Chapter 8

Performance Rating

8 Introduction

As the time study analyst observes a job and collects time data, the analyst is also evaluating the employee's actual performance in relationship to the analyst's impression of what the normal, average speed for doing the job should be[1].

Rating is a subjective factor and relies on the judgment and experience of the analyst. While observing the worker, the time study analyst evaluates the worker's performance (or pace), and a record of this pace is assigned to each work element time. The evaluation of the worker's pace is called ***performance rating***[2]. The observed time is multiplied by the performance rating to obtain the normal time for the work element or task[3].

The analyst must consider the difficulty of the job and the conditions under which the job is performed and make the appropriate adjustment to their concept of normal pace.

All employees do not work at the same speed or pace. Some are average, some are slow, and some are fast. The purpose of performance rating is to adjust the actual observed time so it will represent the standard time for the average trained employee to do the job.

A trained analyst can observe any employee working at any speed, and still be able to compute the standard time to do the job.

8.1 Accuracy of Performance Rating

Performance rating is the most controversial topic in time studied standards.

All standards will be in error. There is no such thing as a perfect standard. However, a standard should be close enough to its true value to be of practical use in its intended application. Table 8.1 shows the degree of accuracy of different worker performance applications.

Table 8.1. Accuracy levels of different worker performance applications.

Application	Accuracy
Incentive Pay Piece Rates	+/- 5%
Day Work Quota Standards	+/- 10%
Costing and Planning	+/- 15%

1. **Incentive piece rates** are used to pay employees for each unit of product they manufacture. This results in the amount of money each person receives in their paycheck

each week. These rates MUST be reasonably accurate. If they are not, then everyone will want to do the good paying jobs, and nobody will want to do the jobs that pay poorly.

2. **Day work standards** are used when daily quotas are established for each job in the facility. On some days actual production may be a little more or a little less than the quota, but as long as the average works out by the end of the week, nobody is concerned. Employees are paid the same each day whether they meet their quota.

3. **Costing and planning standards** are used for bookkeeping purposes to allocate costs to the various products so that customer pricing can be reasonable. They do NOT impact individual pay checks nor the daily plant output.

8.2 Rating Methods

1. Rate the entire job. Regardless of the number of elements or times, you only rate the job once.

2. Rate each element individually. If there are seven different elements, then you have seven ratings.

3. Rate each individual time value as it is recorded. If there are 200 times, then you have 200 ratings.

In this course we will be using option 2 above. Each major element will be rated by itself.

8.3 Normal Performance Concepts

Normal, average performance is established at 100% productivity. Each company must decide how they will define 100% productivity. The following two methods are commonly used:

High Task Standard: 100% is established at the exact center of the normal bell curve (the mean). Therefore, half of the employees will not be able to achieve standard (they will require more time than the standard). In Figure 8.1, a High Task Standard would be 20 Seconds per cycle, which would equal a daily paycheck of $132. Half the company's employees could work faster than this and they would earn more per day, but half the employees would work slower than this and they would earn less per day.

Low Task Standard: 100% is established near the right end of the normal bell curve so that 95% of the company's employees can achieve or exceed 100% productivity. Only

5% of the employees will require more time than the standard time. In Figure 8.1, this would be 24 Seconds per cycle, which would equal a daily paycheck of $110 per day. Approximately 95% of the company's employees would be able to work faster than this and they would earn more per day. Only 5% would need more time and they would earn less per day.

