



Predictive Maintenance

Servicing tomorrow – and where we are really at today

April 2017



Deutsche Messe

EXECUTIVE SUMMARY – STATUS OF PREDICTIVE MAINTENANCE

The manufacturing industry has clearly understood that maintenance (PM) is a key issue, a precondition for efficient, sustainable service delivery in the future. Progress in the technologies required by PM is swift and significant. Yet there are still gaps in the way data is translated systematically (or not) into (customer) benefits, as well as in implementation in specific business models.

- > Nearly all the companies we surveyed confirmed the importance of PM as a success factor, opportunity and necessity for business in future – not only in the context of service!
- > The majority of firms also see the technical feasibility of PM as a given and believe that the requisite technologies are already largely mastered, despite substantial challenges that remain in the area of data analytics.
- > Businesses still often take an opportunistic approach to predictive maintenance and are very uncertain and unclear about their own position and role in the future PM ecosystem. Action must be taken to define exactly what value each organization adds in the PM value chain and to choose suitable strategies to cash in on PM offerings.
- > Companies expect that PM business models will be shaped mainly by software capabilities, believing that hardware's share of value added will gradually erode.
- > Since they do not yet know exactly what customers expect of PM, many businesses currently define it from an internal, technical perspective (e.g. further product improvements). As things stand, co-creation with customers is at best still just a nice idea.
- > A clear trend toward collaboration is perceivable: Many respondents believe that working with external cooperation partners – even with direct competitors, if necessary – is important if PM is to add customer-specific value.

Predictive maintenance (PM) is one of the key innovations brought forth by Industry 4.0. Thanks to continuous measurement and analysis, PM makes it possible to forecast the remaining service life of machine components, for example. Critical operating parameters can serve as decision aids to optimize the timing of maintenance and define operating statuses.

PM is based on a concept called "condition monitoring", which already collects real-time information about the operating status of the components being monitored. Up to now, however, condition monitoring has never produced forward-looking outage and wear predictions. That is why PM marks a turning point: With the aid of ever more sophisticated sensors, higher-performance communication networks and more powerful computing platforms – to process mass data and compare it with fault patterns using stochastic algorithms – it is now possible to identify, simulate and interpret patterns in operating parameters. And it is these patterns that allow service life predictions to be calculated more accurately, as well as joining up all operating data in the entire system to optimize every aspect of service provision – for the customer, of course, but also to help the provider make specific improvements to its products.

The ability to make accurate forecasts thus opens the door to focused, well-founded support for proactive processes and decisions in a company's production and service environment. As a result, PM concept providers become value-added partners to customers. → [01](#)

PM technologies will lead to profound changes in customers' maintenance and production strategies and mechanical engineering firms' service business models. One possible consequence is that sensors, networking and computing power could increasingly compete with the knowledge and experience of service specialists. This in turn makes it more and more likely that new players with a background in the digital world will enter

