

Roland Berger

Focus

July 2018

Predictive maintenance –
From data collection to value creation



Management summary

A TURNING POINT IN INDUSTRIAL SERVICES

Predictive maintenance clearly marks a turning point in the world of industrial services. Unlike previous approaches, such as reactive service models, preventive maintenance, and condition-based maintenance, predictive maintenance adds a critical edge to the use of sensors and measuring machine data: It applies algorithms to predict the best point in time for carrying out maintenance before the actual occurrence happens or parameters drastically change. As such, operations can be adjusted to achieve the best overall asset performance and cost. This gives companies an opportunity to fundamentally transform their service, and consequently the whole underlying business model of products and services.

WORLDWIDE MARKET EXPANSION: USD 11 BILLION IN 2022

The new approach of predictive maintenance has already established itself firmly in the European industrial world. Some 81 percent of firms report that they are currently devoting time and resources to the topic. Around the same number believe it will lead to strong growth of their service business in the future, replacing a significant amount of hardware product sales revenues. We predict that the worldwide market will expand to around USD 11 billion by 2022.

ENSURE FUTURE COMPETITIVENESS

The drivers for predictive maintenance are already well developed in the areas of sensor technology, data and signal processing, and condition monitoring and diagnosis. Here, we expect to see the core technology enabling predictive maintenance up and running within the next three years. The real challenge lies elsewhere: in the areas of predictive ability, process and decision support, and the resulting opportunities in service and business models. This is where companies need to take action now.

TECHNICAL AND CULTURAL CHANGE: CHALLENGE AHEAD

In this article, we look at how companies can transform themselves from believers in technology and mere collectors of data into service-oriented partners in customer value creation. We examine the implications of predictive maintenance and how they are currently viewed by the business world. We elaborate in detail various factors driving the further development of the new approach, using our specially developed Roland Berger Predictive Maintenance Radar. And we identify the changes that companies need to make – both technical but much more so cultural – in order to provide maximum benefit to their clients and ensure future competitiveness.

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1. The future of service – predictive, not reactive

More than just a technology.

The sale of a product marks the beginning of a business relationship – a relationship that only becomes truly profitable through the service relationship that follows. Ideally, that relationship lasts throughout the product and customer lifecycle. Service is thus not just something that you are obliged to offer customers after you sell them something: It is an essential part of a profitable, long-term business model. Predictive maintenance (PdM) – as opposed to routine ex-post or preventive maintenance – offers companies the chance to fundamentally transform their service and business model. For that to happen, they must start seeing PdM not just as a means of collecting data, but as a vital tool for creating additional value in an active partnership with their customers. PdM combines the topics of service and digitalization and opens up significant new value pockets. But to turn this immense theoretical opportunity into solid reality, companies are obliged also to meet certain conditions. Above all, they need to understand that PdM, as a form of "Services 4.0", is far more than just a question of IT. It calls for the transformation of the whole organization. PdM is about creating customer benefits right along the whole value chain – a mammoth task that tests not just the technical skills of a company, but rather its entire digital mindset.

Of course, plant, machinery, components and the like will still require physical services in the future. You cannot repair a real product with "zeros and ones". But PdM is not about digitalization for digitalization's sake: It is no sterile task to be undertaken just because it is technologically feasible. It is about transforming yourself from a hardware seller into a service-driven output provider across the product lifecycle.

PdM has been a hot topic in many industries and areas of application for some time already. Companies are particularly excited about its promise of major cost savings. That promise is particularly enticing as, on average

across industries, around 70 percent¹ of total operating costs for plant and machinery relate to services. PdM can cut those costs substantially, for customers and providers alike. But costs are only the first of the benefits.