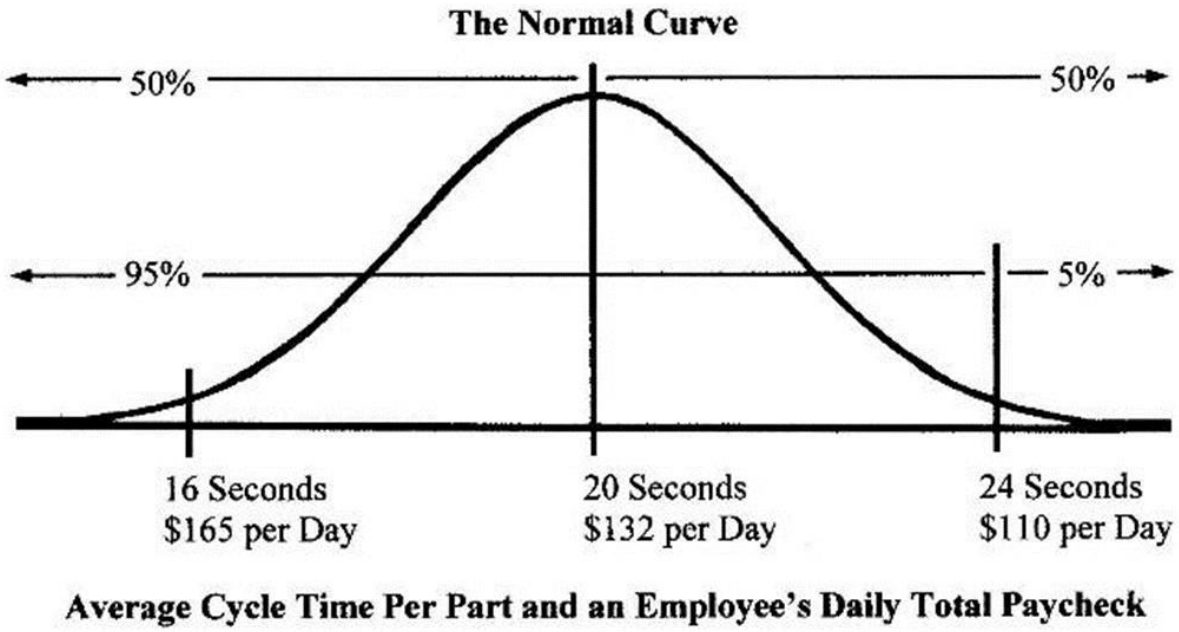

Figure 8.1. The Normal Curve with High Task Standard and Low Task Standard.

Labor Cost: In both a High Task Standard and a Low Task Standard, the actual payroll cost to the company is the same. The reason is because the amount of pay is based on how many seconds it takes an employee to complete one cycle. For example, in a High Task Standard if the employee averages 16 Seconds per cycle, the employee will earn $165 per day. In a Low Task Standard if the employee averages 16 Seconds per cycle, the employee will earn $165 per day.

Employee Morale: If the Low Task Standard is set at 24 Seconds per cycle, then approximately 95% of the employees will be able to go home each day knowing that they met or exceeded the standard quota for the day. But if a High Task Standard is set at 20 Seconds per day, then only 50% of the employees will be able to go home each day knowing they met or exceeded the standard quota for the day. The other 50% would go home each day in poor spirits because they would know that once again, they failed to meet the company's standard quota for their job. This would have a long-term negative impact on their morale, and it may lead to other problems in the future, such as a union organization campaign. This could have been avoided by using a Low Task Standard and simply saying that 24 Seconds per day is 100% performance.

In both the High Task Standard and the Low Task Standard, the actual labor cost to the company remains constant because the company is paying the same cost per part produced. The only difference is the impact on employee morale. A Low Task Standard preserves employee morale and allows more of the company's employees to have a positive self-image of himself or herself. Therefore, a Low Task Standard should be used whenever possible.

8.4 Other Rating Systems

8.4.1 The Point Factor Rating Method:

The Point-Factor (or Point-Rating) method defines characteristics or elements common to the jobs being evaluated, defines degrees of each element, and allocates point values to each degree. The total value determined for each job is the sum of the point values assigned by the evaluators. There are factors and degrees for each job element as shown in Table 8.2.

Table 8.2. The Point-Factor Rating Method[4]

Factors	Importance	Lowest	Next	Next	Next	Highest	Candidates	
Total points = 500	**Weight**	**Degree**	**Degree**	**Degree**	**Degree**	**Degree**	**Ashley**	**Kaylyn**
Skill = 250 points								
1. Education	1.2	14	28	42	56	70	1.2(42)	1.2(28)
2. Experience	1.5	22	44	66	88	110	1.5(22)	1.5(66)
3. Initiative and integrity	1.0	14	28	42	56	70	1(14)	1(56)
Effort = 75 points								
4. Physical demand	1.0	10	20	30	40	50	1(10)	1(10)
5. Mental or visual demand	1.5	5	10	15	20	25	1.5(10)	1.5(10)
Responsibility = 100 points								
6. Equipment or Process	1.5	5	10	15	20	25	1.5(15)	1.5(20)

7. Material or Product	1.0	5	10	15	20	25	1(10)	1(10)
8. Safety of others	1.5	5	10	15	20	25	1.5(25)	1.5(20)
9. Work of others	1.0	5	10	15	20	25	1(25)	1(20)
Job Conditions = 75 points								
10. Working conditions	0.75	10	20	30	40	50	.75(30)	.75(40)
11. Unavoidable hazards	1	5	10	15	20	25	1(15)	1(20)
						Totals	254.9	353.6

8.4.2 The Westinghouse System[5]:

A four-factor system based on skill, effort, environment (or conditions), and consistency. In short, skill is proficiency in following the given method, effort is the will to work, environment refers to the general work surroundings; and consistency refers to the performance itself. A table is used to determine the plus or minus percent to be applied for each factor, with the final rating being the sum of the four factors plus 100%. There are levels and scales of numerical values for each factor as shown in Table 8.3.

