The impact of OEE indicator on improvement of results in production management: case studies

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Abstract
This paper presents case studies aborder the use of indicators for continuous improvement on production management through the impacts from application of OEE (Overall Equipment Effectiveness) indicator in companies. At the end gains in reaction time to problems and more precise actions have been shown.

Keywords Sourcing, Supply Chain, Product Development

Introduction
The need to produce ever more with less use of resources and in the shortest time becomes increasingly competitive market. Therefore, the measurement and analysis of production systems are essential for industries seeking to remain in the market in order to detect and solve problems, contributing to the continuous improvement of the whole process. Therefore, there is a need to improve the efficiency of equipment and these improvements can be obtained by calculation and analysis to determine the productive efficiency of a given process and to identify and eliminate waste in the manufacturing process. According to Fox (2011, p.656), "performance indicators are rational, objective and quantitative representation of performance used by managers aiming to reach the operational and strategic goals set by the companies."

So to make the improvement in the efficiency of equipment, is an important tool used to TPM (Total Productive Maintenance), which can easily be related to the concepts of Lean Manufacturing (Lean Manufacturing) which, according to Nakajima (1984) apud by Albertin et al (2012), part of the following: maximizing the efficiency of equipment, rigorous preventive maintenance during the life cycle of the equipment, application in various departments and involvement of all employees.

In TPM, one of the indicators used for monitoring the efficiency of equipment is the OEE (Overall Equipment Effectiveness) which, according to Ribeiro et al (2010) is an indicator that promotes improvements in quality and productivity as it helps in the understanding of manufacturing performance and identifies which is the highest efficiency.

However, the efficiency of a process is currently treated subjectively by many companies, which are often not able to see the real productive capacity of their machinery and equipment.
However, when it comes to efficiency can not analyze an abstract situation but calculated figures that represent reality. This is evident when it has an increase in production, which is important to the achievement of continuous improvement by analyzing the results of OEE, because they avoid unnecessary investments (SANTOS and SANTOS, 2007).

Therefore, this article aims to interest companies for the use of OEE, so that they can become more competitive, since there will be concrete information of actual efficiency of their equipment, enabling decision making for best rates are achieved. For this, the goal is to expose, through case studies, the differential of companies working with the OEE indicator as well as the results obtained, considering the advantages and disadvantages and evaluating the impact of the use of the indicator in the organizational context.

**Bibliographic review**

According Scuccuglia and Lima (2004) principles of Lean is to have the right material in the right place at the right amount and at the right time; work aimed at continuous improvement and seek Great Quality.

For Lean, wastes are activities that do not add value to the product, everything that the customer is unwilling to pay, between these activities, according to Alukal (2008) apud Raposo (2011), 08 are considered mainly waste as shown in Figure 1.

Relying on the use of various Lean tools and due to the constant quest for waste disposal, companies began to consider the application of the Lean Manufacturing philosophy not only on the shop floor, but throughout the company, giving rise to the Lean Thinking, which according to Fernandes and Ramos (2006), is to eliminate the existing waste in manufacturing processes in order to generate more customer value. The organization shall better understand customer needs and optimize resources, generating more return on investment.

For Costa and Garden (2010), five steps are used to lean thinking happen, they are: 1 - Identify what is customer value; 2 - Map the production flow and identify waste; 3 - Deploy the stream; 4 - Let the customer pull production; 5 - Seek perfection.

But it is necessary that the philosophy of Lean Thinking is widespread in all areas of the organization to achieve its real efficiency at all organizational levels.

According to Ribeiro et al. (2010, p. 2) it can be defined as "a campaign that spans the entire enterprise, involving the entire body of employees, to achieve maximum equipment utilization, using oriented management philosophy of the equipment".

![Figure 1 - Wastes of Lean Manufacturing (MARCOS, 2011)](image-url)
The TPM tool is divided into eight pillars (see Figure 2) that are the basis for process improvements, involving the entire organization and leading it to set targets for the reduction of failures, breakdowns and zero defects (RAPOSO, 2011).

![Figure 2 - Pillars TPM (ORTIS, 2004)](image)

The performance of the TPM tool can be accurately measured using indicators that can identify the "degree of efficiency of equipment, quality scores of products and processes, number of accidents and increase the degree of professional competence of employees" as stated by (TONDATO, 2004, p. 14).

