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In the new world of multifunction manufacturing teams, limited resources, and relentless pressure on costs, managers are wrestling with three common issues: How to prioritize the use of limited resources. How to manage for optimum results. How to measure progress. If what you measure is what you get, perhaps we had better begin from this perspective. Unfortunately, there are several weaknesses to many of the popular measures.

Maintenance cost as a percentage of replacement asset value, a common metric for benchmarking, establishes cost objectives with no regard for operating intensity or age of assets.

What value is created by performance defined by a high percentage of scheduled to total maintenance if the scheduled tasks are unnecessary or improperly performed?

How valuable is reliability as a performance measure when required availability is significantly less than 100 percent or when there are substantial system redundancies?

Overall equipment effectiveness (OEE) and asset utilization measure availability and production output, but fail to include the cost of attaining increased availability and production.

To rectify these shortcomings, I would like to propose another measure of performance: timed production effectiveness (TPE). TPE can be applied as a measure of effectiveness of individual components as well as an entire facility.

TPE = timed availability x production output x conversion effectiveness.

- Timed availability is the time a facility, system, or component is capable of producing a required result divided by the time windows in which production is scheduled or required. Timed

availability adds two conditions to the conventional definition of availability:

1.

The target or objective is the actual time in which operation is required.

2.

In the event of a failure that slows or interrupts production, the interruption does not end for the purposes of calculating timed availability until production is fully restored.

- Production output is production delivered in specification divided by the production objective. The concept of a production time increment also is applied so that the term reflects output when required to meet scheduled demand. Because actual output can be greater than scheduled output, production output may be greater than 1. If off-specification production is sold at a lesser price, a constant is applied to account for diminished income.
- Conversion effectiveness is a conversion cost objective divided by actual conversion cost. The calculation must include all applicable conversion costs, including those for utilities (electricity, steam, water, etc.), operations, maintenance, administration, and waste disposal.

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Several people who have been introduced to TPE have commented that their enterprise prefers real numbers rather than normalized values. This requirement is easily accommodated. The denominator of conversion effectiveness divided by the numerator of production output results in conversion cost per unit output, a valuable performance measure in its own right. There are other vital measures that can be derived from TPE provided the information structure is properly designed.

During several discussions of TPE, the difficulty of obtaining accurate cost information has been cited as a major barrier. There are two answers:

- First, it is imperative to know exactly how much it costs to deliver a given product. Lacking this knowledge it is easy to sell a product at less than the manufacturing cost, especially in today's highly competitive climate where fractions may be the difference between profit and loss.
- Next, regardless of whether accurate cost information is available today, competitive survival mandates it tomorrow. Those who cross the information bridge separating "guesstimated" and actual costs will have an enormous competitive advantage as well as crucial information with which to prioritize activities.

Whatever the measurement criteria and benchmarks for asset management, they must connect directly to unit objectives and profit, be familiar and understood by senior executives, and lead to optimized management decisions. Nothing else will attract the attention of those who control the funds. **MT**

- To preserve the functions of our physical assets throughout their technologically useful lives
- To the satisfaction of their owners, of their users, and of society as a whole
- By selecting and applying the most cost-effective techniques
- For managing failures and their consequences
- With the active support of all the people involved.