CORNERSTONES OF DIGITALIZATION

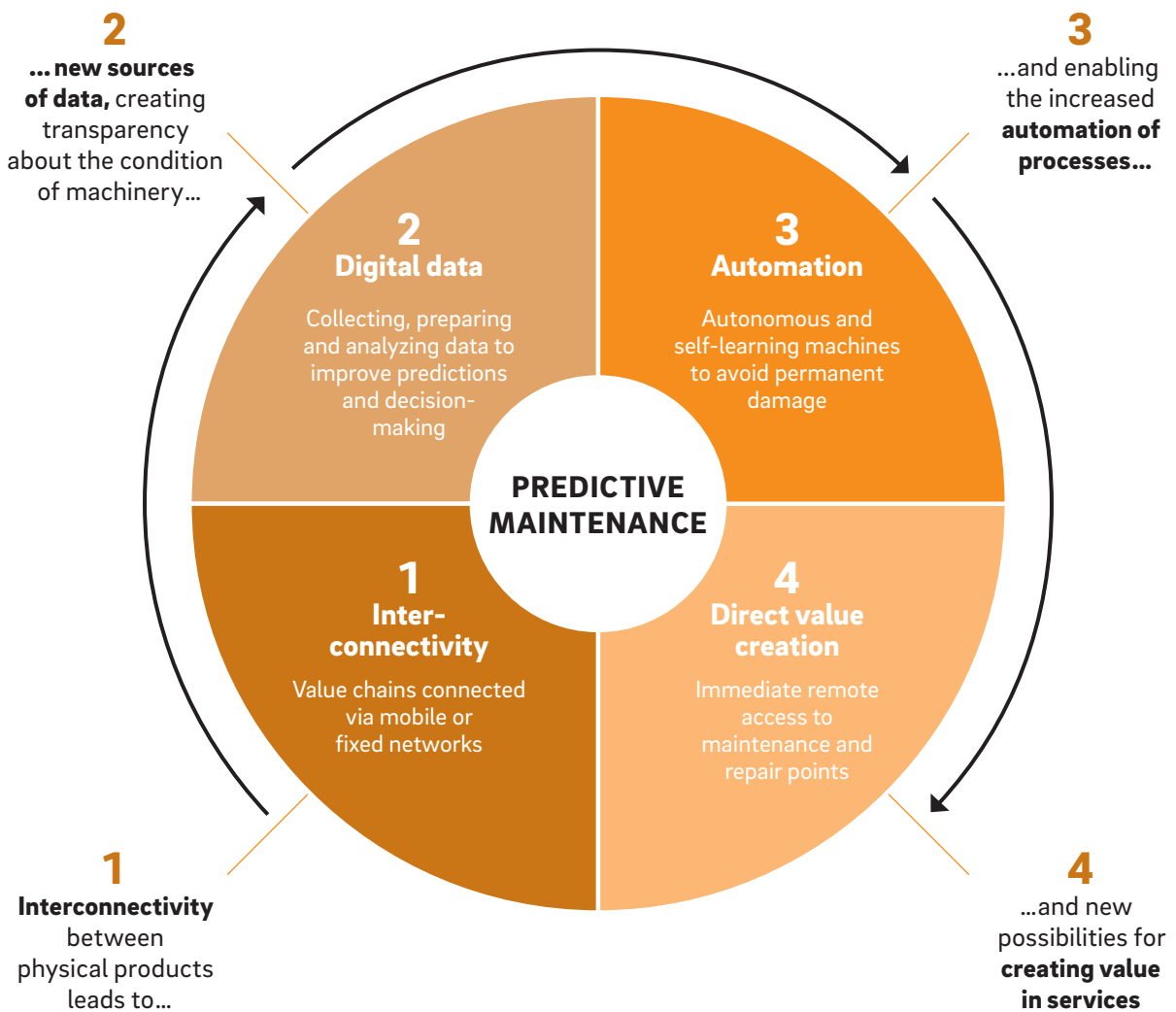
PdM builds on the four cornerstones of digitalization: interconnectivity, digital data, automation, and value creation. By continuously measuring data provided by sensors and evaluating the relevant parameters, it predicts the remaining performance life of components, machines, and whole asset parks. This can help companies determine the best point in time for maintenance and adjust to optimal operating conditions, thereby improving product and service quality and getting the most out of their investments. → [A](#)

