

IENG112
Notes #6

Work Design and Organizational Performance Measurement

1. Productivity Measurement

1.1 General Idea:

$$\frac{\text{output}}{\text{input}} \quad (1)$$

Examples. (a) Units per Labor Hour, (b) Units per Ton (raw material), (c) Units per Joule/BTU¹/kWh, (d) Units per Dollar. Units can be thousands, millions, etc. of basic units.

Good for comparison for other organizations in the same industry or different industries. Companies are watching one another.

Aggregate units are units which are suitable for measuring different items. The most frequent aggregate units are time and money.

Example: A Factory

Say that a factory produces \$1,000,000 worth of televisions in a month, with 800 hours worked in total by all of its employees.

The productivity formula would look like this: Productivity = 1,000,000 / 800 = \$1,250 / hour. This means that the factory is producing \$1,250 worth of televisions an hour.

This is not to be confused with profit, because the productivity value does not take into account operating costs, wages for employees, and other overhead of the factory.

1.2 Dynamic Version

$$\frac{\frac{\text{output}_{\text{this time period}}}{\text{input}_{\text{this time period}}}}{\frac{\text{output}_{\text{base time period}}}{\text{input}_{\text{base time period}}}}$$

Base time period. Examples: (i) first full year of the company, (ii) first full year after a major reorganization. Base time period is also used in statistics. It can be the first year after a war or any major changes.

Dynamic index shows tendencies.

1.3 How to Find a Proper Index Set for a Company

The method is called: Nominal Group Technique (NGT), the result is Normative Productivity Measurement Model.

NGT

¹ British Thermal Unit: Approx. 1055 joule = the energy the increase the temperature of 1 pound of water by one degree Fahrenheit.

STEP 0: A group of 5 to 12 persons with a head must be nominated. The group must cover all areas of the company.

STEP 1: (Silent Generation) Each person prepare a list of measures.

STEP 2: (Round Robin; special meeting) Each person presents one measure. This continues around the group as many times as necessary to exhaust everyone's list.

STEP 3: (Group Clarification) All ideas are clarified and duplications are filtered out.

STEP 4: (Voting) In the case of N measures each member of the group gives number from 1 to N to the measures. N is the most important, 1 is the less important. Selection is made based on the result of voting.

Remark. Compare the American style meeting by the Japanese style meeting.

2. Analysis of the Moves of Individual Workers and Methods of Improvement

2.1 Creation of Flow Process Chart

Flow process chart shows the current method.

Example. Textbook Example 6.2, pages 156 to 158, Mr. Café's spaghetti production.
Assaumption: tap water is drinking water.

Process: Prepare Spaghetti Begins: In Storage Charter: Ind. Eng. Present <input checked="" type="checkbox"/> Proposed <input type="checkbox"/>		Man <input type="checkbox"/> or Material <input checked="" type="checkbox"/> Noodles Ends: Ready to Serve Date: 7/24
Steps	Symbol	Notes
1. Noodles on Shelf	▽	
2. Carried to Cooker	◇	
3. Cooked	○	
4. Placed in Bowl	◇	Wash in Cooker?
5. Carried to Sink	◇	Very Heavy
6. Washed	○	
7. Bowl Carried to Work Area	◇	Very Heavy
8. Placed in Serving Pans	◇	Six Pans-Full
9. Meat and Sauce Added to Pans	○	Repeated Six Times
10. Pans Carried to Heater	◇	Repeated Six Times
11. Warmed	▽	
12. Carried to Serving Line	◇	Repeated Six Times

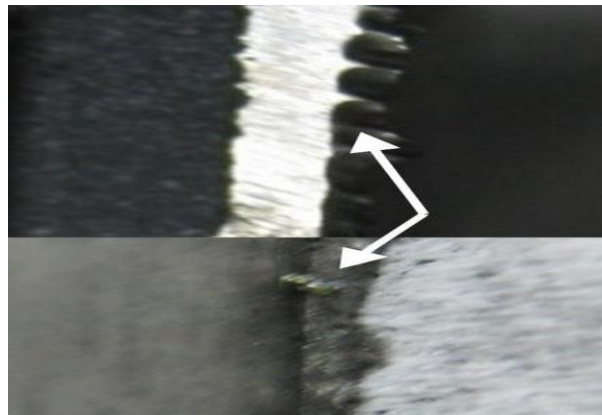
The suggested new method is presented also in flow process chart. Here the suggested new method is that the spaghetti should be washed in the cooker. The method needs a new tap close to the cooker. Advantage: no transportation of heavy item.