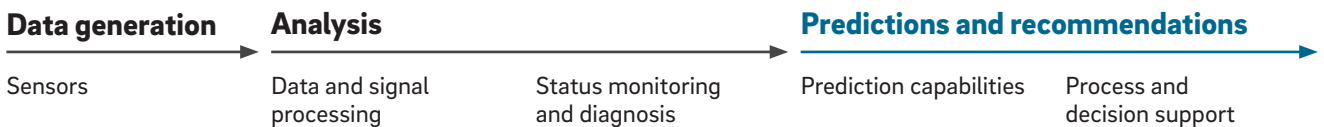
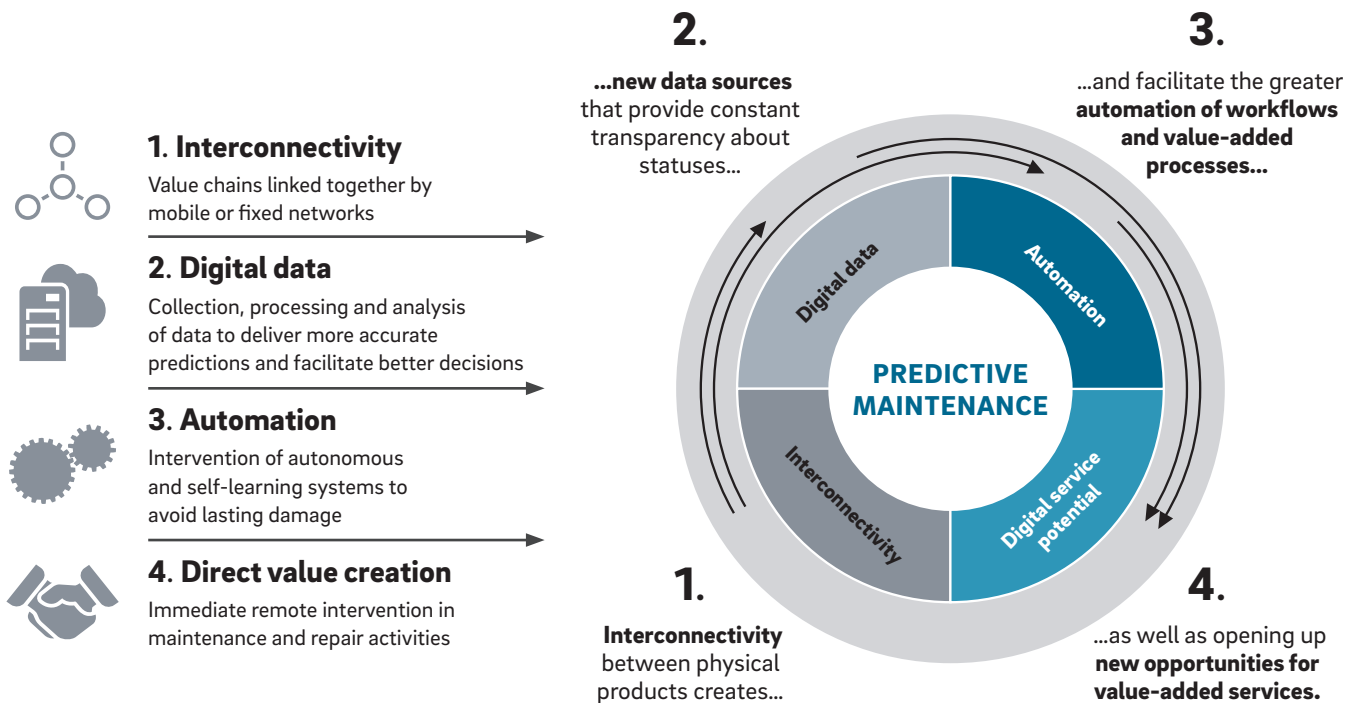
the market for service business in the production industry. The stakes are high for the German engineering sector, which must respond by taking the lead in defining, implementing and disseminating PM solutions. For this reason, Germany's Mechanical Engineering Industry Association VDMA and trade fair operator Deutsche Messe made predictive maintenance one of the main themes of this year's Hannover Messe. Numerous approaches and initial solutions are already in existence across all segments of mechanical and plant engineering, yet opinions on the topic vary very considerably. To keep the debate on an objective level and establish where the development of predictive maintenance is at right now, Roland Berger therefore teamed up with VDMA and Deutsche Messe to conduct a broad-based corporate survey. Its aim? To paint a clear picture of the current status of PM solutions and the degree to which German engineering has adopted and implemented them.

The key questions in the survey were these:

- > How do German mechanical engineering firms rate the importance, opportunities and possible risks of PM for their future business?
- > What is the current status of development in the industry with regard to product and service offerings for PM?
- > What do companies see as the principal areas where action must be taken to establish and expand a leading array of PM service offerings?

The survey specifically targeted companies in segments that are particularly exposed to the relevant issues: power transmission engineering/fluid power, electrical automation/robotics, discrete manufacturing technology, software engineering and digitization technology. → [02](#)
This publication summarizes the key findings of the survey.

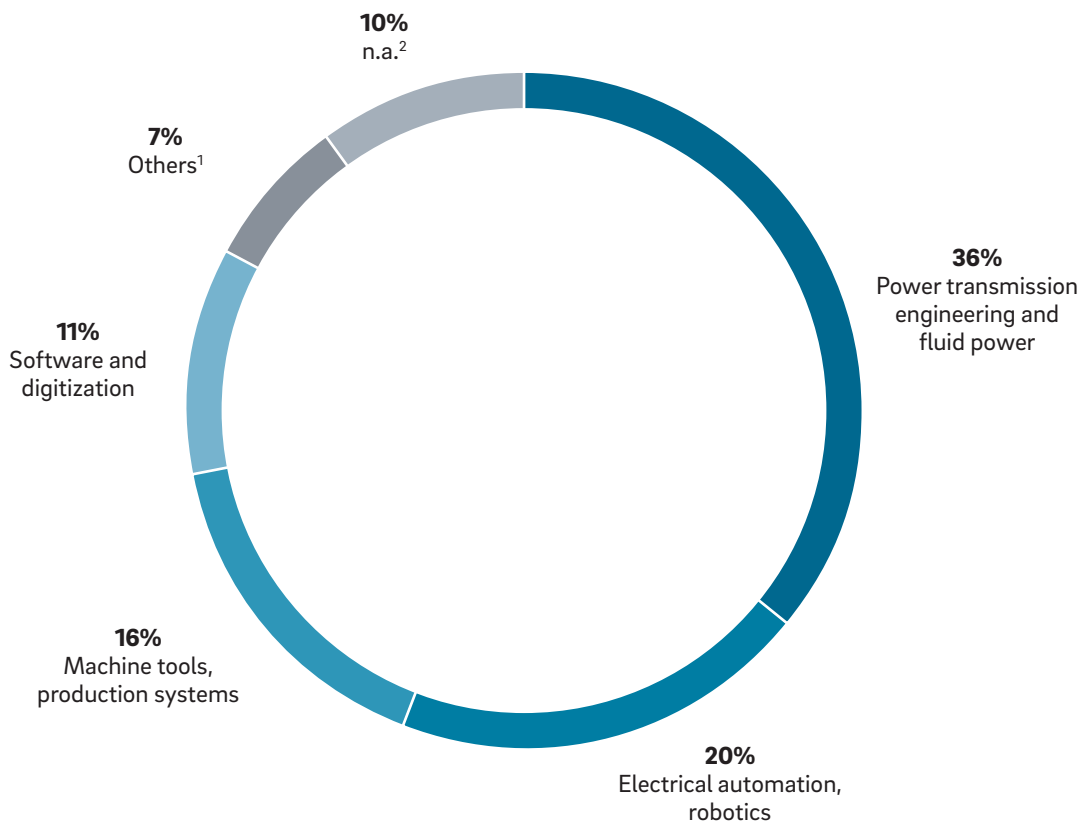
01: The philosophy behind predictive maintenance