EVOLUTION OF THE SERVICE MODEL: FROM REACTIVE TO PROACTIVE

PdM now marks a clear turning point in the world of services. It represents the final stage in the evolution of service models. In the past, companies would only take action when a problem or defect occurred or pre-defined operational parameters got beyond limits – an essentially reactive approach. With PdM, they now can act on the basis of time and content forecasts – creating proactivity. Rather than servicing plants and machinery at statistically pre-defined, regular time intervals, or assessing the health of a system on the basis of physical data (vibrations, temperature, resistance, and so on) and only taking action if the figures deviate from certain norms, PdM actually predicts future trends in the equipment's operating parameters and thereby accurately determines its remaining operating life. This triggers a profound change in the maintenance strategy and service business model, for both individual products as well as networked production systems.

¹Based on Roland Berger project experience and focus interviews on predictive maintenance.

A: From interconnectivity to value creation.
The four cornerstones of digitalization.



2. Growth, not cannibalism

The view of the business world.

PdM has established itself as an important industry trend in the global industrial and manufacturing industries. A study by Roland Berger, VDMA and Deutsche Messe AG reveals that 81 percent of companies are currently devoting time and resources to this topic, while 40 percent already believe that mastering PdM will be particularly important for future business.²

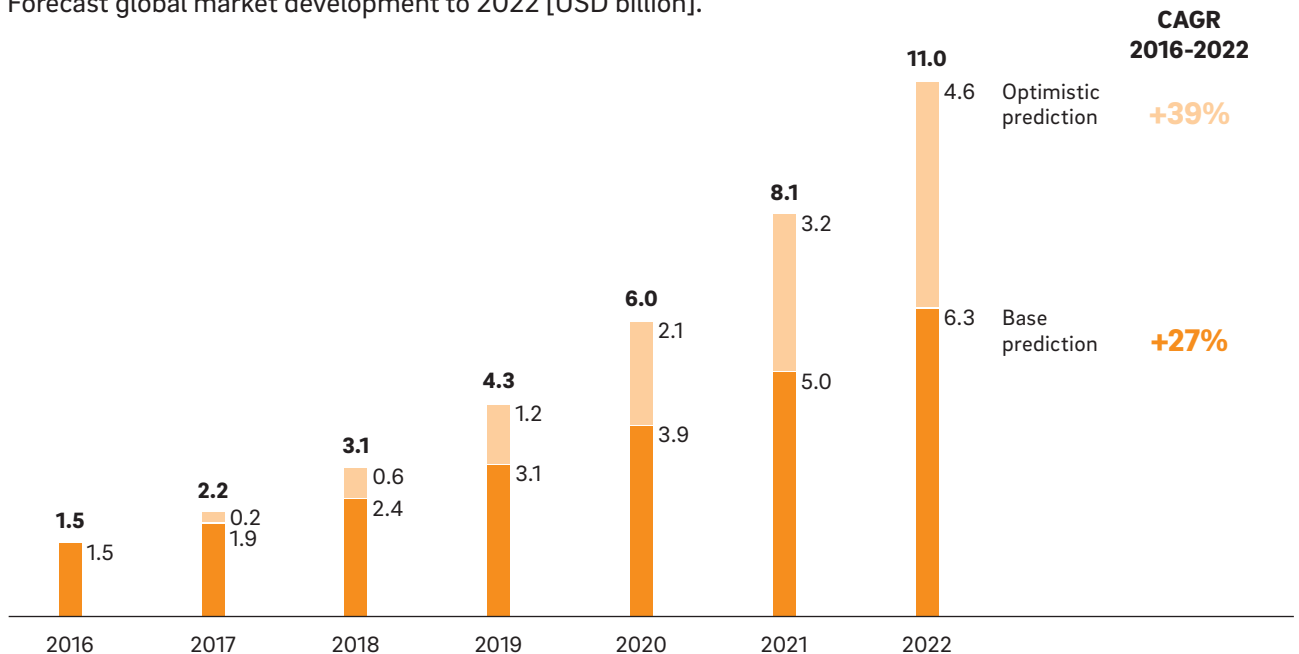
Companies are also intensely discussing the possible financial impact of PdM. Here, their hopes that PdM will stimulate clear growth outweigh their fears that it will cannibalize existing operations in sales and service. In-

deed, as many as 80 percent of respondents were expecting PdM to lead to strong growth of the service business in the future.

