Customers’ Voice
Predictive Maintenance in Manufacturing, Western Europe

Status Quo, Approach, Customer Needs, Decision Paths

Stuttgart, November 2017
www.frenus.com
Customers’ voice: Predictive Maintenance in Manufacturing, Western Europe is an in-depth research into the status quo, customer needs and decision paths with respect to the adoption and future potential of predictive maintenance technologies based on insights from the customers’ standpoint.

Predictive maintenance is a revolutionary use case, made possible due to the advent of Internet of Things (IoT). Owing to the emergence of advanced IoT platforms and analytics, predictive maintenance has made it possible to predict a failure long before it actually occurs via real-time asset condition monitoring. This has resulted in a multitude of benefits for the production and maintenance teams, including reduction of asset downtime and costs, continuous operational enablement and identification of downtime-inducing factors.

The report presents an opportunity for all the key stakeholders in predictive maintenance. Decision makers from manufacturing and related asset-intensive companies can get an in-depth insight regarding how similar companies are planning to implement predictive maintenance strategies along with its status quo.

Solution providers can assess the customer needs, best practices regarding communication channels, perceptions across the implementation funnel, etc. to better tailor their solution development, marketing and sales strategies.

Find out more: www.frenus.com

Frenus’ exclusive cooperation with T-Systems ensured that the study results were as close to reality as possible in an industrial scenario.

Domain experts from T-Systems provided valuable input from the implementer’s point of view during the design phase of the interview guidelines. As a leading ICT services and consulting firm, T-Systems has extensive digitalization-focused implementation and project experience and its own predictive maintenance solution on the market since nearly one year.

Thank you for the pleasant and successful cooperation!
Prevention is better than cure – a fundamental truth that can also be applied to business processes. Predictive maintenance, for instance, minimizes the risk of unplanned downtime, and is the key to significantly lower operating costs. This study, however, suggests this message has not yet been fully embraced: more than three-quarters of companies surveyed do not yet deploy predictive maintenance solutions. Around 20 percent have commenced piloting. At the same time, an overwhelming majority believes predictive maintenance is vital to manufacturing in the longer term. In other words, change is in the air. According to a recent study, production outages due to welding-robot downtime costs the automotive industry almost a billion euros annually*. Stark figures such as these are prompting a rethink.

Organizations that log equipment failures and have corresponding historical data can make intelligent use of this information to improve outcomes and enhance products. Predictive maintenance transforms machine data into an actionable resource for innovation and value creation.

Self-learning algorithms analyze data, recognize patterns, and identify correlations. They are able to pinpoint direct links between problems and specific operating parameters, and to predict both impending failures and their causes. Insights into cause and effect can, for example, be leveraged to forecast the failure of robots or other systems days or even weeks in advance – and to plan and optimize the maintenance process.

By harnessing these technologies, T-Systems enables customers to migrate a fully digitized service chain. To this end, we provide modular solutions that integrate with existing systems – and add any “missing links”. These can include sensors, ERP, MES, IoT platforms and data capture to establish a data lake. The result is a closed-loop process.

To help our customers kick-start their predictive maintenance journey, we offer innovation and design-thinking workshops – where we co-develop the transformation roadmap and identify the most suitable business use cases.

Depending on their current situation, customers also have the option of commencing with a proof of concept (POC) study, before moving on to roll-out. As the ICT market leader in the automotive and manufacturing industries, T-Systems has extensive experience of maintenance and production scenarios – and is therefore ideally equipped to help customers put data-driven ideas, goals and business models into successful practice.

No matter what your preferred approach, as proven systems integrators we can assure you of this: your enterprise stands to benefit from predictive maintenance. Grasp this opportunity to better manage the unexpected, to streamline your processes, enhance product quality, and significantly reduce operating costs.

We hope you find this study informative – and inspiring.

Best regards,
Georg Rätker

* Source: as cited in the study.
Methodology

304 interviews conducted

Participants’ origin

Management level

- Over 60% of the interviewed industry experts are in mid or top management positions

Departments

- 80% of interviewees are working in production, logistic or quality department

Participant demographics

- Geographical scope: Germany & Western Europe
- Corporate hierarchy: Managers and above
- Industry: Manufacturing and related asset-intensive domains
- Decision makers from 15+ industrialized countries across Europe

Company size

- One-third of companies have revenues above EUR 1 bn

Predictive maintenance

- 25% already use predictive maintenance, whilst 16% are in pilot phase

Interview Execution

- Number of interviews: more than 300
- Methodology: Primarily 20-30 minute interviews conducted via a phone conference. Filling out of an online questionnaire in a few specific cases, when specifically requested by expert

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80% of interviewees are working in production, logistic or quality department

One-third of companies have revenues above EUR 1 bn

25% already use predictive maintenance, whilst 16% are in pilot phase

*incl. OEMs and suppliers

Source: FRENUS
53% of the respondents think that predictive maintenance solutions justify (fully/ most often) the hype created in solving customer needs.
With the rise in Industry 4.0 and digitalization, predictive maintenance has also garnered a lot of hype and attention from providers and the industry

