

## OEE improvement through data analytics

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### Some questions for you

- How can data collection help increase production effectiveness?
- Are your maintenance blitzes for equipment organized regularly?
- Does your production plan consider the equipment downtime?

### What's the Overall Equipment Effectiveness (OEE)?

In manufacturing, the OEE is an indicator to measure how well an asset, such as a machine or production line, is utilized during the run-time periods compared to its full potential.

The OEE of a manufacturing unit can be calculated as the product of three separate metrics:

- **Availability:** Ratio between the time in which the machine has actually been producing and the planned working time
- **Performance:** Speed at which the production runs as a percentage of its programmed speed
- **Quality:** Percentage of acceptable pieces produced, among the total pieces produced

An OEE score of 100% means that the process is fully productive with no availability, performance, or quality losses.



### Availability

Downtime is the largest source of productivity loss for most manufacturers, and it is often the point that can be quickly improved. It is essential to capture a reason and duration for each downtime incident to enable the team to effectively set priorities and focus. Moreover, keeping track of downtimes also serves the goal to avoid the same downtime causes and anticipate them if possible. There is a significant difference between working reactively (fixing problems as they occur) and working proactively (anticipate problems' occurrence and avoid this through long-term fixes and improvements). Working proactively aims at avoidance of production stops that can cause serious efficiency downgrade and production time loss for a long period of time.

It is fundamental to also provide clear visuals to indicate when the line is down and explicitly demonstrate if the line remains down for an extended period of time to have an accurate and comprehensive view of production time loss.

### Performance

The Ideal Cycle Time is the lowest cycle time that a process can have under the optimal conditions and it is the result of theoretical process analysis. The human factor can strongly affect performance: the motivation and moral of the workers is extremely important and the company culture usually helps to improve them. However, from a strictly technological point of view, the performance is affected by other factors such as:

- Tools and Equipment
- Training and Development
- Excess Processing
- Transportation

## Quality

Quality in OEE terms is the ratio between pieces with acceptable quality and total pieces produced. Quality loss considers both Start-up and Production rejects:

- **Start-up Rejects** are defective parts produced from start-up until stable production is reached, as example after suboptimal changeovers, equipment may need “warming up” cycles (spindles) or equipment that inherently generates waste after start-up (web press)
- **Production Rejects** are defective parts produced during stable production, including parts that can be reworked.

## What will ZDMP achieve

### Availability

Several ZDMP functional blocks have the potential to improve the overall availability of the equipment. For example, in Lot-size-one manufacturing the impact of AI tools for data analysis grows with every day in terms of more efficient prediction of imminent failures. This allows the deployment of predictive maintenance tools, which anticipate the expected breakdowns by planning the maintenance of the equipment in advance, allowing for shorter shutdowns resulting in a longer uptime of machines [1]. On the contrary, if most of the time is spent reactively fixing problems the efficiency is limited. Reserve time for proactive improvements, and strive, over time, to shift the balance from reactive to proactive maintenance, including ordinary maintenance scheduling optimization.

Moreover, many actions can be done remotely with an appropriate remote maintenance that contributes to Availability metric improvement. On-site maintenance is an expensive approach and not always really needed.

### Performance

As previously mentioned, there are many reasons that affect the Performance metric. ZDMP aims at provision of a software ecosystem that facilitates the development and deployment of software-based solutions, such as a tool used to visually map the production flow. It shows the current and future state of processes in a way that highlights opportunities for improvement.

As an example, the use of a digital twin allows a simulation to be made in advance of each single process with its specifications in order to evaluate possible improvements and avoid possible accidents and impediments that could lead to delays and low quality.

## Quality

ZDMP, by analysing various data from the manufacturing process, can reduce production waste and improve the quality of the pieces produced. It is possible with dedicated ZDMP tools (customizable and reliable) providing functionality to make a global diagnosis and detect the critical points of a production process to improve its efficiency.

For example, with the information on temperature that has to be considered to avoid the thermal deformation of the tools, and on vibrations, it is possible to prevent defects that are not easy to detect with just a visual check to obtain workpiece with zero defects.

## ZDMP Links

• <b>Architecture Component(s)</b>	N/A
• <b>Work Package</b>	WP9, WP10 – Use cases
• <b>Tasks</b>	All tasks

## References/Acknowledgements

[1] 2014 Vorne Industries, Inc. "Down Time Tips Executive Summary"