Ch01 Introduction Work Systems The Methods, Measurement & Management of Work by Mikell P. Groover

Management information systems (الجامعة الأردنية)

Review Questions

1.1   Define work.

Answer: As defined in the text, work is an activity in which one exerts physical and mental effort to accomplish a given task or perform a duty.

1.2   What are basic motion elements? Give some examples.

Answer: Basic motion elements are actuations of the limbs and other body parts while engaged in performing the task. Examples include reaching, grasping, moving something, walking and eye movement.

1.3   What is a work element?

Answer: A work element is defined as a series of work activities that are logically grouped together because they have a unified function in the task.

1.4   Why is time important in work?

Answer: Reasons given in the text include the following: (1) The most frequently used measure of work is time. (2) Most workers are paid according to the amount of time they work. (3) Workers must arrive at work on time. (4) While on the job, workers must utilize their time effectively. (5) When production workers are paid on an incentive plan, they earn their bonuses based on how much time they can save relative to the standard time for a given task. (6) Labor and staffing requirements are based on workloads measured in units of time.

1.5   Define work system as a physical entity.

Answer: As a physical entity, a work system is a system consisting of humans, information, and equipment that is designed to perform useful work.

1.6   Define work system as a field of professional practice.

Answer: As a field of professional practice, work systems includes (1) work methods, which consists of the analysis and design of tasks and jobs involving human work activity, (2) work measurement, which involves the analysis of a task to determine the time that should be allowed for a qualified worker to perform it, and (3) work management, which refers to the various organizational and administrative functions that must be accomplished to achieve high productivity of the work system and effective supervision of the workers.

1.7   What are some of the functions included within the scope of work management?

Answer: As listed in the text, the functions of work management include (1) organizing the workers to perform the specialized tasks that constitute the workload in each department, (2) motivating the workers to perform the tasks, (3) evaluating the jobs in the organization so that each worker is paid an appropriate wage or salary commensurate with the type of work performed, (4) appraising the performance of workers to reward better-performing workers appropriately, and (5) compensating the workers using a rational payment system for the work they perform.

1.8   Name the four broad categories of worker occupations.

Answer: The four broad categories of worker occupations are (1) production workers, (2) logistics workers, (3) service workers, and (4) knowledge workers.

1.9   Define productivity.

Answer: As defined in the text, productivity is the level of output of a given process relative to the level of input.

1.10   Labor is one input factor that determines productivity. What are two other factors that are more important than labor in improving productivity? Define each of these two additional input factors.

Answer: The two additional input factors are capital and technology. Capital refers to the substitution of machines for human labor; for example, investing in an automated production machine to replace a manually operated machine. Technology refers to a fundamental change in the way some activity or function is accomplished. It is using a brand new type of machine to replace the previous type.

1.11   What is the difference between the labor productivity ratio and the labor productivity index?

Answer: The labor productivity ratio is defined as the output work units (e.g., tons of steel produced, number of automobiles produced) divided by the number of input labor hours, whereas the labor productivity index is the labor productivity ratio in some period of interest divided by the labor productivity ratio in a defined base year.

1.12   A given task performed by a worker can be considered to consist of the basic productive work content and excess nonproductive activities. (a) What is meant by the term *basic productive work content*? (b) What is meant by the term *excess nonproductive activities*?

Answer: As defined in the text, (a) the basic productive work content is the theoretical minimum amount of work required to accomplish the task, where the amount of work is expressed in terms of time; and (b) the excess nonproductive activities are the extra physical and mental actions performed by the worker that do not add value to the task, nor do they facilitate the productive work content that does add value.

1.13   What are the three categories of excess nonproductive activities, as they are defined in the text?

Answer: The three categories of excess nonproductive activities are (1) excess activities caused by poor design of the product or service, (2) excess activities caused by inefficient methods, poor work layout, and interruptions, and (3) excess activities caused by the human factor.

Problems

Productivity

1.1   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.

Solution: (a) Possible measures of productivity, $O = 500$ units
(1) Output units per person-month: $LPR = 500/5 = 100$ units/person-month
(2) Output units per person-day: $LPR = 500/5(22) = 4.545$ units/person-day
(3) Output per labor hour: $LPR = 500/5(22)(8) = 0.568$ units/hr

(b) $O = 600$ units/month
(1) Output units per person-month: $LPR = 600/5 = 120$ units/person-month
(2) Output units per person-day: $LPR = 600/5(20) = 6.0$ units/person-day
(3) Output per labor hour: $LPR = 600/5(20)(8) = 0.75$ units/hr

Productivity index (using month 1 as base)
(1) $LPI = 120/100 = 1.2$
(2) $LPI = 6.0/4.545 = 1.32$
(3) $LPI = 0.75/0.568 = 1.32$

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 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.