Globally, we expect the market for PdM to grow by 20 to 40 percent a year across all industries and applications.³ That figure includes all forms of PdM, from services to components, contracts, consulting services, IT architecture, and software. Much of the growth will be commencing from Europe, where some PdM solutions have already hit the market or are at an advanced stage of development. → **B**

B: Predictive maintenance.

Forecast global market development to 2022 [USD billion].



Source: "Market research future", IoT Analytics, Roland Berger

² "Predictive maintenance – Servicing tomorrow – and where we are really at today", Roland Berger, VDMA, Deutsche Messe AG (April 2017)

³ "Market research future", IoT Analytics, Roland Berger

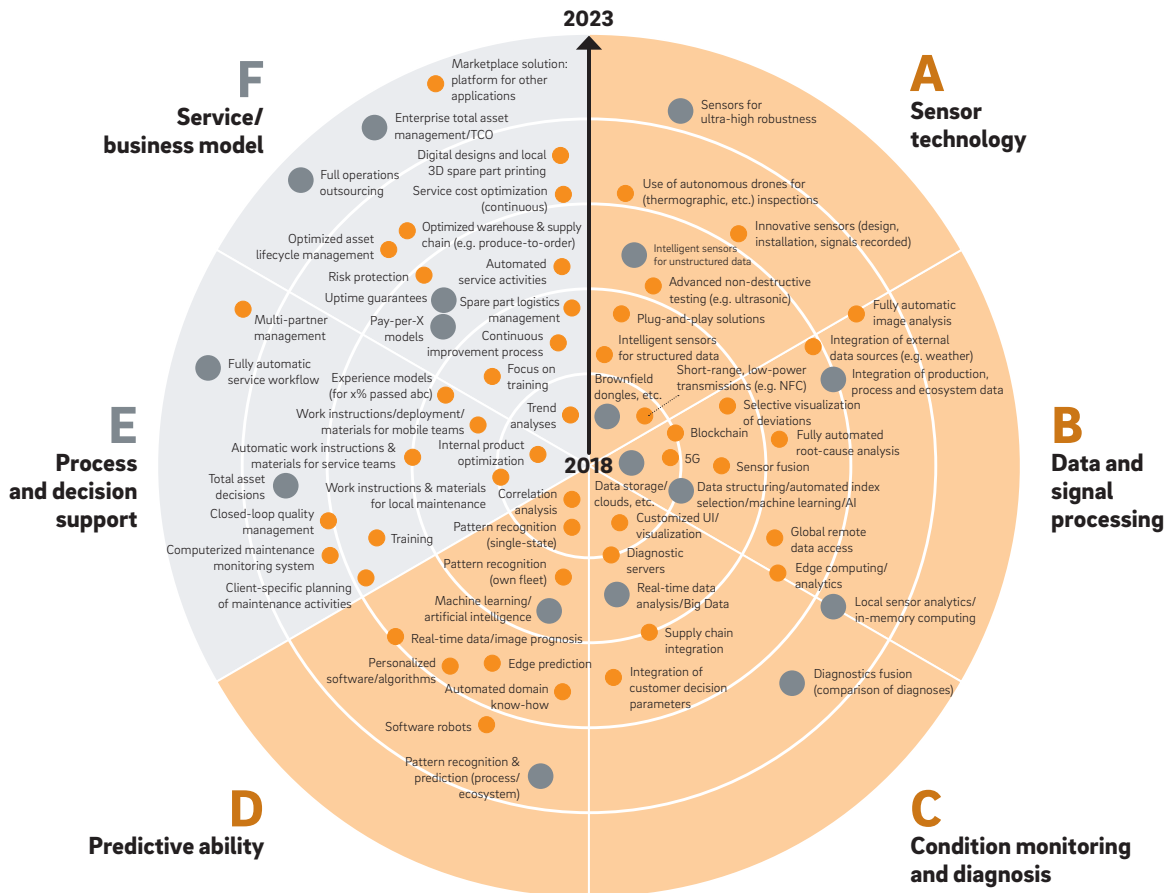
3. The Roland Berger Predictive Maintenance Radar

