Chapter 1

Introduction to Work Methods and Measurement

Productivity

$$LPR = \frac{WU}{LH}$$

LPR = labor Production Ratio

WU = work units of output

LH = labor Hours of input

Let's say company X produces 60,000 parts (output) utilizing 1,000 labor hours (input). Calculate the company's labor productivity.

$$LPR = \frac{60000}{1000}$$

$$= 60 \text{ Parts/labor hour}$$

Example: Productivity Measurement

- During the base year in a small steel mill, 300,000 tons of steel were produced using 200,000 labor hours.
- In the next year, the output was 320,000 tons using 250,000 labor hours.

Determine:

(a) The labor productivity ratio for the base year

(b) The labor productivity ratio for the second year

(c) The productivity index for the second year.

(a) in the base year :-

$$LPR = \frac{300000}{200000} = 1.5 \text{ tons/labor hour}$$

(b) in the second year :-

$$LPR = \frac{320000}{250000} = 1.3 \text{ tons/labor hour}$$

(c) $LPI = \frac{1.3}{1.5} = 0.867 < 1$

Productivity went down in the second year

Problem # 1.2

A work group of 10 workers in a certain month produced 7200 units of output working 8 hr/day for 22 days in the month. Determine the labor productivity ratio using

(a) units of output per worker-hour in the month and

(b) units of output per worker-month

(c) suppose that in the next month, the same work group produced 6800 units but, there were only 20 workdays in the month.

For each productivity measure in (a) and (b), determine the productivity index for the next month using the prior month as a base.

Part ①

(a) Workers hours / Month $= 10 * 8 * 22$

$= 1760$ labor hours / Month

* $LPR = \frac{7200}{1760} = 4.09$ units / labor-hour

(b) $LPR = \frac{7200}{10} = 720$ units / labor-Month

Part ②

(c) Workers hours / Month $= 10 * 8 * 20$

$= 1600$ labor hours / Month

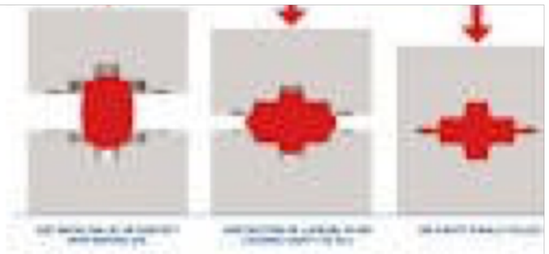
$LPR = \frac{6800}{1600} = 4.25$ units / labor hour

$LPR = \frac{6800}{10} = 680$ units / labor-Month

$LPI = \frac{4.25}{4.09} = 103.9\ \%$

$LPI = \frac{680}{720} = 94.4\ \%$

Problem # 1.4



Batch and setup-time

There are 20 forging presses in the forge shop of a small company. The shop produces batches of forgings requiring a setup time of 3.0 hours for each production batch. Average standard time for each part in a batch is 45 seconds, and there is an average of 600 parts in a batch (one batch per press). The plant workforce consists of two workers per press, two foremen, plus three clerical support staff. (a) Determine how many forged parts that can be produced in 1 month, if there are 8 hours worked per day and an average of 21 days per month at one shift per day. (b) What is the labor productivity ratio of the forge shop, expressed as parts per worker-hour?

20 PRESS → batch } 3 hr Setup

600 Parts ⟹ 45 sec/Part

2 Workers/PRESS
+ 2 Foreman
+ 3 Clerical

} 8 hrs/day, 21 day/Month

(a)

* Time to Produce a batch $= T_B$

$$T_B = 3\ hr + 600 * \frac{45}{60*60}\ hr$$

$$= 10.5\ hr$$

* $\frac{Hours}{Month} = 8 * 21 = 168\ \frac{hr}{Month}$

* $R_p = \frac{168}{10.5} = 16\ batches/Month$ Per Press

* With 20 Presses $R_p = 16 * 20 = 320\ \frac{batches}{Month}$

* $\frac{Forged\ Parts}{Month} = 320 * 600 = 192000\ \frac{Parts}{Month}$

(b) Worker hours $= (20 * 2 + 2 + 3) * 8 * 21$

$= 7560$ labor hours/Month

$$LPR = \frac{192000}{7560} = 25.4\ \frac{Parts}{labor\ hour\ Month}$$

1. A workgroup of 5 workers produced 500 units of output in a certain month working 22 days (8 hours per day).
   a. What productivity measures could be used for this situation, and what are the values of their respective productivity ratios?

