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EFFICIENCY OF LINE BALANCING/CYCLE TIME REDEFINED

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Efficiency is defined as "the ability to do something or produce something without wasting materials, time, or energy: the quality or degree of being efficient."http://www.learnersdictionary.com/definition/efficiency.

Heizer and Render (page 378, 2014), Jacobs and Chase (page 189, 2011), and Meredith and Shafer (page 57, 2013), when describing efficiency of balancing the production line, present the following relationship:

Efficiency = (output)/ (input)
= (total task time)/ [(actual workstations) X (cycle time)]
= TTT/ [NA X CT] **Equation 1**

Where:
N_T = number of theoretical workstations
TTT = Total Task Time
CT = Cycle Time

Conceptually this is correct, but it leaves the reader to wonder whether this is the same efficiency when comparing the "theoretical workstations" to "the actual workstations." After all, wouldn't this also be a measure of efficiency? The efficiency presented by the authors should be equal to the following relationship:

Efficiency = (Number of theoretical workstations) / (Number of actual workstations)
= N_T/N_A

Equation 2

Where:
N_T= number of theoretical workstations
The mathematical proof of this relationship is:
The number of theoretical workstations is estimated using the following equation taken from the above cited authors.
Use the abbreviations provided above to follow the logic of this proof.
N_T= Total Task Time/Cycle Time = TTT/CT

Equation 3

Therefore, using simple algebra we can redefine Equation 3to reflect the following relationship
→ TTT = CT * NT

Equation 4

Now, substitute Equation 4 into Equation 1 as follows:
Efficiency = (TTT)/ (NA* CT) = (CT*NT)/ (NA*CT)
The CT's cancel out leaving us with → Efficiency = NT/NA

Equation 2

Thus, quod erat demonstrandum.
Going back to Meredith and Shafer (pg. 57) the theoretical workstations is 4.75 and the actual workstations is 5, so the efficiency is (4.75/5) = 95% which is their estimate when using Equation 1.
We find this definition of efficiency to be easier to visualize and it is an easy check to ensure that efficiency is estimated correctly.

References:

[1].Heizer, Jay and Barry Render. (2014) Operations Management 11th edition. Pearson. 796 pp.
[2].Jacobs, F. Robert and Richard B. Chase. (2011) Operations and Supply Chain Management 13th edition. McGraw Hill. 793 pp.
[3].Meredith, Jack R. and Scott M. Shafer. (2013) Operations Management for MBAs 5thedition. Wiley. 445 p