- 53% think that predictive maintenance solutions justify (fully/ most often) the hype created in solving customer needs
- Main argumentations for the positive evaluation of predictive maintenance in this context were the significant downtime reduction, efficiency/ productivity increase, cost savings, early detection of failures as well as cost and time savings
- A large percentage of respondents stated that predictive maintenance provides the possibility to stay competitive and save costs, exhibiting a potential to combat competition from low-wage countries
- On the other hand, 21% of all respondents do not believe that predictive maintenance solutions justify (fully/ most often) the hype created in solving customer needs
- Main reasons for that were amongst others, the high costs due to costly solutions and expensive sensors as well as the complex implementation for which a holistic approach is needed
- Additional reasons include reduced data availability, low technology infrastructure maturity and irrelevance for certain business environments – some also stated that the hype is mainly driven by providers
- Manufacturing companies with a mass production based business model especially valued the benefits of predictive maintenance high
Predictive maintenance has a bright future in the long-term, with 80% of the respondents quoting that it is essential for the manufacturing industry and will gain additional strength in the future.

- Even though around 80% of all respondents agree that predictive maintenance is essential for manufacturing industry and will gain additional strength, a majority did not agree that major stake will implement predictive maintenance solutions in the next two years.
- Hence, it can be deduced that the respondents believe that predictive maintenance has a bright future in the long-term.
- Predictive maintenance users evaluate the prior implementation of condition monitoring significantly higher than non-users.
- 77% of the respondents agreed that predictive maintenance is a real need to stay competitive, further cementing the fact that when the investment is justified, predictive maintenance is a powerful tool for business success.
- Results indicate that although predictive maintenance is gaining traction, predefined maintenance cycles are still not a product of the past.
- Respondents without having a predictive maintenance implemented generally had a similar level of agreement with respondents using predictive maintenance, for all statements, except for the pre-implementation of Condition Monitoring.
- Pursuing a hybrid predictive-preventive approach with predictive maintenance for critical assets/processes while using predefined maintenance cycles for non-critical assets/processes was highlighted by some of the interviewees as a maintenance strategy.

Please describe your level of agreement to the following statements:

Source: FRENUS
Predictive maintenance, a “smart” version of condition monitoring, represents an intermediate stage before prescriptive maintenance which uses artificial intelligence for advanced statistical modelling.

### Maintenance solution evolution

<table>
<thead>
<tr>
<th>Description</th>
<th>Reactive/ preventive maintenance</th>
<th>Condition-based maintenance</th>
<th>Predictive maintenance</th>
<th>Prescriptive maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reactive/ preventive maintenance</strong></td>
<td>■ Equipment maintenance based on pre-defined schedules using criteria such as time or amount of usage</td>
<td>■ Looks at the assets’ actual condition to determine the need of maintenance using sensors which stream data in real-time</td>
<td>■ Uses engineered algorithms and/or machine learning with multiple input parameters</td>
<td>■ Builds on predictive maintenance with alerts that provide diagnostics and guidance for repair</td>
</tr>
<tr>
<td><strong>Condition-based maintenance</strong></td>
<td>■ It applies to assets with an age-related failure pattern where the frequency of failure for the asset increases with age, runtime, or number of cycles</td>
<td>■ It typically applies to production &amp; automation equipment</td>
<td>■ Combines “small data” from a IoT devices in real time with input from historical performance data to build predictive models</td>
<td>■ Information for determining the timing and impact of failure is also included to help assess priority and urgency</td>
</tr>
<tr>
<td><strong>Predictive maintenance</strong></td>
<td>■ Reduction in human intervention and attention which is enabled via automated anomaly alerts</td>
<td>■ Models calculate probability of future failure, along with identification of influencing parameters</td>
<td>■ Usage of AI for advanced statistical modelling</td>
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<tr>
<td><strong>Prescriptive maintenance</strong></td>
<td>■ Assets, whose probability of failure increases with usage or time</td>
<td>■ Critical assets where unplanned downtime has significant business impact</td>
<td>■ Some prescriptive maintenance systems also have the ability to act on the recommendations</td>
<td>■ Assets requiring cognitive problem diagnosis skills</td>
</tr>
</tbody>
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### Asset attributes

- **Reactive/ preventive maintenance**
  - Assets, whose probability of failure increases with usage or time

- **Condition-based maintenance**
  - Assets with a random or unpredictable failure pattern, requiring supervision at all times

- **Predictive maintenance**
  - Critical assets where unplanned downtime has significant business impact

### Relevant analytics

- **Descriptive analytics**
  - Why did the past failure occur?

- **Real-time analytics**
  - What is the present health of the machine/asset?

- **Predictive analytics**
  - Which machine health scenarios could result in a future outage and when?