Traditional mindset
DATA GATHERER

Digital mindset
VALUE-ADDED PARTNER

02: Structure of survey respondents



1 Compressors, compressed air and vacuum technology, power and heat generation engines, thermal turbines and power plants, plastics and rubber machinery, wind turbines

2 No industry specified

DETAILED ACCOUNT: KEY FINDINGS ON THE STATUS OF PREDICTIVE MAINTENANCE

Predictive maintenance is a key issue for Germany's engineering sector

There is no question that German engineering, in its capacity as a supplier of capital goods, has now accepted and understood PM as an important industry trend. 81% of the respondent companies are already tackling this issue intensively. → [03](#)

Looking ahead, many companies still find it hard to assess PM's value as a success factor

Nearly 40% of companies say that mastering PM is of particularly great importance for future business – as a differentiator and success factor to help sustainably uphold and increase service revenues.

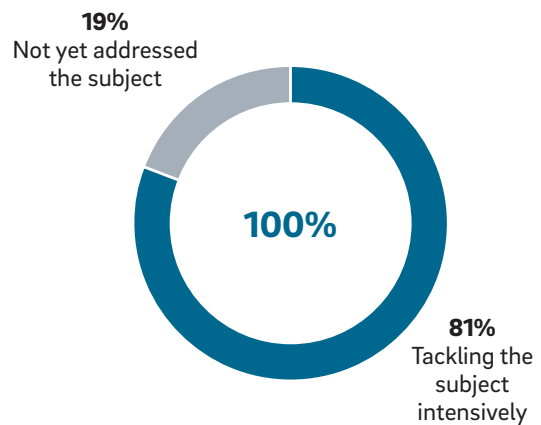
General consensus across different industry segments

Despite minor differences between the individual industry segments with regard to product and deployment attributes for PM, the study gives no indication of significant discrepancies between the segments. On the whole, the perspectives, development statuses and challenges facing companies are comparable across the different segments.

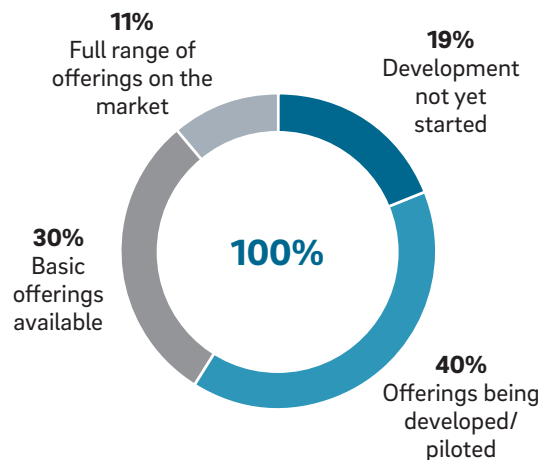
Only some companies already have concrete predictive maintenance offerings

As far as the availability of concrete PM "products" is concerned, the level of maturity still varies greatly within the engineering industry. While nearly 40% of the respondent companies do already offer the relevant technologies and services, the majority are still working on their PM offerings – or not yet doing anything. → [04](#)

