

Viewpoint on Manufacturing:

OEE – What is it all about?

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Overall Equipment Effectiveness

OEE stands for Overall Equipment Effectiveness. It is a metric that combines measures of (1) Availability, (2) Performance and (3) Quality into one overall number. This metric is widely used by companies as a KPI, Key Performance Indicator, to monitor and improve the effectiveness of individual equipment, a work cell or a whole production line.

According to a survey conducted by the Aberdeen Group, **Best-In-Class companies**, the top 20% of the survey, had **an average OEE of 88%**. The Average Companies, the middle 50%, averaged 81%. While the Laggards, the bottom 30%, averaged 75%.¹ The Best-In-Class companies **over-achieved their Return-on-Assets by 25%**; whereas, the Laggards missed their targets by 10%. Having visibility to this KPI and using it as part of a program to drive improvements has enabled the Best-in-Class companies to be **more profitable**.

Where would you stand?

How do you calculate OEE ?

The OEE calculation is based on the three OEE Factors, Availability, Performance, and Quality. Here's how each of these factors is calculated.

- Availability - takes into account Down Time Loss, and is calculated as:

$$\text{Availability} = \text{Operating Time} / \text{Planned Production Time}$$

- Performance - takes into account Speed Loss, and is calculated as:

$$\text{Performance} = (\text{Total Pieces} / \text{Operating Time}) / \text{Ideal Run Rate}$$

Where, the *Ideal Run Rate* is the number of parts per hour that your process is expected to achieve in optimal circumstances. In a Lean Manufacturing environment it is the reciprocal of the Takt time. Performance is capped at 1.0 (100%)

- Quality takes into account Quality Loss, and is calculated as:

$$\text{Quality} = \text{Good Pieces} / \text{Total Pieces}$$

OEE takes into account all three **OEE Factors** and is calculated as:

$$\text{OEE} = \text{Availability} \times \text{Performance} \times \text{Quality} \times 100$$

The following is an example of an OEE calculation for a hypothetical shift of operations:

Performance Factor	Data
Shift Length	8 hours = 480 min.
Short Breaks	2 @ 15 min. = 30 min.
Meal Break	1 @ 30 min. = 30 min.
Down Time	47 minutes
Ideal Run Rate	60 pieces per minute
Total Pieces Produced	19,271 pieces
Reject Pieces Produced	423 pieces

Using these data we calculate the following:

$$\begin{aligned} \text{Planned Production Time} &= [\text{Shift Length} - \text{Breaks}] \\ &= [480 - 60] \\ &= \mathbf{420 \text{ minutes}} \end{aligned}$$

$$\begin{aligned} \text{Operating Time} &= [\text{Planned Production Time} - \text{Down Time}] \\ &= [420 - 47] \\ &= \mathbf{373 \text{ minutes}} \end{aligned}$$

$$\begin{aligned} \text{Good Pieces} &= [\text{Total Pieces} - \text{Reject Pieces}] \\ &= [19,271 - 423] \\ &= \mathbf{18,848 \text{ pieces}} \end{aligned}$$

Then:

$$\text{Availability} = 373/420 = .888 \text{ (88.8\%)}$$

$$\text{Performance} = (19,271 / 373) / 60 = .861 \text{ (86.1\%)}$$

$$\text{Quality} = 18,848 / 19,271 = .978 \text{ (97.8\%)}$$

So that

$$\text{OEE} = .888 \times .861 \times .978 \times 100 = \mathbf{74.8\%}$$

As you can see, even though the quality level was quite good, the down time and under-performing production rate (performance) had a significant impact on the resulting OEE metric. Again, according to the Aberdeen report, the Best-In-Class companies had down availability averaging 98%! In this example, assuming the same high Quality percentage, it would mean that the Performance has to be over 90% also!

So ... What does this all mean?

As you can see, being Best-In-Class requires focus on all three areas.

- In order to have a high Availability, you must have *equipment that does not need frequent repairs* and *repairs are completed in a short time.*

- In order to have high Performance, you need both to have *equipment that runs at the expected rate* and *have limited problems that prevent production such as material outages or long setup times*.
- In order to have High Quality you need to have a *stable process with low variation* relative to the specifications and *high quality incoming materials* or components.

Achieving such performance in all three areas requires focused effort, but the payoff as noted at the beginning is higher profitability.

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We, at Applied Technology and Science, Inc., have the experience and technical background to facilitate the required activities for your Manufacturing Operations to improve your OEE metrics. Our facilitator will ...

- Quickly come up to speed in a situation,
- Work with people at all levels in an organization,
- Gather, structure and analyze data into actionable information,
- Formulate an viable action plan,
- Organize, motivate and lead groups of people to achieve the desired results, and
- Work as an Individual Contributor in both Technical and non-Technical areas where necessary.

And, if we don't have the specific skills or expertise needed by your situation, we can find the expert who does. Visit our website at www.appliedtechnsci.com to explore our background, see what our clients have said about us. Then give us a call at 610-850-2769 or send us an email to dhavas@appliedtechnsci.com

ⁱ Shah, M., Littlefield, M., Asset Performance Management, Aberdeen Group, Inc. (www.aberdeen.com), ©2009, pp. 6-7.