According Albertin et al (2012), using this indicator identifies the areas that need improvement, and quantified those already deployed in production, whether in equipment, cells or rows. The results obtained in this indicator for working with aspects of quality, performance and availability of each device enable you to find the resource that has a greater disability, directing thus necessary for the resolution of problems shares.

As Ljungberg (1998) apud Santos and Santos (2007), before use of these indicators, industries worked considering only the availability of the equipment in use, which would eventually leave the oversized capacity.

In this sense, according to Hansen (2006) cited in Ribeiro et al (2010), the OEE indicates the effectiveness of the process at the time the equipment is required to operate and for this calculation considers three components:

- **Availability (μ1)**: according to ABNT NBR 5462 - Reliability and Maintainability, "the ability of an item to be able to perform a certain function at a given time or during a certain time interval";

- **Performance (μ2)**: maximum utilization of equipment , with reductions and eliminations of stops and or rate reductions;

- **Rate Quality (μ3)**: What is the relationship between good manufacturing and total product manufactured products seeking the so-called "zero defect".

To find the values for the indices cited above should be applied to Equation (01) (Nakajima, 1988 apud by Albertin et al (2012):

\[
OEE = \text{Availability(\%) x Performance(\%) x Quality(\%)}
\]  \hspace{1cm} (01)

To find the values of Availability, Performance and Quality Equations (02), (03) and (04) are used, respectively:

\[
\text{Availability(\%)} = \frac{\text{Operating Time}}{\text{Time Available}}
\]  \hspace{1cm} (02)
Methodology

The study were conducted in two companies, X and Y, both multinationals located in the state of São Paulo, with:

- **Company X:** automotive industry that has the system for calculating OEE deployed since February 2012 and,
- **Company Y:** branch of solutions in measuring system that has deployed since November 2012.

The studies were performed in order to analyze the impacts of the use of OEE in production management taking into account the advantages and disadvantages of the system implementation based on survey data regarding the availability, quality and equipment performance (necessary data to perform the calculation of OEE) before and after deployment.

For Company X data collection was performed on a bench leak test, which is a checking station located at the end of a production line.

For company Y data collection was performed on a bench checking electricity meters, being a bottleneck equipment located at the end of the production cell.

After collecting and analyzing data to compare the data on the current and previous status was (after implementation of the system) for each of the companies concerned.

Data collection

Data collection was performed by a participant observer who did the survey data. This person has been integrated into the team and was an interactive viewer, because it was not just watching. The collected data relating to the past and present of companies X and Y are listed in Table 1.

<table>
<thead>
<tr>
<th>Past</th>
<th>Present</th>
<th>Past</th>
<th>Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available hours</td>
<td>Time available</td>
<td>Number of employees</td>
<td>Time Available</td>
</tr>
<tr>
<td>Parts by hour</td>
<td>Unscheduled shutdowns</td>
<td>Foul</td>
<td>Unscheduled shutdowns</td>
</tr>
<tr>
<td>Parts produced</td>
<td>Scheduled stops</td>
<td>Hours presents</td>
<td>Scheduled stops</td>
</tr>
<tr>
<td>Parts planned</td>
<td>Total time of the day</td>
<td>Efficiency</td>
<td>Total time of the day</td>
</tr>
<tr>
<td></td>
<td>Volume processed</td>
<td>Absenteeism</td>
<td>Volume processed</td>
</tr>
<tr>
<td></td>
<td>Cycle time</td>
<td>Failures detected</td>
<td>Cycle time</td>
</tr>
<tr>
<td></td>
<td>Operating time</td>
<td>Type of failure</td>
<td>Operating time</td>
</tr>
<tr>
<td></td>
<td>Produced good parts</td>
<td>total parts produced</td>
<td>Produced good parts</td>
</tr>
<tr>
<td></td>
<td>total parts produced</td>
<td></td>
<td>total parts produced</td>
</tr>
</tbody>
</table>

Processing of data

With this integrated in production lines of two scenarios studied system, one can now perform analysis at any time, so the intervals between takes data will be different from the past, where

\[
\text{Performance}(\%) = \frac{\text{Volume Processed} \times \text{Ideal Cycle Time}}{\text{Operating Time}}
\]

\[
\text{Quality}(\%) = \frac{\text{Good Parts Produced}}{\text{Total Parts Produced}}
\]
each scenario followed a different pattern, however, unlike the days current were calculated for each predetermined period.

The data collected in this state were analyzed with doing a comparison with the data obtained in the recent past, when not yet used the philosophy of OEE, and thus show clearly the differential deployment of the integrated system of data collection.