[03](#): Getting to grips with predictive maintenance



[04](#): Existing product/service offerings

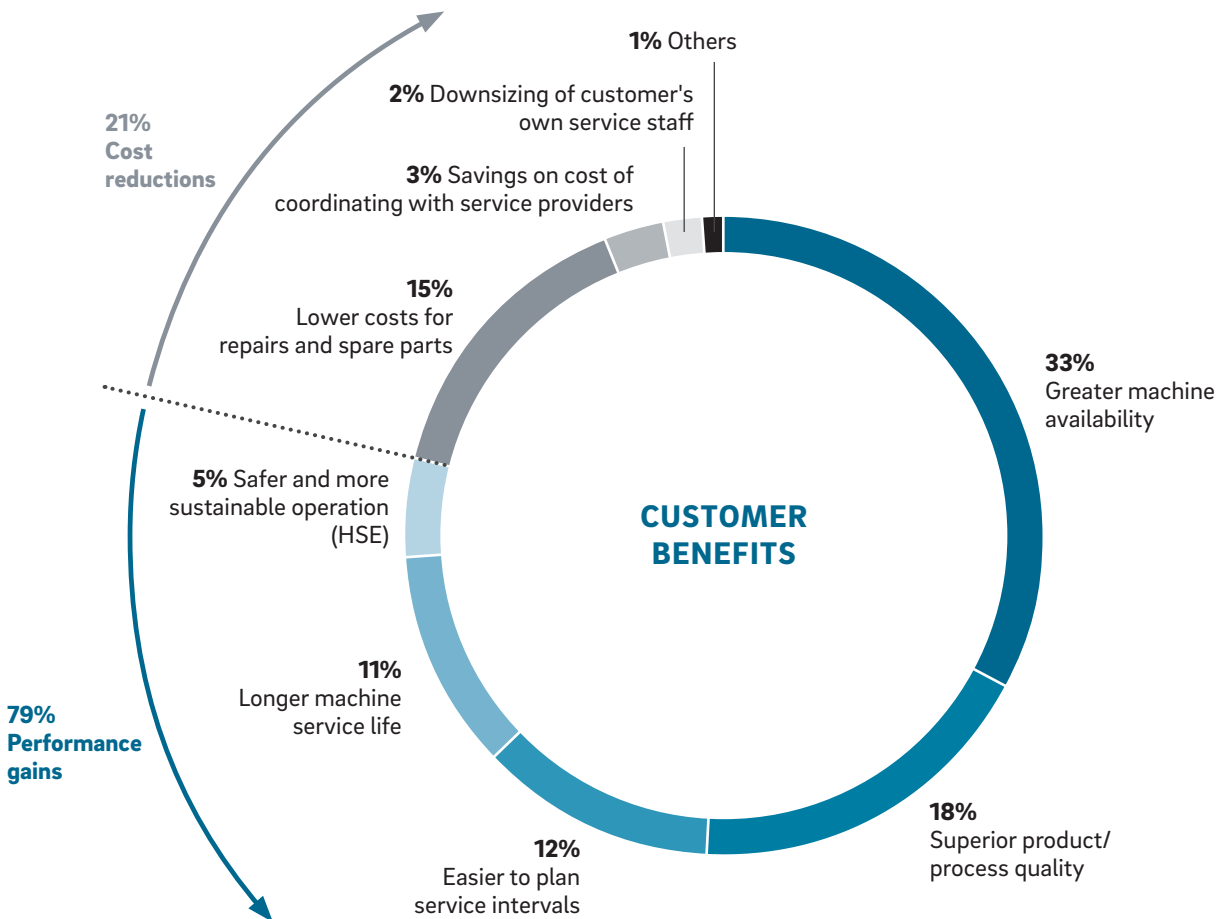


Enhanced performance is seen as the main benefit that predictive maintenance offers to customers

According to 79% of the survey participants, the main benefit that customers derive from predictive maintenance is superior performance in production technology – thanks to higher machine availability, longer service lives and more stable processes, for example. By contrast, only just under a fifth of the respondent companies see PM as a way to cut maintenance costs. → [05](#)

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05: Benefit categories and their relative importance¹



