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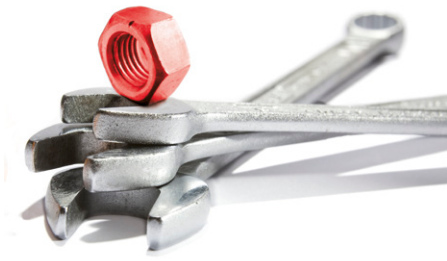

Maintenance 4.0

Maintenance Management for the Future Factory

Maintenance Management in the age of Industry 4.0

Automation and digital transformation are having a main impact on the factors of production: "capital" (plants/machines) is becoming more and more important whereas the role of "labor" is fading. All major industries rely on robots to enhance their production processes. The number of automated equipment has been rising for a long time and this trend isn't going to lose speed. The charts of the International Federation of Robotics (IFR) point only in one direction – up. According to IFR estimates 2.6 million industrial robots will be used all around the globe in 2019.

Maintenance has always been a strategic factor of success in capital-intensive industries like raw material processing, the chemical and automotive industry. As manual labor is becoming obsolete due to automation in a wide variety of industries, maintenance is pushed to the forefront as a prerequisite for success. Traditional drivers of efficiency in a lean organization are no longer adequate under the rules of Industry 4.0.

The best example is Adidas. Sneakers used to be a product of handwork, literally put together by hand from sometimes up to a hundred parts. Now they are assembled by specialized machines in a largely automated process. As a result, maintaining these machines is now an important driver of profitability for Adidas.

> "Maintenance 4.0 is the determining factor in making tomorrow's production plants profitable

Maintenance has to improve continuously because new developments in industrial manufacturing demand increased availability, reliability and flexibility of plants and machinery (Fig. 1). Maintenance 4.0 is the technical foundation and the driver of efficiency in the factory of the future.

Another important question: What are the building blocks of a forward-looking asset management? We have sifted through research papers, independent studies and the results of ConMoto's numerous projects. The conclusion: Crucial industrial developments open three main fields of action for maintenance:

- Predictive Maintenance
- Mobile Maintenance
- Asset Innovation/ Life Cycle Costing

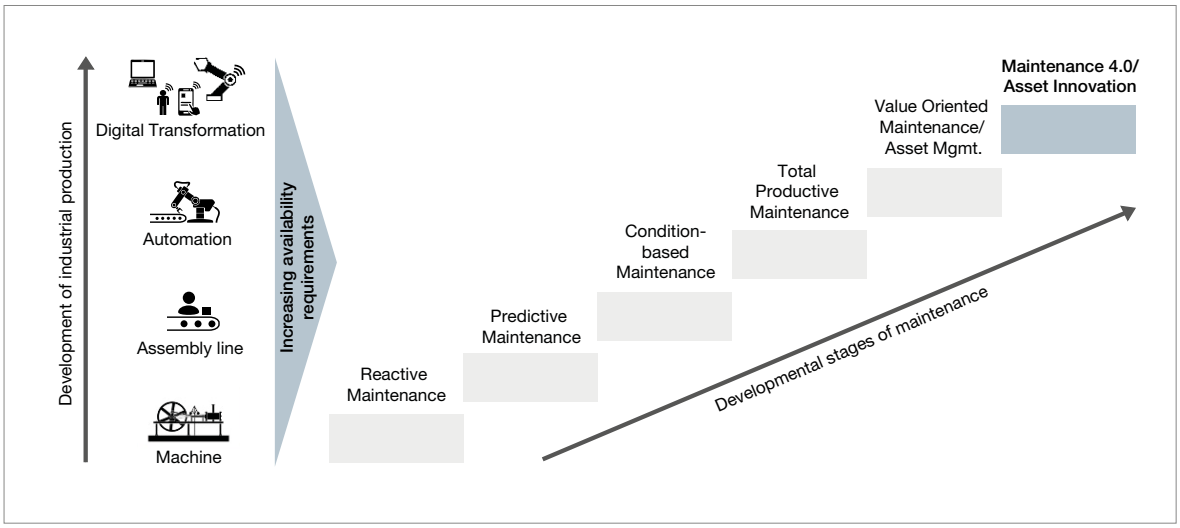

Figure 1: Maintenance – Developmental stages on the way to Maintenance 4.0.

Predictive Maintenance – Knowing in advance which machines will shut down at which point in time

A sustainable, highly efficient production system requires an optimized Overall Equipment Effectiveness (O.E.E.), focusing on reliability, availability and process stability. Plants and machines have to run dependably. From their own experience, managers in charge know that equipment failure reduces a company's profitability (RONA[1]) as quickly as basically nothing else.

An automated and interconnected production system can be brought to a standstill by a single malfunctioning machine or component. Direct downtime costs (personnel, spare-parts, external services) and – even more important – loss of production costs (production shortfall, delivery failure, reduction in quality) have immediate negative effects on operating income. In our projects we see time and again, that companies suffer intolerable reductions of equipment availability despite substantial maintenance expenditures. Root causes of production loss are:

- Machine breakdown cannot be avoided, because risks of failure are not detected in time.
- Error causes and part-failure curves (P-F curves) are not available.
- Maintenance intervals for critical components are too long or necessary maintenance work is simply not done.
- After a failure, reaction and repair take too much time.
- Repair quality is insufficient causing rework and repeated errors.

Machine availability is reduced not only by unplanned failures, but also by planned downtime. Frequent weak points of industrial production are:

- Maintenance and inspections are scheduled according to time intervals NOT according to machine usage.
- Identical maintenance intervals for similar machines that have strongly differing workloads.
- Maintenance expenditure for uncritical components.
- Poorly executed repairs.

High maintenance expenditure accompanied by a deficit in machine availability is caused by reactive maintenance. This is not only costly, but also fails to solve the problem. Metaphorically speaking maintenance is trying to constantly cope with a burning fire – and even taking pride in putting it out again and again – instead of intelligently investing in fire safety, preventing a fire from breaking out.

With that in mind, how can unnecessary production losses be avoided in order to significantly reduce follow-up costs? In expert circles plant and machinery data is treated as the fourth factor of production complementing land, labor and capital. To put it bluntly: companies that fail to understand that data is the new production factor, will fall out of competition. The solution is simple – predictive maintenance – at least that is what the glossy brochures of management consultancies and IT-experts are telling their clients. Predictive maintenance, they claim, is the measure of all things.

1) Return on Net Assets (RONA) is a key performance indicator that measures a company's profitability. RONA is calculated as net income divided by fixed assets and net working capital.

The pages 4 to 7 are not included in this preview.
Should you be interested in the whole White Paper "How sustainable Maintenance and Asset Management put your company in the fast lane – New approaches for the automotive industry", please contact:

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CONSULTING GROUP

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In musical terms, "con moto" means "moved" or "with movement". We named ourselves ConMoto, because we are convinced that consulting is only successful, if it moves people to take action and results in verifiable improvements.

Our consultants have a wealth of managerial experience and adopt an entrepreneurial approach to create sustainable value enhancement for our customers. Using innovative methods and acting in a spirit of partnership, we systematically develop and implement solutions, efficiently change structures and processes and successfully motivate people.

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