENTS	5
WEIGHING THE AREA MICRO INGREDIENTS	3
AREA OF PALM OIL WEIGHING	6,8
PACKING AREA	0,4

Table 12. Times in all areas with the new implementation

Determine how many stops are being made based on the observed time and as the process is parallel to the largest weighing area value of palm oil is taken, plus the area of packaging according to the 8-hour workday.

- Area weighing palm oil: 6.8min
- Area packing:  $0.4 * 44 \text{ min} = 17 \text{ min}$
- An estimated 8 hours of working time in minutes, this results in 480 minutes ( $8 \text{ h} \times 60 \text{ min} = 480 \text{ min}$ ).

production time of a stop:  $6.8 \text{ min} + 17 = 23.8 \text{ min}$

With these data, we proceed to calculate the formula daily stops

$$\text{daily stops} = \frac{(\text{working time in minutes} * \text{stop})}{(\text{production time stop})}$$

$$\text{daily stops} = \frac{(480 \text{ min} * 1 \text{ stop})}{(23.8 \text{ min})}$$

$$\text{daily stops} = 20 \text{ stops}$$

20 stops are performed daily within 8 hours of the workday.

#### Analysis of production

Few units are balanced sacks produced in the day were calculated.

#### daily production

$$= \text{daily stops}$$

$$* \text{bags balanced on a stop}$$

#### daily production stops

$$= 20 * 44 \text{ bags balanced producción diaria}$$

$$1.1.1.1 = 880 \text{ balanced bags}$$

#### Increased productivity stops

$$\Delta Pr = \left[ \frac{\Delta \text{Final productivity}}{\Delta \text{initial productivity}} - 1 \right] * 100$$

$$\Delta Pr = \left[ \frac{20}{19} - 1 \right] * 100$$

$$\Delta Pr = [1.05 - 1] * 100$$

$$\Delta Pr = [0.05] * 100$$

$$\Delta Pr = 5\%$$

## 4. Resultados

### INGREDIENTS AREA MACRO

PREVIOUS	MEJORADO
operating ratio	operating ratio
71%	100%
Cycle time	Cycle time
7 min	4 min
Production	Production
68 paradas/turno	120 paradas /turno

### AREA OF PALM OIL

PREVIOUS	IMPROVED
operating ratio	operating ratio
87%	88%
Cycle time	Cycle time
8 min	6.8 min
Production	Production
60 paradas/turno	70 paradas /turno

### PRODUCTIVITY (UNITS / TURN)

INITIAL	ENHANCED
836 u	880 u

### TOTAL PRODUCTION TIME ONE STOP (MIN)

START TIME	IMPROVED TIME
25 min	24 min

INGREDIENTS AREA MACRO	
PRODUCTION TIME (min)	
STAR T TIME	IMPROVED TIME
7 min	4 min

## 5. Conclusiones

We conclude by obtaining the proposed results, because by collecting information about the study methods and time, to define the knowledge well, took a survey of processes with a power of time and movements of each of the operations in the area balanced production, this study failed to determine factors causing delays in operations, and redeployment of workers was also performed, for greater productivity without hiring another operator.

This study which showed us as a result of 25 minutes, the time it takes to make the production process a stop with the study of methods and times were observed faults and make decisions for improvement was developed in the production process, so that a car load was implemented in the area of ingredients and macro weighing method change in the packing area of the final product. This change in method was redistributing operators packing area, all this implementation favorable results were obtained as uptime stop is now 24 minutes, so production downtime also increased that were previously 19 are now 20 stops daily

The productivity increase was 836 units today are balanced bags 880 bags balanced units before so it was possible to increase productivity by 5%

Now the area Reproavi production company, has a database, which was a great help for improvement.

## Thanks

Thank Balanced Production Area Reproavi Company that welcomed proposals to carry out this research.

Special thanks to Engineer, Mayra Maya for the cooperation, patience, support in the realization of the thesis

At the Faculty of Engineering of Applied Science, Industrial Engineering Technical University North for giving me knowledge, which now will be implemented in the professional field

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THE 1ST UTN - EFL INTERNATIONAL CONVENTION

"FOURTH CONFERENCE ON HEALTH AND SAFETY AT WORK" on the Theme: Ergonomics for Public Administration, organized by the General Labour Risk Insurance IESS Imbabura, on October 19, 2012, lasting 8 hours.

"III DAYS OF HEALTH AND SAFETY AT WORK" (WITH EMPHASIS ON AGRO), organized by the General Labour Risk Insurance IESS during days 3 and 4 May 2012 with a duration of 16 hours.

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