¹ Percentage of total mentions; multiple answers possible

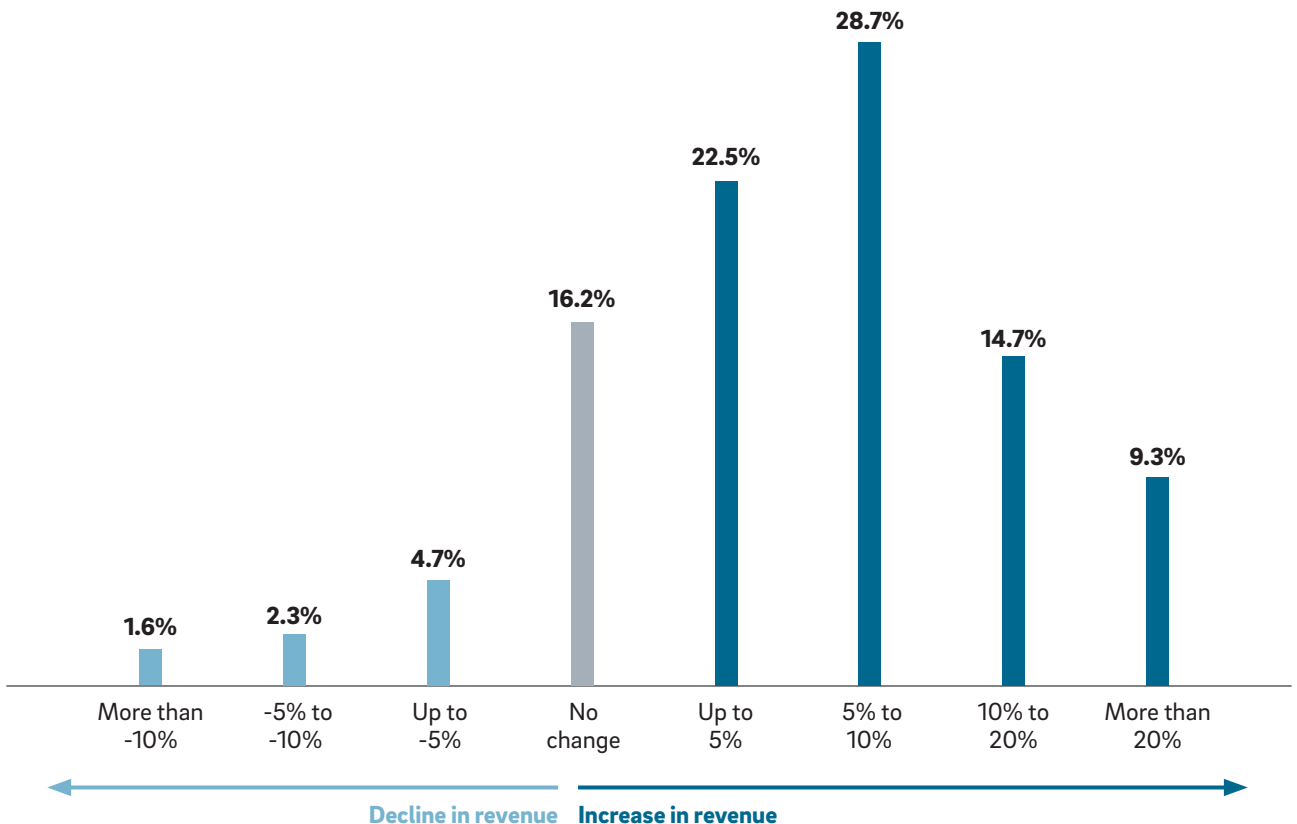
PM mostly expected to drive growth

While heated debate rages over the overall financial effect of PM, growth expectations outshine the respondents' fears of cannibalization. Looking at their own business prospects, 80% of participants expect that PM will deliver considerable growth stimulus to their service business. In contrast, 20% of companies are more focused on the risk that their existing service business could be cannibalized, albeit to a comparatively minor extent. → [06](#)

Urgent need for alignment with customers' needs

The development of PM offerings to date is evidently driven first and foremost by the technological perspective of mechanical engineers who are keen to improve their own products. Nearly 90% of the respondents admit to still having deficits in their understanding of what customers and their end customers genuinely need. Logically, therefore, they remain uncertain about whether the benefits promised by PM providers as the basis for commercial success will genuinely add significant and readily quantifiable value in the view of customers too. → [07](#)