**Data of Company X**

For the first scenario, the company X, it was used Excel spreadsheet to calculate the OEE of production lines daily, based on data from three production shifts, as shown in Table 2.

**Table 2 – Report used to calculate the OEE**

<table>
<thead>
<tr>
<th>Date</th>
<th>Shift</th>
<th>Reference</th>
<th>Production Lines</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/05/2012</td>
<td>1º S</td>
<td>Planned</td>
<td>698</td>
<td>726</td>
<td>738</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Produced</td>
<td>464</td>
<td>455</td>
<td>226</td>
<td></td>
</tr>
<tr>
<td>2º S</td>
<td></td>
<td>Planned</td>
<td>689</td>
<td>717</td>
<td>728</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Produced</td>
<td>289</td>
<td>608</td>
<td>653</td>
<td></td>
</tr>
<tr>
<td>3º S</td>
<td></td>
<td>Planned</td>
<td>503</td>
<td>523</td>
<td>531</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Produced</td>
<td>237</td>
<td>230</td>
<td>339</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>Planned</td>
<td>1890</td>
<td>1966</td>
<td>1998</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Produced</td>
<td>990</td>
<td>1293</td>
<td>1218</td>
<td></td>
</tr>
</tbody>
</table>

OEE

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>52.4%</td>
<td>65.8%</td>
<td>61.0%</td>
</tr>
</tbody>
</table>

Completion of the worksheet shown in Table 2 occurred as follows:

- **Planned**: calculated by Equation (05).

  \[
  \text{Planned} = \text{Available Hours} \times \text{Number of parts produced} \quad (05)
  \]

- **Produced**: production leaders passed the information on the quantity produced in another worksheet after the end of each turn and only the next day these data were provided by an employee in spreadsheet to calculate the OEE which was conducted by Equation (06).

  \[
  \text{OEE} = \frac{\text{Quantity Parts Produced}}{\text{Planned Parts Produced}} \quad (06)
  \]

These data were treated only in the following by a team of professional production, engineering, production scheduling, maintenance, and quality day.

After deployment of the system to calculate the OEE, the indicators analyzed became Availability Machine, Product Quality and Performance. These indices are calculated automatically through a software that collects information from the HMI's (Human Machine Interfaces) located in the equipment of production, which are stipulated all scheduled and unscheduled downtime with quick and easy information.

The calculation of the Availability Index follows the pattern of the Equation 02, where the Operating Time (Equation 07) and Time Available (Equation 08) are:

\[
\text{Operating Time} = \text{Time Available} - \text{Unscheduled Shuddowns} \quad (07)
\]

\[
\text{Time Available} = \text{Total Time of the Day} - \text{Scheduled stops} \quad (08)
\]
All scheduled and unscheduled shutdowns are registered and when one of them happens to it is selected by the operator through the HMI located on the countertop leak test.

The calculation of the Performance Index, which the company X is called Productivity, follows the pattern of the Equation 03, where the processed volume is accounted for through the terminal located on the countertop leak test.

To calculate the quality index were registered in all types of software failures and when a defective part is detected the operator selects the type of failure and enrolls in HMI, following the pattern of the Equation 04.

To calculate the OEE is performed multiplication of the three previous indicators, as shown in Equation 01.

These data are updated in real time and the entire team of production management has access, as showed in Figure 3:

![Figure 3 - Results of the indices needed to calculate the OEE](image)

**Data of Company Y**

For the second scenario, the company Y, the availability indicator machine was not calculated in a specific way, just according to the time available to work on.

When the target was reached daily efficiency, was not observed any other aspect of the availability of the machine were only analyzed charts for maintenance, for example, if there was an impact on efficiency.

The performance indicator was analyzed as efficiency and is used spreadsheets in Excel, as shown in Table 3, to perform this calculation with the calculation of absenteeism.

