Calculating rated capacity

Evaluating Capacity, Utilization, and Efficiency

The capacity of a resource (or a resource group as a system) and its use (utilization, efficiency, productivity) must be assessed on at least three different levels:

- Resource element: machine or individual worker
- Resource group: work centers or line
- System: plant or supply chain, as a combination of several resource groups

Capacity (potential, current, and historical) can be measured in:

- Units of output: e.g. liters of wine bottled or number of cars running of the line
- Standard time: the standardized duration for a job (how long a qualified operator would take at normal pace to perform the task)
- Clock time indicating how many hours, minutes, etc. a resource can be or is used

A comparison between different capacity measures is only valid for the same time period.

Capacity available

Refers to how much output (units) a machine, work center, or operator, etc. can produce within a specific time period. Capacity available is affected by:

- Product specifications and work content which determine the effort or work required to make the product and how many units can be produced in a given time
- Product mix or work required based on the combination of different products.

There are always reasons why the available capacity cannot be fully used. These losses can be tracked back to causes that are related to the resources (such as the unavailability of machines, workers, tools) or that are rather inherent to the process (such as setups, defects or startup losses).

Utilization

The first set of losses consumes some of the available time of a resource. The actual operating time is lower than the available time. Utilization assesses to what degree an available capacity is used. It is "a measure (usually expressed as a percentage) of how intensively a resource is being used to produce a good or service. Utilization compares actual time used to available time. Traditionally, utilization is the ratio of direct time charged (run time plus setup time) to the clock time available. Utilization is a percentage between 0% and 100% that is equal to 100% minus the percentage of time lost due to machine, tool, worker, etc., unavailability". In other words, it can be described as the percentage of available time that is used. Utilization is often calculated based on historical data to obtain a measure of past performance.

Efficiency

The second set of losses is related to the process itself. Sometimes work goes faster, sometimes it takes longer. There are defects, startup losses and other factors that determine how the actual operating time is or can be used to create output. Efficiency measures "the actual output to the standard output expected […,] how well something is performing relative to existing standards". Assessed over a period of time (a day, a week, etc.), it is a ratio of actual to expected values:

- actual units produced to the expected number based on the standard rate of production
- actual standard hours produced to actual hours worked (taking longer means less efficiency, being faster increases efficiency)
- actual value (expressed in a currency) of output to an expected standard value

In other words, efficiency shows how well the hours actually worked (by a person or a machine) are used compared to the standard way of using them.

Productivity

Productivity measures the overall "ability to produce a good […]. It is the actual output of production compared to the actual input of resources. Productivity is a relative measure across time or against common entities (labor, capital, etc.)". As it takes into account utilization and efficiency, it can be expressed by the following formula:

$$Productivity = Utilization \times Efficiency$$
$$= \frac{Hours\ actually\ worked}{Available\ time} \times \frac{Standard\ hours\ of\ worked\ produced}{Hours\ actually\ worked}$$

Which is equal to:

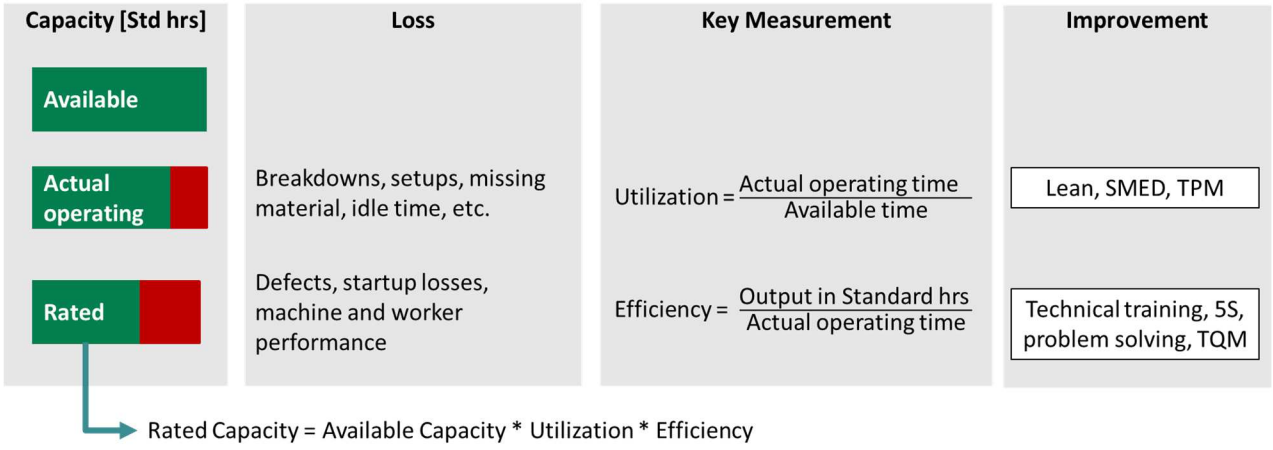
$$Productivity = \frac{Standard\ hours\ of\ worked\ produced}{Available\ time} = \frac{Output}{Input}$$

Rated Capacity

Rated, or calculated, capacity is the product of available time, utilization, and efficiency. It indicates how much of the available capacity is actually used in a productive way.

Summary

In the summary bellow, the right hand shows what measures would allow a company to reduce the losses and increase efficiency and utilization.



For more information please contact:

Christoph LENHARTZ Christoph.Lenhartz@catena-strategies.com