06: Impact on revenue in service business

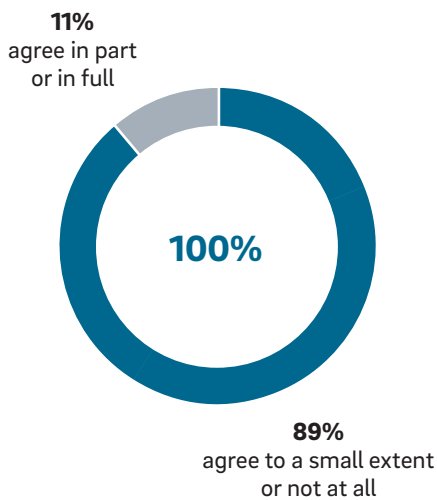


Deficits in systematic strategy and product development

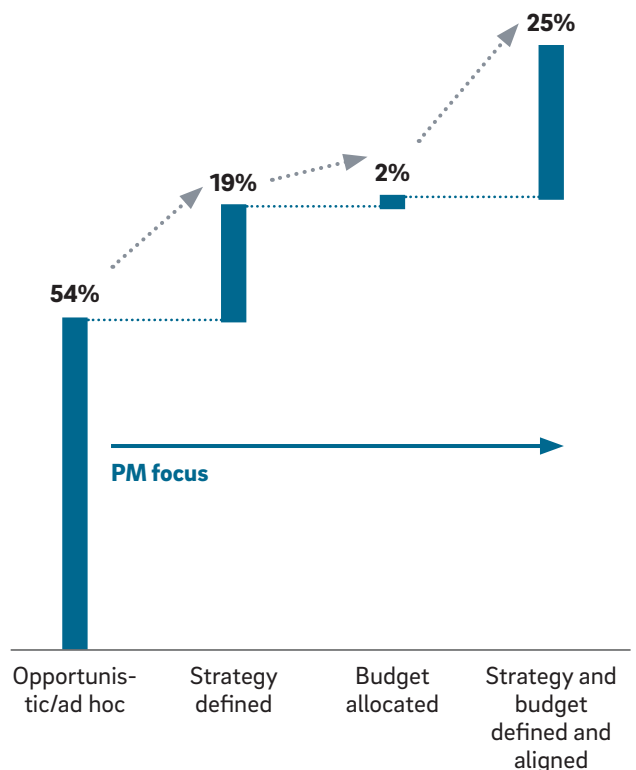
The current mostly technology-driven approach and respondents' failure to engage customers is also reflected in the fact that more than 50% of the respondent companies do not as yet have a genuinely systematic approach – in the sense of a clear strategy with defined business targets and a corresponding development budget – to building their PM business model. → [08](#)

07: Customer orientation

"I have a clear understanding of the actual needs of my customers with regard to PM."



08: Approach to business development



Industry believes it largely masters the basic technologies that underpin predictive technology

As the survey participants see it, the technical conditions for PM are largely in place. Technological challenges still exist in particular regarding the capability to analyze and identify patterns in machine operating and status data, to fine-tune the quality of PM, and to advance forecasting and decision support from the level of components and machines to the level of production and systems (networked production).

Many companies are still uncertain of their own position in the predictive maintenance value chain

One of the most complex aspects of PM is the ability to properly translate operating data into ecosystem intelligence and customer benefits. Almost 65% of respondents claim to be unclear about their own position – probably due in part to the fact that digital expertise is still underrepresented, especially among SMEs. Virtually all market players still have a hard time assessing how customers' "ecosystem" and the platforms that will be used for it will develop in the future.

Yet it is imperative for companies to align themselves rigorously with these changes and with a clear understanding of the specific value that the overall logic of PM can deliver. Since the digital elements involved will only increase, it is no surprise that 69% of the respondents see cooperation with specialized external partners as exceptionally important, especially in the area of software and data analysis. 40% of the survey participants do not even categorically rule out collaboration with direct competitors.

Still not clear: How do you make money out of predictive maintenance?

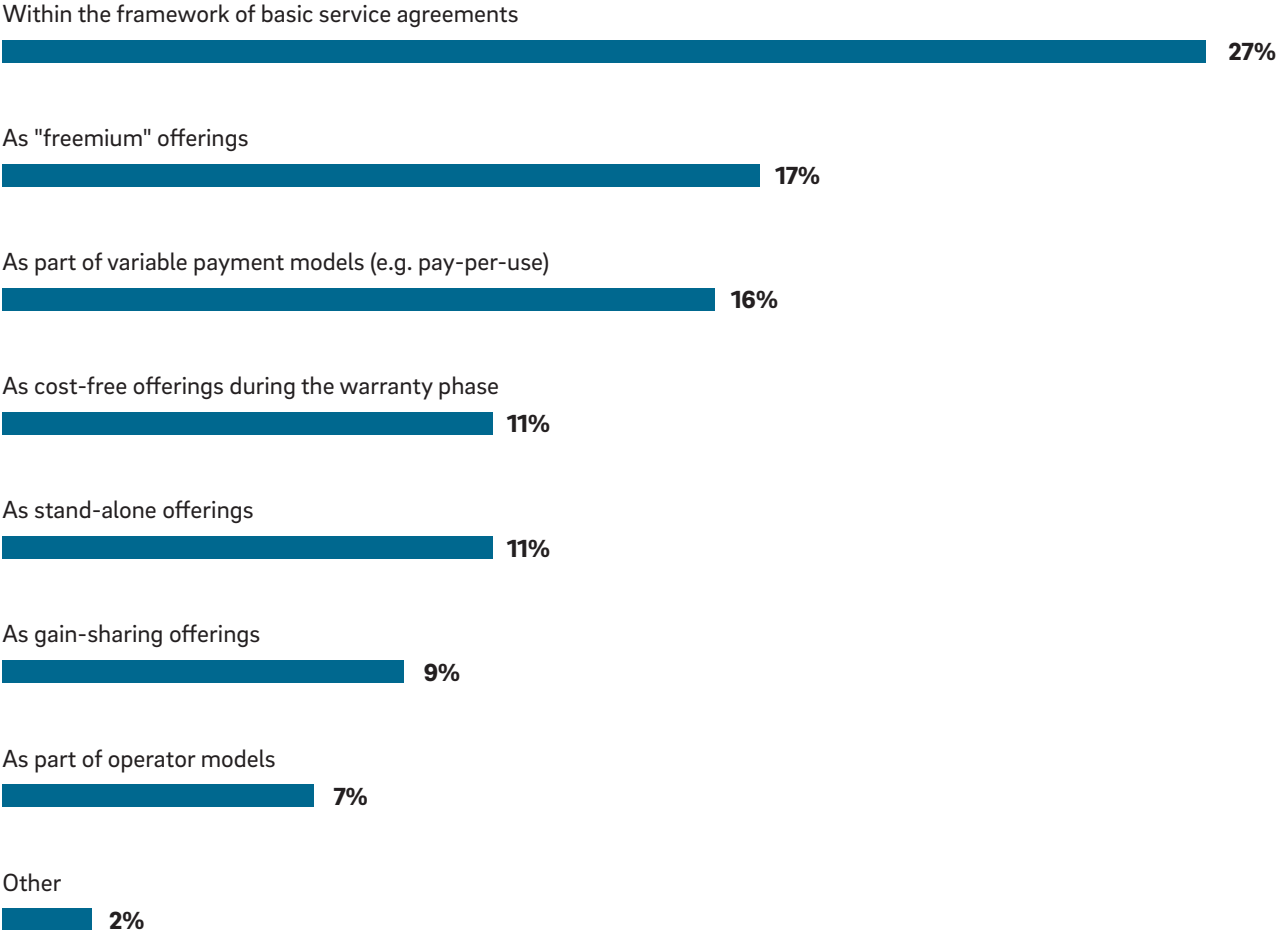
Mentioned by 90% of respondents, the question of how to earn money on PM services is obviously a very wide-