Table 8.3. The Westinghouse Rating System[6,7]

Skill			*Effort*			*Environment(Condition)*		
+0.15	A1	Super skill	+0.13	A1	Excessive	+0.06	A	Ideal
+0.13	A2	Super skill	+0.12	A2	Excessive	+0.04	B	Excellent
+0.11	B1	Excellent	+0.10	B1	Excellent	+0.02	C	Good
+0.08	B2	Excellent	+0.08	B2	Excellent	0.00	D	Average
+0.06	C1	Good	+0.05	C1	Good	-0.03	E	Fair
+0.03	C2	Good	+0.02	C2	Good	-0.07	F	Poor
0.00	D	Average	0.00	D	Average	*Consistency*		
-0.05	E1	Fair	-0.04	E1	Fair	+0.04	A	Perfect
-0.10	E2	Fair	-0.08	E2	Fair	+0.03	B	Excellent
-0.16	F1	Poor	-0.12	F1	Poor	+0.01	C	Good
-0.22	F2	Poor	-0.17	F2	Poor	0.00	D	Average
						-0.02	E	Fair
						-0.04	F	Poor

Table 8.4 provides summary results of an example of performance rating an employee using the Westinghouse Rating System.

Table 8.4. Westinghouse Rating System – Example of Performance Rating an Employee

Category	Rating	%
Skill	B2	8%
Effort	C1	5%
Environment	E	-3%
Consistency	C	1%
Net Difference	=	11%
Performance Factor Rating =		**111%**

8.5 Benchmark Standards

Walking 3 miles per hour (or 50 feet in 11.3 seconds or 0.189 minutes) carrying no weight, on level ground, taking an average 27-inch stride.

Walking 3.57 miles per hour through an unobstructed area unencumbered with an average 34-inch pace (MTM Association guideline).

Dealing 52 playing cards into four piles in 30 seconds (or 0.500 minutes). The left hand holds the deck behind the front edge of the table and pushes each card forward with the left thumb. The right hand takes each card and delivers it (not tosses it) to each of the four stacks, located at the inside corners of a one-foot square with the first stack directly in front of the left hand.

Normal, average performance is established at 100% productivity. In other words, it is the speed the average trained employee can maintain for an entire workday. If the person is working slower than the average employee, the rating would be less than 100%, such as 80% or 95%. If the person is working faster than the average employee, the rating would be more than 100%, such as 105% or 120%. When you complete the Performance Rating Practice Record, you should rate the speed at which the walking or hand motion is being done in relation to the time that would be required for the average person. Ratings are always in percents, such as 100% or 90% or 115%. You are not trying to guess the amount of time required. You are trying to estimate the speed at which the feet are moving, or the speed at which the hands are moving, in relation to 100%. This percentage is the value you insert in the "My Rating" column.

8.5.1 Walking Rating Practice

Benchmark = Walking 3 miles per hour (or 50 feet in 11.3 seconds or 0.189 minutes) carrying no weight, on level ground, taking an average 27-inch stride.

You are to measure a flat, level area where you can walk unobstructed for exactly fifty feet. There should be an additional five feet at the beginning of this area and an additional five feet at the end of this area so the total unobstructed distance will need to be sixty feet. The first five feet are used to start walking and to get up to the normal walking speed. The final five feet is to slow down and come to a stop **after** passing the measured fifty-foot mark.

You should start standing still at the beginning of the sixty-foot area. You should then start walking and when you pass the beginning of the measured fifty-foot area, you should start your stopwatch and let it time you until you pass the end of the measured fifty-foot area. As you step past the fifty-foot mark, you should stop your stopwatch and then slow down and come to a complete stop at the end of the sixty-foot area.

Without looking at your stopwatch, estimate how fast you were walking in terms of the 100% average walking speed. Write that percentage down in the "My Rating" column of the data collection form (below). In the "Stopwatch Time" column write down the time from your stopwatch in seconds (or in 1/1000 of a minute). In the "Leveled Rating" column, convert the actual time to the leveled time by dividing 11.3 seconds (or 0.189 minutes) by the actual stopwatch time in seconds (or minutes), then multiply by 100 to convert into a percentage.