Mindset changes and business model disruptions: The real challenge ahead.

In order to realize this exciting growth opportunity, firms need to devise a comprehensive PdM strategy. Roland Berger has developed a handy tool to help them with this task. The Predictive Maintenance Radar charts future trends and developments in the period 2018 to 2023

along six dimensions: four technologically-driven dimensions (sensor technology, data and signal processing, condition monitoring and diagnosis, and predictive ability), and two business-driven dimensions (process and decision support, and the service/business model). → C

C: The Roland Berger Predictive Maintenance Radar. Trends and developments 2018-2023.



Source: Roland Berger

● Relevant developments and trends

● Essential developments and trends – areas where companies must develop expertise

The six dimensions of the Predictive Maintenance Radar

From purely technological dimensions to the holy grail of PdM

A

Sensor technology

Sensor technology forms the technological basis for PdM. The core competency lies in the ability to detect a multitude of signals quickly, accurately and in a targeted, reliable fashion. Many companies are busy retrofitting sensor technology to their global installed base to access data that they were previously unable to collect.

Companies implementing PdM need to ask themselves what type of sensor technology they want to employ and whether they should operate it themselves or rely on the services of a third party. They will also need to decide how widely to deploy sensor technology and what data it should actually collect.

B

Data and signal processing

Once a signal has been detected, data is generally collected and stored on local hardware or somewhere in the cloud. With virtually no limits on the amount of data available today, firms must make sure to structure and index the data logically so it is immediately accessible for analytics, diagnostics and forecasts.

Companies need to decide where to store their data, and how to structure and distribute it. The more effectively they do this, the faster and more impactful the resulting analyses will be.

C

Condition monitoring and diagnosis

The data collected from the machinery indicate its current condition. This information then forms the basis for deciding whether servicing is required or not. The added value lies in the fact that the data on the machine condition and the diagnosis are presented via a user-oriented, transparent, easy-to-understand user interface (UI). This UI can be tailored to the specific user group, be it the Operations, Finance, Service, or any other functions.

The key success factor for condition monitoring and diagnosis is deciding what exactly you are trying to achieve. What should the system flag up? And who should receive this information?

D

Predictive ability

Rather than just recording the current status of machinery, PdM makes it possible to forecast its future condition. Key to this innovation is the use of algorithms, which combine data on the current condition of the machine, service life models, and sometimes parameters from the production ecosystem, such as surrounding temperatures, humidity or service plans. The algorithms then determine ahead of time the optimal and critical dates for servicing. The most advanced systems of this type also make use of artificial intelligence (AI) and machine learning.

The critical question when it comes to enhancing a company's ability to make forecasts is what skills in Big Data and algorithms the company needs to achieve. Do they need to train their own data scientists? Should they work with a partner to make the best use of their existing expertise? And is the focus purely on the product, or do customers expect the PdM solution to form part of a wider integrated system?

E

Process and decision support

The holy grail of PdM is automatic decision-making and process steering. Like a self-driving car, in a firm run entirely by PdM, the industry processes would to a large extent function autonomously.

When it comes to automating processes and decisions, firms need be clear about whether their customers want to retain control of the model or would prefer to see it function as autonomously as possible.