<table>
<thead>
<tr>
<th>Cell</th>
<th>Nº Employees / Cell</th>
<th>Fouls</th>
<th>Worked Hours</th>
<th>Produced Hours</th>
<th>Efficiency</th>
<th>Absenteism</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>9</td>
<td>0</td>
<td>74</td>
<td>68,45</td>
<td>92%</td>
<td>0%</td>
</tr>
<tr>
<td>B</td>
<td>9</td>
<td>0</td>
<td>74</td>
<td>72,15</td>
<td>97%</td>
<td>0%</td>
</tr>
<tr>
<td>C</td>
<td>13</td>
<td>0</td>
<td>107</td>
<td>104,8</td>
<td>97%</td>
<td>0%</td>
</tr>
<tr>
<td>D</td>
<td>27</td>
<td>2</td>
<td>224</td>
<td>127,1</td>
<td>57%</td>
<td>7%</td>
</tr>
<tr>
<td>E</td>
<td>19</td>
<td>1</td>
<td>157</td>
<td>88,1</td>
<td>56%</td>
<td>5%</td>
</tr>
<tr>
<td>F</td>
<td>18</td>
<td>0</td>
<td>149</td>
<td>144</td>
<td>96%</td>
<td>0%</td>
</tr>
<tr>
<td>G</td>
<td>20</td>
<td>0</td>
<td>166</td>
<td>170,5</td>
<td>103%</td>
<td>0%</td>
</tr>
<tr>
<td>H</td>
<td>15</td>
<td>0</td>
<td>124</td>
<td>30</td>
<td>24%</td>
<td>0%</td>
</tr>
<tr>
<td>Average / Day</td>
<td>130</td>
<td>3</td>
<td>107</td>
<td>804,6</td>
<td>75%</td>
<td>2,3%</td>
</tr>
</tbody>
</table>

Completion of the worksheet shown in Table 3 occurred as follows:

- **Number of employees**: the leaders themselves of sectors filled with the number of employees in the cell, according to the line balancing;
- **Fouls**: they were also satisfied by the leaders of the sectors;
- **Worked Hours:** Automatically calculated according to Equation (09), considering Available Hours = 8.3 hrs / shift.

\[
\text{Worked Hours} = \text{Employees number} \times \text{Hours Available Day} \tag{09}
\]

- **Hours produced:** MRP extracted according to the production notes played on the day;
- **Efficiency:** calculated according to Equation (10).

\[
\text{Efficiency} = \frac{\text{Hours Produced}}{\text{Hours Gifts}} \tag{10}
\]

- **Absences:** calculated according to Equation (11).

\[
\text{Absences} = \frac{\text{Total Fouls}}{\text{Total Employees}} \tag{11}
\]

This efficiency indicator replaced the performance indicator used to calculate OEE.

The quality indicator was calculated using an index of faults, where there was an array for manual filling the cell with the potential problems to be detected, as shown in Table 4.

The calculation performed to define the percentage of failure was made of the period according to Equation (12).

\[
\% \text{ Failures Months} = \frac{\text{Total of good parts}}{\text{Total Number of Parts Produced}} \tag{12}
\]

At the end of each shift operators fulfilled the matrix presented in Table 4 and the next day was fed a spreadsheet with failures detected and the production of the day (good parts) and generated the failure rate by process and supplier.

Thus the calculation of the indicators that make up the OEE were performed, however, not analyzed jointly and information broken in several places and collected by different people.

After deployment of the system for monitoring OEE, the indicators analyzed became Availability, Performance and Quality and were fed via an HMI installed in the machine, responsible for captartodas information issued by it and also inserted by the operator through a scanner and barcodes.

The availability indicator started to be analyzed considering the events of Table 5.

The stops listed as unplanned, or any other type of stop that existed during the day and they were not programmed directly interfere in the result window. The calculation of the Availability Index follows Equations 02, 07 and 08.

The type of stop is made at the time that it happens and by the operator that through bar codes for each stop, select the related reason.

The performance indicator in the specific case of the studied machine, is calculated through the cycles issued every start of production of a banking as showed in Equation 03.

For Quality indicator, were registered in all types of software faults already found and also through a list of bar code relating to each type of fault, the operator selects the most suitable means of a scanner, accounting for the defective part when where the same is identified and calculating the following Equation 04.