Process: Prepare Spaghetti Begins: In Storage Charter: Ind. Eng. Present <input type="checkbox"/> Proposed <input checked="" type="checkbox"/>		Man ___ or Material <u>X</u> Noodles Ends: Ready to Serve Date: 7/26
Steps	Symbol	Notes
1. Noodles on Shelf	▽	
2. Carried to Cooker	⇨	
3. Cooked	○	
4. Washed in Cooker	○	Add a Tap Adjacent to Cooker
5. Meat and Sauce Added	○	
6. Warmed	▽	
7. Placed in Serving Pans	⇨	Repeat Six Times
8. Carried to Serving Line	⇨	Repeat Six Times

2.2 Application of Left-Hand – Right-Hand Chart

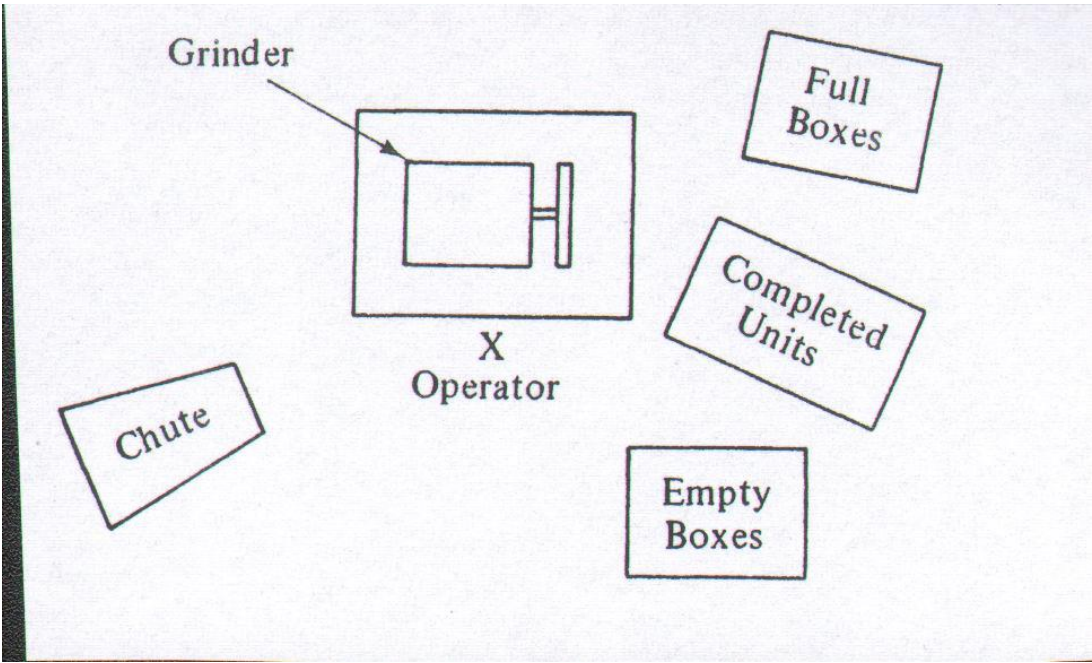
Example.

The key notion is *burr*: it is an undesirable surplus which must be removed. Burr is created at any kind of welding including even plastic. The example is about plastic. The product is pot handle. The machine which is used in the operation is *grinder*. Grinder can be used for sharpening knives. Transportation of the semi-finished handles is made by a *chute*. Chute is a transportation equipment which uses gravity as the power which moves the items. Item completed the operation are transported in boxes.

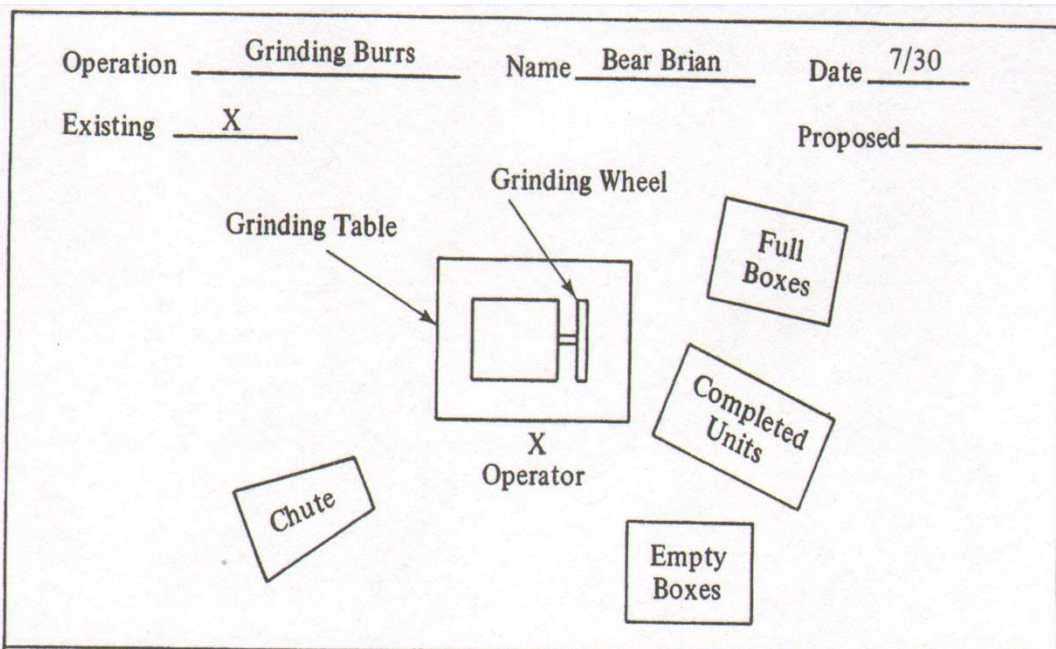


Burr

The current arrangement of the workplace:



The chart of the current method:



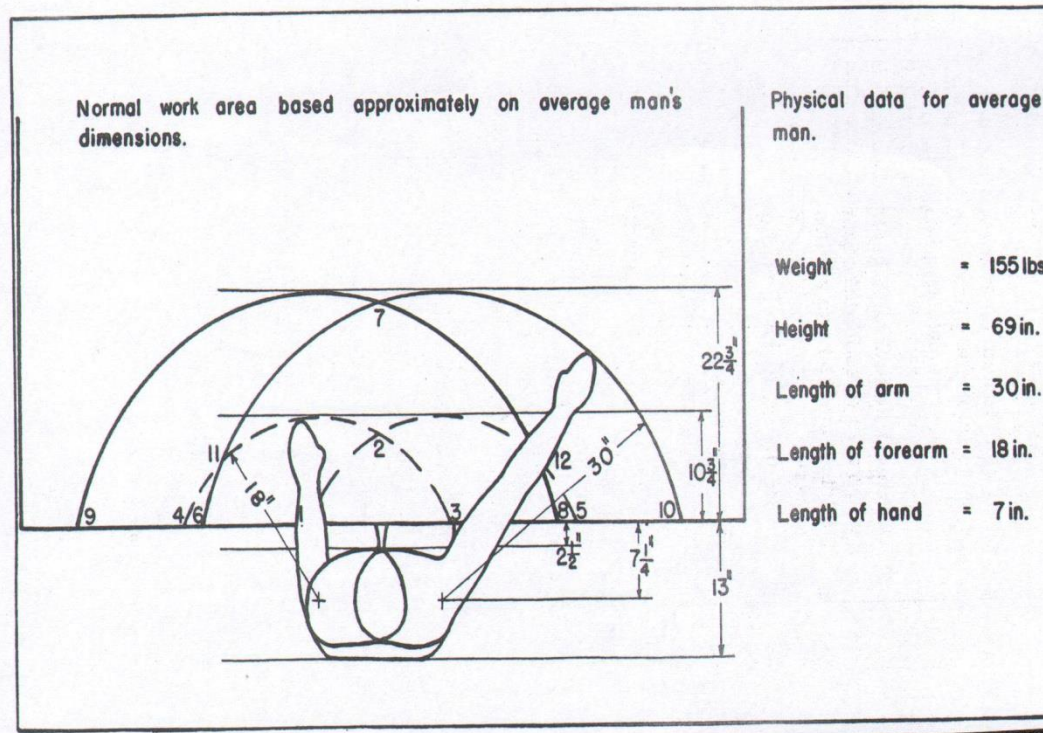
Left-hand Activity	Symbol	Symbol	Right-hand Activity
1. Reach to Chute	◇	D	1. Wait
2. Pick up 3 Parts	○	D	2. Wait
3. Move to Center	◇	D	3. Wait
4. Hold Parts	▽	○	4. Position Part and Grind
5. Hold Parts	▽	◇	5. Move to Right and Drop in Box
6. Hold Parts	▽	◇	6. Move Back to Center
7. Hold Parts	▽	○	7. Repeat 4
8. Hold Parts	▽	◇	8. Repeat 5
9. Hold Parts	▽	◇	9. Repeat 6
10. Hold Parts	▽	○	10. Repeat 4
11. Hold Parts	▽	◇	11. Repeat 5
Repeat Steps 1 through 8 56 times.			
9. Walk to Box	D	D	9. Same as left hand
10. Slide Full Box Out	◇	◇	10. Same as left hand
11. Move Empty Box In	◇	◇	11. Same as left hand
12. Walk Back	D	D	12. Same as left hand

The suggested solution is double-handed operation with a common drop hole.

Operation Grinding Burrs Name Ara Smith Date 7/30
 Existing _____ Proposed X

Left-hand Activity			Right-hand Activity
1. Reach to and Preposition Handle	◇	◇	1. Reach to and Preposition Handle
2. Slide to Grinder	◇	◇	2. Slide to Grinder
3. Grind	○	○	3. Grind
4. Slide to Center and Drop	◇	◇	4. Slide to Center and Drop

2.3 Analysis of Human Work Areas



Any tool should be placed in a distance such that it is easy to reach the tool. The method can be used even for designing kitchen.