F

Service/business model

Companies can use the possibilities described above to derive a service model based on PdM. They should work together with their customers to tailor this model for their specific application and industry. This type of customization, which may involve cooperating with further partners, is a necessity to create an attractive service model and also involves the establishment of new tariff and commercialization models.

The key challenge for companies is bringing PdM to the market, integrated across the Development, Sales, Finance and Service functions. Many of the theoretical service and business models for PdM are not possible within traditional organizational and corporate structures. If the company wants to fully exploit the commercial potential of PdM, it will likely have to completely revisit its existing setup.

The Roland Berger Predictive Maintenance Radar clearly shows that the basis for a successful PdM is already advanced along the four technological dimensions, namely sensor technology, data and signal processing, predictive ability, and condition monitoring and diagnosis. Here, only a few areas have still to reach maturity. We therefore expect to see all the core technology required for PdM up and running within the next three years.

The real challenge for PdM lies elsewhere: in the areas of process and decision support and service/business model. Here, far-reaching innovations, mindset changes and business model disruptions will be required in the years to 2023 and beyond, which few companies have fully got to grips with as yet.

"Predictive maintenance is not at all just a matter of technology. The real challenge lies both in process & decision support and the subsequent creation of business models."

Sebastian Feldmann

4. Looking beyond

From data collector to value creation partner.

How can companies turn the trends and requirements of PdM identified in the Roland Berger Predictive Maintenance Radar to their advantage? PdM offers clear growth opportunities, but many companies are still hesitating today. Based on our project experience and our survey of decision-makers from various industrial sectors,⁴ we estimate that more than half of firms are not yet pushing the question of whether – and how – to build their own PdM business model. They lack a clear strategy as well as dedicated budgets.

Why this reluctance to commit? The defensive attitude of many companies has its origins in the fact that businesses are nervous about the radical challenges that would inevitably result from implementing PdM throughout their organizations. Oftentimes they fail to realize – or maybe prefer not to see – that PdM will fundamentally change the way service functions and the way a company with its products is perceived. And that means a radical transformation of the traditional service model – from "After Sales" to "Pre Sales".

EVOLVING FROM A TRADITIONAL TO A DIGITAL COMPANY

If they want to master PdM and all that it entails for the future, companies are urged to change the way they look at PdM and the role of service as a whole. Only by transforming your corporate culture, evolving from a "traditional" to a "digital" company, will you be able to provide maximum benefit to your clients in the area of predictive maintenance – and consequently extract maximum value for your company in the longer term. → **D**

So how can firms initiate this process of change? Once again, they can draw on the Roland Berger Predictive Maintenance Radar. To turn PdM into a success story,

companies first need to understand all six dimensions. Then they can start building and interconnecting the necessary skills across the firm's entire value chain. The technological trends outlined in the Roland Berger Predictive Maintenance Radar can help companies put service on a digital footing and translate it into relevant information across the lifecycle. Unplanned outages can be reduced and output increased. Services can be planned more efficiently and automated. Service provision and the underlying supply chain can be streamlined.