spread problem as firms move to set up PM business models. One reason is undoubtedly customers' traditional reluctance to pay for "digital" offerings in the manufacturing industry. It is nevertheless conspicuous that the respondent companies' current considerations clearly tend more toward cost-based billing than performance-oriented and hence "more digital" pricing models. → [09](#)

Many companies have, however, clearly understood that this "new" type of service also demands a fresh mindset – regarding who to approach on the customer's side, for example. On this score, selling to the shop floor is no longer appropriate. Instead, partnership and dialogue must take place at the highest levels of management if common goals for and KPI effects from PM solutions are to be defined and piloted.

In some areas, the value creation concept for PM necessitates separate, digital-friendly structures and an integrated product/service strategy. However, most respondents currently operate PM in the context of legacy structures – and are making little progress in the design of their PM offerings (e.g. KPIs, pricing, sales, controlling and vertical integration).

09: Different pricing models for predictive maintenance solutions are perceivable¹



¹ Multiple answers possible

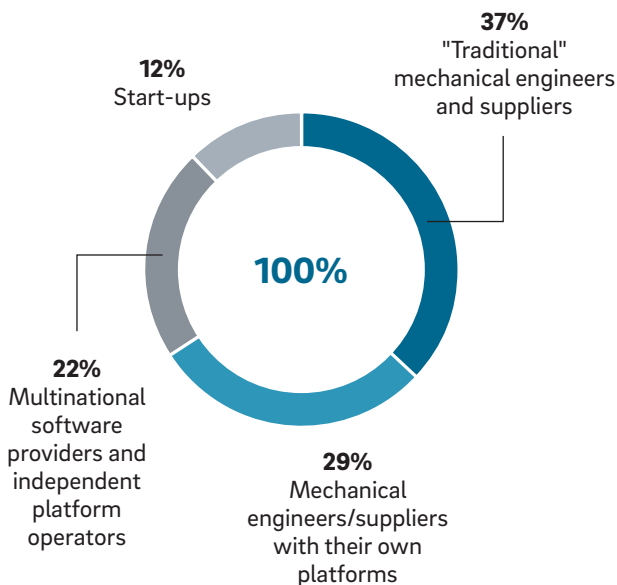
Predictive maintenance breakthrough expected by 2020

Opinions differ sharply on how fast PM will penetrate the market, especially given general uncertainty about the extent to which the requisite sensors and their connectivity technology can be retrofitted, or whether new installations must first be grafted into the installed base. It is likewise unclear how quickly, to what extent and on what internal and external storage media customers will be willing to grant the necessary access rights to their data. That said, close to 50% of the respondent companies expect PM to make the breakthrough by 2020. This assertion again highlights the digital nature of the PM concept, characterized as it is by short cycles and disruption.