* out Put units Per Worker Month

$$LPR = \frac{500}{5} = 100 \ \frac{units}{Labor - Month}$$

* out Put units Per Worker - day =

$$LPR = \frac{500}{5*22} = 4.545 \ \frac{units}{labor-day}$$

* out Put units Per Worker - hour =

Worker hourf = $5 * 8 * 22$

$$LpR = \frac{500}{5*8*22} = 0.568 \ \frac{units}{labor-hour}$$

The same workgroup produced 600 units of output in the next month, working only 20 day (8 hours per day).
b. Using the same productivity measures as in (a), determine the productivity index using the month in (a) as a base.

* out Put units Per Worker Month

$$LPR = \frac{600}{5} = 120 \ \frac{units}{Labor - Month}$$

$$LPI = \frac{120}{100} = 1.2$$

* out Put units Per Worker - day =

$$LPR = \frac{600}{5*20} = 6 \ \frac{units}{labor-day}$$

$$LPI = \frac{6}{4.545} = 1.32$$

* out Put units Per Worker - hour =

$$LpR = \frac{600}{5*8*20} = 0.75$$

$$LPI = \frac{0.75}{0.568} = 1.32 \ \frac{units}{labor-hour}$$

Quiz

4. The ABC Company makes screwdrivers in its plant. Costs have increased recently, so there is more attention being focused on productivity. ABC has a target of increasing productivity by 3 percent per year. The data reported below indicate inputs used and outputs produced for one month this year and an equivalent month last year.

base ?!!!

	One Month Last Year	One Month This Year
Labor (hours)	1200	1300
Units Produced	400	375
Material (kg)	65	50
Energy (BTU)	3500	2850

a. Using the appropriate partial productivity measure, compute the productivity for one month last year for each category (labor, material and energy).

Base year

Solution:

Output per labor hour : LPR = $\frac{400}{1200} = 0.333$ (2)

Output per kg material : MPR = $\frac{400}{65} = 6.154$ (2)

Output per BTU Energy : EPR = $\frac{400}{3500} = 0.114$ (2)

b. Using the appropriate partial productivity measure, compute the productivity for one month this year for each category (labor, material and energy).

Solution:

Output per labor hour : LPR = $\frac{375}{1300} = 0.288$ (2)

Output per kg material : MPR = $\frac{375}{50} = 7.5$ (2)

Output per BTU Energy : EPR = $\frac{375}{2850} = 0.132$ (2)

c. Compute the percent change in productivity from last year to this year for each category (labor, material and energy). Has ABC met its productivity improvement target?

Solution:

LPI = $\frac{0.288}{0.333} = 0.8654 < 1$ ∴ % Change = -13.46 % (3) No

MPI = $\frac{7.5}{6.154} = 1.22 > 1$ % Change = 22% (3) Yes

EPI = $\frac{0.132}{0.114} = 1.15 > 1$ % Change = 15% (3) Yes

3. There are **15** forging presses in the forge shop of a small company. The shop produces batches of forgings requiring a setup time of 3.0 hours for each production batch. Average standard time for each part in a batch is 45 seconds, and there are an average of **650** parts in a batch. The plant workforce consists of two workers per press, two foremen, plus three clerical support staff.

(a) Determine how many forged parts can be produced in 1 month, if there are 8 hours worked per day and an average of 21 days per month at one shift per day. (4 Points)

(b) What is the labor productivity ratio of the forge shop, expressed as parts per worker-hour? (2 Points)

H.W

End of Ch (1)

Previous QUiz

Question 1

Differentiate between work methods and work measurements

Question 2

A work group of 5 workers in a certain month produced 500 units of output working 8 hr/day for 22 days in the month. **(a)** What productivity measures could be used for this situation, and what are the values of their respective productivity ratios? **(b)** Suppose that in the next month, the same work group produced 600 units but there were only 20 workdays in the month. Using the same productivity measures as before, determine the productivity index using the prior month as a base.