- **Prescriptive analytics**
  - What exactly to do when a scenario like machine/asset failure happens?
### Efficiency & margins, product quality stated as current key issues among Western European manufacturing companies – both pain points are directly or indirectly addressed by predictive maintenance

<table>
<thead>
<tr>
<th>Not facing/ not important</th>
<th>Important/ very important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complying with standards and regulations</td>
<td>16%</td>
</tr>
<tr>
<td>Efficiency &amp; margins</td>
<td>8%</td>
</tr>
<tr>
<td>Product quality</td>
<td>16%</td>
</tr>
<tr>
<td>Maintaining a loyal customer base</td>
<td>19%</td>
</tr>
<tr>
<td>Qualified staff</td>
<td>8%</td>
</tr>
<tr>
<td>Remaining competitive in a global marketplace</td>
<td>12%</td>
</tr>
<tr>
<td>Outages</td>
<td>22%</td>
</tr>
</tbody>
</table>

- Efficiency & margins, product quality and qualified staff represent key issues among interview participants.
- Efficiency & margins as well as Product quality represent pain points which are directly or indirectly addressed by predictive maintenance.
- Predictive maintenance enables companies to lower their maintenance costs by optimizing maintenance scheduling and minimizing costly, unplanned downtime, reflecting a positive effect on Efficiency & margins.
- Simultaneously, the prediction of asset failure and the identification of poor quality parts enables production departments to improve the quality of manufactured products and components.
- Finding qualified staff and their retention also represent key pain points for manufacturing and related asset-intensive companies. This can potentially lead to enhanced HR department costs, contributing to existing problems in efficiency & margins.
- This pain point might also represent a potential barrier for the implementation rate of predictive maintenance systems for SMEs as they often need to compensate lack of internally existing skillsets for example, via recruiting of specialists (e.g., data scientists & IT specialists) who are much presently sought-after.
- Around 60% of the respondents regard outages in operations as important issues which are in need of immediate attention, as they are directly related to efficiency & margins as well as product quality issues, cited by 80% as important problems.
One-stop shop vendors enable companies to source all elements and solutions needed from one source, thereby easing integration between different technologies by receiving a comprehensive solution.

Some customers choose multiple providers to source different components of the predictive maintenance value chain.

Multiple touchpoints with various vendors while managing the compatibility and integration between technologies could be difficult to manage, but this approach provides more control and choice for the customer.

- A one-stop shop approach relies on a single provider for the sourcing of various components of the predictive maintenance value chain.
- The main predictive maintenance provider can either offer all the components or can choose to partner with other providers to deliver a comprehensive solution for the customer.
- Eases integration between different technologies but reduces choice.

Source: RENUS
Receive access to the full report
Customers’ Voice: Predictive Maintenance in Manufacturing, Western Europe

- Consolidated insights of more than 300 interviews with industry experts in Western Europe (in total over 250 hours of interviews)
- Over 50 slides (16:9) for direct presentation but with deep explanations (hybrid format) – see examples in preview
- Content covers status quo of maintenance and IT technology adaption as well as customer needs in regard to Predictive Maintenance solutions (see below for more details)
- The report is suited specially for Marketing and Sales in IT companies as well as Production and IT in Manufacturing companies
- Results are prepared in English – each license contains half an hour of exchange with our analysts

Find additional information and options to purchase under: https://www.frenus.com/product/customers-voice-predictive-maintenance-manufacturing-report/

- Familiarity with concept of Predictive Maintenance
- Predictive Maintenance – a hype topic?
- Opinions and Predictions
- Components of a Predictive Maintenance System
- Excursus: Predictive Analytics in Predictive Maintenance
- Evolution of Predictive Maintenance concepts
- Status quo Maintenance technologies
- IT Solutions: Definition/ Explanation
- Status Quo IT solution usage
- Big Data Analytics usage prior to Pred. Maintenance implementation
- Main Types of Data Storage Infrastructure
- Preferred type of data storage infrastructure
- Current pain points in Manufacturing companies
- Concrete impact of unplanned shut downs
- Number of unplanned hours on production line
- Share maintenance costs on production costs
- Estimated savings potential due to Predictive Maintenance
- Responsible party for maintenance/ optimal working for machines & assets
- Predictive Maintenance funnel phases
- Key stakeholder involved in process of Predictive Maintenance implementation
- Time spending per implementation phase
- Recommendations for smooth implementation
- What characterizes a good Predictive Maintenance solution
- Preferred customer touch points
- Relevant needs to be addressed by Predictive Maintenance solution
- Relevant decision criteria for provider selection
- Excursus: Predictive Maintenance Vendor Engagement Models
- Key barriers and obstacles regarding implementation
- Main Vendors: Predictive Maintenance
- Selected partnerships among Predictive Maintenance providers
- Awareness and capability evaluation of Predictive Maintenance providers
- Preferred type of providers for solution sourcing
About this study

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