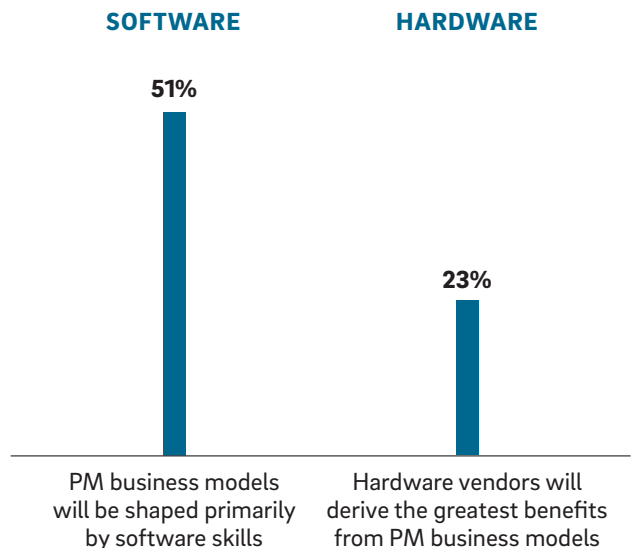
Not yet clear who the PM winners and losers will be

The issue of who will dominate future business with PM is the subject of vigorous debate. Right now, domain expertise is still the core competency and market advantage of hardware vendors. Yet it is difficult to know whether this advantage will remain in the future. A large number of respondents certainly see a potential threat from technology and platform providers from other industries who may not have the application knowledge, but who could still make good use of their advantages in terms of IT infrastructure and big data expertise. → [10](#) Even so, it is apparent that a majority of the respondents see the "PM gold" of the future in software. → [11](#)

10: Expected future breakdown of the market for predictive maintenance



11: Future source of value added in predictive maintenance



PREDICTIVE MAINTENANCE – SUMMARY AND OUTLOOK

There is no question about PM's importance to German engineering as an area of potential in the field of industrial digitization. Accordingly, it has a regular slot on the agendas of most companies. However, this is another area where the heavily technology-driven innovation philosophy favored by machine and component builders comes to light. In many cases, the other major success factors – such as a precise understanding of customers' needs and the clear alignment of business models with these needs – have not yet been tackled with commensurate systematic rigor.

To establish a leading and commercially successful market position in PM, it would seem that – as well as building up the requisite big data and data analytics skills – the following aspects in particular are of great importance:

A different innovation process: "Market pull"

PM solutions must be developed more from the perspective of customer benefits, based on closer collaboration with customers and the use of development methods borrowed from the digital realm (e.g. design thinking and co-creation). Development processes must also be accelerated enormously and must include an acceptance of iteration cycles ("fail fast, learn fast").

Different market access: "Digital model"

Specific, quantifiable use cases must be presented alongside the greater use of innovative, software-oriented pricing models and sales concepts to communicate the benefits to customers. It is vital to cultivate an awareness of an extended and changed approach to stakeholder management for customers. At the same time, companies must more carefully consider how cus-

tomers perceive their importance in the future value chain (on the basis of B2C models) so that PM cost elements can be passed on to customers.

Different forms of collaboration: "Networked approach"

Companies must concentrate on their own strengths and the value they add as they systematically building up key competencies. Also, they must become more open and actively foster partnerships in order to add the skills, technologies and infrastructures they will need to operate a successful PM business model. If necessary, these partnerships must even embrace competitors. Nor should the option of partnering with companies from other segments and industries be ruled out.

Digitization is a compulsory discipline for mechanical engineering, as for other industries. Irrespective of the business opportunities it affords, no company can afford to stay on the sidelines. In the case of PM, management is again called on to actively take hold of these opportunities by mapping out clear strategies and systematic business concepts.

PM is not a panacea that will make up for legacy deficits in offerings, companies' footprints and/or service provision. Service business must continue to be analyzed and optimized as part of a holistic corporate strategy. Driven from a customer-centric perspective, it is nevertheless imperative that companies define their own needs and possibilities within the PM narrative if they are to maintain sustainable success in the service business – advancing from the internal optimization of products and efficiency to long-term relationships of trust as value-added partners to customers.

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About VDMA

VDMA, Germany's Mechanical Engineering Industry Association, represents more than 3,000 mostly medium-sized companies in the mechanical and plant engineering industry. The organization is celebrating its 125th anniversary in 2017. More than a million employees in Germany and revenue of an estimated EUR 220 billion in 2016 make this sector the country's largest industrial employer and one of the leading branches of industry in Germany.

About Roland Berger

Roland Berger, founded in 1967, is the only leading global consultancy of German heritage and European origin. With 2,400 employees working from 34 countries, we have successful operations in all major international markets. Our 50 offices are located in the key global business hubs. The consultancy is an independent partnership owned exclusively by 220 Partners.

Navigating Complexity

For the past 50 years, Roland Berger has helped its clients manage change. Looking at the coming 50 years, we are committed to supporting our clients conquer the next frontier. To us, this means facilitating navigating the complexities that define our times by providing clients with the responsive strategies essential to success that lasts.

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