Example 1. Walking Performance Rating

The example below in seconds. You may use either seconds or minutes but be consistent. Although one person can perform this exercise, it is strongly recommended that two people work together on this exercise. While one person is walking at different speeds during each cycle, the other person can record the stopwatch times.

Number	My Rating	Stopwatch Time	Leveled Rating	Difference
1	90	14.0	81	+ 9
2	115	8.5	133	- 18
3	105	12.0	94	+ 11

How to calculate the above **Leveled Ratings**:

(11.3 seconds / 14.0 seconds) x 100 = 81.
(11.3 seconds / 8.5 seconds) x 100 = 133.
(11.3 seconds / 12.0 seconds) x 100 = 94.

How to calculate the above **Differences**:

90 - 81 = +9
115 - 133 = -18
105 - 94 = + 11

Do **not** show the above calculations of all the numbers on your form. The goal in performance rating is to have a zero difference between the analyst's estimated performance rating and the leveled rating. A positive difference indicates overestimating the performance rating. A negative difference indicates underestimating the performance rating. The further away the difference is from zero, the worse the estimate is for the performance rating.
Ratings are always in multiples of five, such as 85, 90, 95, 100, 105, 110, etc. Industrial Engineers do **not** rate in exact values such as 88, 94, 106, etc. Therefore, the times in the "My Rating" column must be your guess to the nearest five units.

However, the "Leveled Rating" is to the nearest whole number. You should compare your rating with the leveled rating and see whether you are rating too high or too low. Record the difference in the difference column on the form. To compute the difference column, subtract the "Leveled Rating" from "My Rating" and show the difference as a positive or negative number. If the difference is a negative number, then try rating a little higher on the next practice opportunity. If the difference is a positive number, then try rating a little lower on the next practice opportunity.

If you were to time yourself walking a total of 10 times, summarize the results on the handout.

You should try to keep your walking speed constant during the entire measured fifty-foot stretch. However, each time you start over at the beginning of the area, you should try to walk at a different speed than you did last time. This will give you some practice at rating different walking speeds. (Try walking slow sometimes and then try walking fast sometimes.)

8.5.2 Hand Motion Rating Practice

Benchmark = Dealing 52 playing cards into four piles in 30 seconds (or 0.500 minutes). The left hand holds the deck behind the front edge of the table and pushes each card forward with the left thumb. The left hand does not move past the front edge of the table. The right hand takes each card from the left hand and delivers it (not tosses it) to each of the four stacks, located on the inside corners of a one-foot square with the first stack directly in front of the left hand.

Using a normal deck of 52 playing cards, complete the above exercise. You will need to have a friend time you as you deal the cards. Your friend should say "Start" and you should begin dealing the cards and your friend will start the stopwatch. When you have placed the last card in the last stack, your friend should stop the stopwatch. You should write down your estimate of how fast you think you were dealing with the cards in the "My Rating" column. Then you should calculate the "Leveled Time" for dealing the cards by dividing 30 seconds (or 0.500 minutes) by the actual stopwatch time, then multiply by 100 to convert into a percentage. Do this 10 times and summarize the results in table format. Keep your hand speed constant during each deal but vary your hand speeds on different deals.

Example 2. Hand Motion Performance Rating

The example below is in seconds. You may use either seconds or minutes but be consistent.

Number	My Rating	Stopwatch Time	Leveled Rating	Difference
1	105	30.23	99	+ 6
2	110	26.27	114	- 4
3	90	32.39	93	- 3

How to calculate the above **Leveled Ratings**:
(30 seconds / 30.23 seconds) x 100 = 99.
(30 seconds / 26.27 seconds) x 100 = 114.
(30 seconds / 32.39 seconds) x 100 = 93.

How to calculate the above **Differences**:
105 - 99 = + 6
110 - 114 = - 4
90 - 93 = - 3

As in the previous Walking Performance Rating example, the goal in performance rating is to have a zero difference between the analyst's estimated performance rating and the leveled rating. A positive difference indicates overestimating the performance rating. A negative difference indicates underestimating the performance rating. The further away the difference is from zero, the worse the estimate is for the performance rating.