Finally, to calculate the OEE is performed multiplication of the three previous indicators, as shown in Equation 01. All these data are correct at time of occurrence, so it may be accompanied by all interested online form.
### Table 4 - Table used to calculate the index Failures

<table>
<thead>
<tr>
<th>Day</th>
<th>A</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>I</th>
<th>K</th>
<th>M</th>
<th>N</th>
<th>O</th>
<th>Q</th>
<th>R</th>
<th>Failures Supplier</th>
<th>Process Failures</th>
<th>Daily Output</th>
<th>% Failures</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>25</td>
<td>2</td>
<td>0</td>
<td>15</td>
<td>6</td>
<td>31</td>
<td>3405</td>
<td>2,4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>20</td>
<td>23</td>
<td>7</td>
<td>5</td>
<td>17</td>
<td>2</td>
<td>47</td>
<td>3310</td>
<td>3,7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>51</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>3323</td>
<td>2,3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>2</td>
<td>18</td>
<td>3420</td>
<td>1,4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>17</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>21</td>
<td>3410</td>
<td>1,8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>21</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>51</td>
<td>3315</td>
<td>2,5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>31</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>32</td>
<td>3590</td>
<td>1,9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>47</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>23</td>
<td>3332</td>
<td>2,8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>21</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>21</td>
<td>3200</td>
<td>1,7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>2</td>
<td>0</td>
<td>15</td>
<td>6</td>
<td>13</td>
<td>3560</td>
<td>1,6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>18</td>
<td>7</td>
<td>5</td>
<td>17</td>
<td>2</td>
<td>12</td>
<td>3540</td>
<td>2,4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>21</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>23</td>
<td>3523</td>
<td>1,4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>25</td>
<td>3552</td>
<td>1,2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Month</td>
<td>6</td>
<td>9</td>
<td>23</td>
<td>1</td>
<td>23</td>
<td>420</td>
<td>18</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>218</td>
<td>% Failures / Month</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Defect (%) 0 0 0,1 0 0,1 0,9 0 0 0 0 0,5

Point of Care: % Failures higher than 3.5%.

### Table 5 – List of charts

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Predicted Parade</th>
<th>Maximum Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>520</td>
<td>Meal</td>
<td>Sim</td>
<td>01:00</td>
</tr>
<tr>
<td>522</td>
<td>Preventive Maintenance</td>
<td>Sim</td>
<td>02:00</td>
</tr>
<tr>
<td>523</td>
<td>Bathroom</td>
<td>Sim</td>
<td>00:10</td>
</tr>
<tr>
<td>11</td>
<td>Without Operator</td>
<td>Não</td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>Corrective Maintenance</td>
<td>Não</td>
<td></td>
</tr>
<tr>
<td>501</td>
<td>Lack of Parts</td>
<td>Não</td>
<td></td>
</tr>
<tr>
<td>503</td>
<td>Assembly</td>
<td>Não</td>
<td></td>
</tr>
<tr>
<td>504</td>
<td>Orientation to Operator</td>
<td>Não</td>
<td></td>
</tr>
<tr>
<td>505</td>
<td>Ambulatory</td>
<td>Não</td>
<td></td>
</tr>
<tr>
<td>525</td>
<td>Pre-Series</td>
<td>Não</td>
<td></td>
</tr>
<tr>
<td>999</td>
<td>SETUP</td>
<td>Não</td>
<td></td>
</tr>
</tbody>
</table>

Figure 5 shows the screen where the data online, in a clear and objective manner are analyzed.

![Verification Box](image)

*Figure 5 - Screen for monitoring OEE*
During the day, an employee is responsible, among other activities, to monitor these values of indicators and, in case of a malfunction, triggering the entire team of troubleshooting that has 10 minutes to be on the machine and analyze the problem as a whole.

**Analysis of results**

Both in Company X Company Y as in the information collected to calculate the OEE were made empirically, without following a plan that would allow the analysis and interpretation of this information.

After deployment of the system for monitoring OEE, information became centralized in one location, following a standard format, where all have access. In addition to more accurate values for the calculations, all the information is entered by the operator on the machine, when they happen, which makes the information constantly updated and can be monitored via the online software for all concerned.

One can notice a significant improvement with respect to taking action and focus the same for the solution of the problem, because when you have all the information necessary to take corrective action centralized in one place, it becomes much easier to identify the root cause.

Through the deployed software, these reasons can be tracked and the necessary actions can be taken to avoid repeating.

**Conclusion**

The implementation of using OEE as a universal indicator is time consuming, but after this step, the gains with respect to decision time for taking actions are smaller and the results are positive, because it attacks the root cause of the problem.

Thus, considering that OEE is the product of three indicators that directly influence the production, if the machine OEE is considered low, it is necessary to analyze what is the impact of each of these three indicators for the outcome and thus the focus of attack problem:

- **Availability**: or by corrective maintenance, lack of parts, lack of operator;
- **Performance**: if the operator is managing to produce the projected pace, if not, how and why is this difference;
- **Quality**: process defects and defects in supplier.

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