Solution: (a) Productivity measure = units of output per worker-hour
$LPR = 7200/10(8)(22) = 4.091$ units/hr

(b) Productivity measure = units of output per worker-month
$LPR = 7200/10(1) = 720$ units/wrkr-mo

(c) For LPR in (a), $LPR = 6800/10(8)(20) = 4.25$ units/hr
$LPI = 4.25/4.091 = 1.039 = 103.9\%$

For LPR in (b), $LPR = 6800/10(1) = 680$ units/wrkr-mo
$LPI = 680/720 = 0.944 = 94.4\%$

1.3   A work group of 20 workers in a certain month produced 8600 units of output working 8 hr/day for 21 days. (a) What is the labor productivity ratio for this month? (b) In the next month, the same worker group produced 8000 units but there were 22 workdays in the month and the size of the work group was reduced to 14 workers. What is the labor productivity ratio for this second month? (c) What is the productivity index using the first month as a base?

Solution: (a) $LPR = 8600/20(8)(21) = 2.559$ units/hr

(b) $LPR = 8000/14(8)(22) = 3.247$ units/hr

(c) $LPI = 3.247/2.559 = 1.269 = 126.9\%$

1.4   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 are an average of 600 parts

3

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

Solution: (a) Time to produce a batch = T_B
$T_B = 3.0(60) + (45/60)(600) = 180 + 450 = 630$ min = 10.5 hr
Hours/month = 8(21) = 168 hr/mo
$R_p = 168/10.5 = 16$ batches/mo per press
With 20 presses, $R_p = 20(16) = 320$ batches/mo
With $Q = 600$ pc/batch, $R_p = 320(600) = 192,000$ pc/mo

(b) Total labor hours during month = 8(21)(2 x 20 + 2 + 3) = 168(45) = 7560 hr/mo
$LPR = 192,000/7560 = 25.4$ pc/wrkr-hr

1.5 A farmer's market is considering the addition of bar code scanners at their check-out counters, which would use the UPC marked on all grocery packages. Currently, the check-out clerk keypunches the price of each item into the register during check-out. Observations indicate that an average of 50 items are checked out per customer. The clerk currently takes 7 seconds per item to keypunch the register and move the item along the check-out table. On average it takes 25 seconds to total the bill, accept money from the customer, and make change. It then takes 4 seconds per item for the clerk to bag the customer's order. Finally, about 5 seconds are lost to transition to the next customer. Bar code scanners would eliminate the need to keypunch each price, and the time per item would be reduced to 3 seconds with the bar code scanner. (a) What is the hourly throughput rate (number of customers checked out per hour) under the current check-out procedure? (b) What would be the estimated hourly throughput rate if bar code scanners were used? (c) If separate baggers were used instead of requiring the check-out clerk to perform bagging in addition to check-out, what would be hourly throughput rate? Assume that bar code scanners are used by the clerk. (d) Determine the productivity index for each of the two cases in (b) and (c), using (a) as the basis of comparison and hourly customers checked out per labor hour as the measure of productivity.

Solution: (a) Current check-out procedure:
Time per customer $T_c = 50(7 + 4) + 25 + 5 = 580$ sec = 9.667 min
Hourly throughput rate $R_p = 60/9.667 = 6.21$ customers/hr per clerk

(b) With bar code scanner:
Time per customer $T_c = 50(3 + 4) + 25 + 5 = 380$ sec = 6.333 min
Hourly throughput rate $R_p = 60/6.333 = 9.47$ customers/hr per clerk

(c) Bar code with separate bagger:
Time per customer for clerk $T_c = 50(3) + 25 + 5 = 180$ sec = 3.0 min
Time per customer for bagger $T_c = 50(4) + 5 = 205$ sec = 3.417 min
  where the 5 sec for bagger is assumed transition time between customers
Hourly throughput rate $R_p = 60/3.417 = 17.56$ customers/hr per lane (clerk and bagger)

(d) For (b), $LPI = 9.47/6.21 = 1.525$

For (c), *LPI* = ½(17.56/6.21) = 1.414 (reduced by ½ because two workers per lane)

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