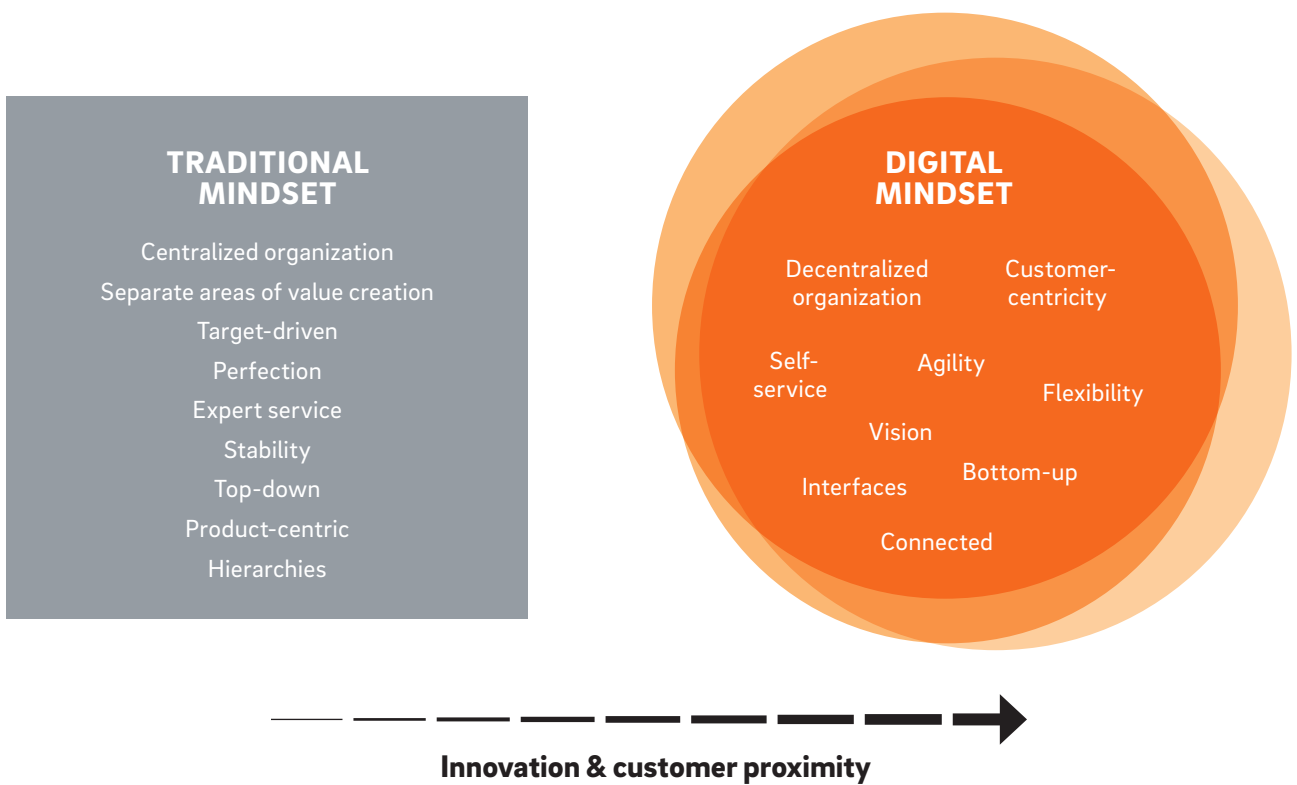
TRANSFORMING CULTURE: FROM HARDWARE SELLER TO OUTPUT PROVIDER

But even mastering all the technological possibilities offered by PdM is not enough to be fully prepared for the future. This requires an understanding of the true value proposition of their product across the entire customer ecosystem and the alignment of their services to that value proposition accordingly. The added value of their product for the customer must be clearly described and quantified. You can only realize the cost-saving and yield-boosting potential of PdM if you understand the complete lifecycle of your product with the customer, within their operations – and its impact on your own company. To do this, companies will have to drastically open up and work with each of their customers individually to get to the sweet spot of additional PdM value. Companies will find it impossible to do this on their own. They may also need to bring in external partners if they cannot build up specific competencies internally, or if it would take them too long to do so – a classic digital approach.

For many companies, the final challenge then lies in transforming their own culture – from a development-

⁴ "Predictive maintenance – Servicing tomorrow – and where we are really at today", Roland Berger, VDMA, Deutsche Messe AG (April 2017)

D: Digital transformation requires a cultural change. Traditional and digital companies differ.



Source: Roland Berger

driven hardware seller to a service-driven output provider. Players need to rethink their offering "bottom up" – from the perspective of each single customer – and develop services extending across the entire product

lifecycle and specific customer ecosystem. Only then can they begin to transform themselves from mere users of technology and collectors of data into service-oriented partners in value creation.

WE WELCOME YOUR QUESTIONS, COMMENTS AND SUGGESTIONS

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