8.6 Alternative Formulas for Calculating the Performance Rating

An alternative method for calculating the worker's performance rating is given by using Eq. 1 or Eq. 2 as follows:

$$PR = P_w = \frac{T_{nw}=100\%}{Operator\ Cycle\ Time} \tag{8.1}$$

Alternatively,

$$PR = P_w = \frac{Operator\ Time\ at\ PR = 100\%}{Operator\ Time\ at\ Actual\ No.\ of\ Hours\ Worked} \tag{8.2}$$

Example 3. Calculating the Performance Rating of an Employee

The snapback timing method in direct time study was used to obtain the times for a worker-machine task. The recorded times are listed in the table below. Element c is a machine-controlled element, and the time is constant. Elements a, b, and d are operator-controlled and were performance rated at 85%. Elements a and b are external to machine-controlled element c. Element d is internal to the machine element. The machine allowance is zero, and the PFD allowance is 12%. Determine (a) the normal time and (b) the standard time for the cycle. The worker's actual time spent working during an 8-hour shift was 7.25 hours, and he produced 500 units of output during this time. Determine (c) the worker's performance during the operator-controlled portions of the cycle.

Element	a	b	c	d
Observed time (min)	0.32	0.20	0.62	0.47

Solution:

(a) Normal time for worker:

For elements a and b, (operator-controlled and external)

$$T_{nw} = (T_e(a) + T_e(b))(PR)$$

$$= (0.32 + 0.20)(0.85)$$

$$= (0.52)(0.85)$$

$$= 0.442\ min/unit$$

Normal time for cycle: (element d is internal; element c is machine-controlled)

$$T_{nc} = (T_{nw} + Max\{T_e(d)(PR), (T_e(c)(PR)\})$$

$$= (0.442\ min + Max\{(0.47\ min)\ (0.85), 0.62\ min(\ 1.0)\})$$

$$= (0.442\ min/unit + Max\{.3995\ min, 0\ .62\ min\})$$

$$= 0.442\ min + 0.62\ min$$

$$= 1.062\ min/unit$$

(b) Standard time:

$$T_{std} = T_{nw}(1 + A_{pfd}) + T_{nm}(1 + A_m)$$
$$= 0.442\ min(\ 1 + 0.12) + Max\{((0.47)(0.85)(1 + 0.12)), 0.62)\}$$

$$= 0.495\ min + Max\{0.447\ min, 0\ .62\ min\}$$

$$= 1.115\ min/unit$$

(c) Worker performance:

$$Produced\ Q = 500\ units\ in\ 7.25\ hr\ of\ an\ 8 - hr\ shift$$

$$Machine\ time = 500\ units\left(\frac{0.62\ min}{unit}\right) = 310.0\ min$$

$$Operator\ Time = H_w - T_m = \left(7.25\ hr \times \frac{60\ min}{hr}\right) - 310.0\ min = 125.0\ min$$

$$Operator\ Cycle\ Time = \frac{Operator\ Time}{Q} = \frac{125.0\ min}{500\ units} = 0.25\ min/unit$$

$$PR = \frac{T_{nw} = 100\%}{Operator\ Cycle\ Time} = \frac{0.442\ min}{0.25\ min/cycle} = 1.768 \times 100 = 176.8\%$$

Alternative method: Operator time at *PR* = 100% = 500 units(0.442 min) = 221 min

$$PR = \frac{Operator\ Time\ at\ PR = 100\%}{Operator\ Time\ at\ 7.25\ hrs\ worked} = \frac{221.0\ min}{125.0\ min} = 1.768 \times 100 = 176.8\%$$

Example 4. Performance Rating of Walking

A common benchmark of standard performance is a healthy person walking at the rate of 3.0 mi/hr. Relative to the benchmark, what is the performance rating of a female walking 2.5 miles in 45 minutes?

Solution:

If standard performance = 3.0 mi/hr,

Then, the standard time to complete one mile is

$$\frac{60\ mi}{3\ min} = 20\ min/mi$$

Therefore,

$$PR = \frac{20min}{1\ mi} \times \frac{2.5\ mi}{45\ min} = \frac{50}{45} = 1.11, or\ 111\%$$

Proof:

$$Expected\ walking\ distance\ at\ standard\ time = \frac{mi}{20\ min} \times 45\ min = 2.25\ mi$$

$$Since\ she\ walked\ 2.5\ miles\ instead\ of\ 2.25\ miles, her\ walking\ pace\ was$$

$$\frac{2.5 - 2.25}{2.25} = \frac{0.25}{2.25} = 0.11, or\ 11\%\ faster\ than\ standard\ performance$$

8.7 Summary

Performance rating plays a crucial role in setting accurate time standards by adjusting observed times to reflect average performance levels. Despite its importance, it remains a controversial topic due to its subjective nature. Methods like the Point Factor Rating Method and the Westinghouse Rating System aim to reduce subjectivity and enhance consistency. Benchmark standards, such as walking and dealing a deck of playing cards, provide valuable references for calibrating performance ratings and ensuring fairness and accuracy in time standards.

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