# Homework #1: Productivity

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?

Solution:

| | | |
|---|---|---|
| Output units per worker-month | : LPR = 500 / 5 = 100 | (2) |
| Output units per worker -day | : LPR = 500 / 5(22) = 4.545 | (2) |
| Output per worker-hour | : LPR = 500 / 5(22)(8) = 0.568 | (2) |

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.

Solution:

| | | |
|---|---|---|
| Output units per worker-month | : LPR = 600 / 5 = 120 | (2) |
| Output units per worker-day | : LPR = 600 / 5(20) = 6.0 | (2) |
| Output per worker-hour | : LPR = 600 / 5(20)(8) = 0.75 | (2) |
| LPI = 120 / 100 = 1.2 | | (2) |
| LPI = 6.0 / 4.545 = 1.32 | | (2) |
| LPI = 0.75 / 0.568 = 1.32 | | (2) |

2. A workgroup of 10 workers produced 7200 units of output in a certain month working 22 days (8 hours per day). Determine the labor productivity ratio using:
   a. units of output per worker-hour and

Solution:

LPR = 7200 / 10(8)(22) = 4.091 units/wo-hr (4)

   b. units of output per worker-month

Solution:

LPR = 7200 / 10(1) = 720 units/wo-month (2)

Suppose that the same work group produced 6800 units in the next month working only 20 days (8 hours per day). For each productivity measure in (a) and (b):

   c. determine the productivity index for the next month using the prior month as a base.

Solution:

LPR = 6800 / 10(8)(20) = 4.25 units/wo-hr (4)
LPI = 4.25 / 4.091 = 1.039 = 103.9% (2)

LPR = 6800 / 10(1) = 680 units/wo-month (2)
LPI = 680 / 720 = 0.944 = 94.4% (2)

3. A workgroup of 20 workers produced 8600 units of output in a certain month working 21 days (8 hours per day).
   a. What is the labor productivity ratio for this month?

Solution:
LPR = 8600 / 20(8)(21) = 2.559 units/wo-hr **(4)**

The same workgroup produced 8000 units of output in the next month working 22 days (8 hours per day) but the size of the workgroup was reduced to 14 workers.
   b. What is the labor productivity ratio for this second month?

Solution:
LPR = 8000 / 14(8)(22) = 3.247 units/wo-hr **(4)**

   c. What is the productivity index using the first month as a base?

Solution:
LPI = 3.247 / 2.559 = 1.269 = 126.9% **(2)**

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.

| | 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).

Solution:
Output per labor hour : LPR = 400 / 1200 = 0.333 **(2)**
Output per kg material : MPR = 400 / 65 = 6.154 **(2)**
Output per BTU Energy : EPR = 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 = 375 / 1300 = 0.288 **(2)**
Output per kg material : MPR = 375 / 50 = 7.5 **(2)**
Output per BTU Energy : EPR = 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 = 0.288 / 0.333 = 0.8654 --- % change = -13.46 (NO) **(3)**
MPI = 7.5 / 6.154 = 1.22 --- % change = 22 (Yes) **(3)**
EPI = 0.132 / 0.114 = 1.15 --- % change = 15 (Yes) **(3)**

5. From problem #4, if ABC Company has determined its cost to be as follows:
   - Labor : $10 per hour
   - Material : $5 per kg
   - Energy : $0.55 per BTU

   a. Using the costs above as well as the data from the table in the last problem; compute the multifactor productivity for one month last year (in terms of screwdrivers per total dollars of input).

   Solution:
   Output per $ : $PR = 400 / (12000 + 325 + 1925) = 0.028 **(5)**

   b. Using the costs above as well as the data from the table in the last problem; compute the multifactor productivity for one month this year (in terms of screwdrivers per total dollars of input).

   Solution:
   Output per $ : $PR = 375 / (13000 + 250 + 1568) = 0.025 **(5)**

   c. Compute the percent change in the multifactor productivity from last year to this year. Has ABC met its productivity improvement target?

   Solution:
   $PI = 0.025 / 0.028 = 0.9016 --- % change = -9.84 (NO) **(3)**