Predictive Asset Management

Anticipate the Future

Listening to your assets significantly benefits your business

Porsche Consulting

Strategic Vision. Smart Implementation.

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Successful management of industrial assets, which are significant investments, is key to staying competitive in most industries. Aircraft, trains, production equipment, energy plants, and even cruise ships need to be utilized for the best economical results. Ordinarily considered a maintenance challenge, this field offers much broader potential.

Imagine being continuously updated on your asset's health status, such as the moment its condition becomes critical, needs a spare part, or requires a specific service. Or even better: your assets actively suggest redistributing or flattening peak workload to ensure planned output and quality for another two weeks without interruption. Fiction? Not necessarily. Nowadays all assets generate data in bulk. But who really works with this hidden treasure? Those that do, boost asset utilization of up to 30 percent and gain a significant competitive advantage. Take Airbus Skywise, for example, who significantly reduces operational disruptions by connecting data from over 2,000 aircraft and allowing the system to learn as a whole.

World wide studies confirm savings potential in various industries

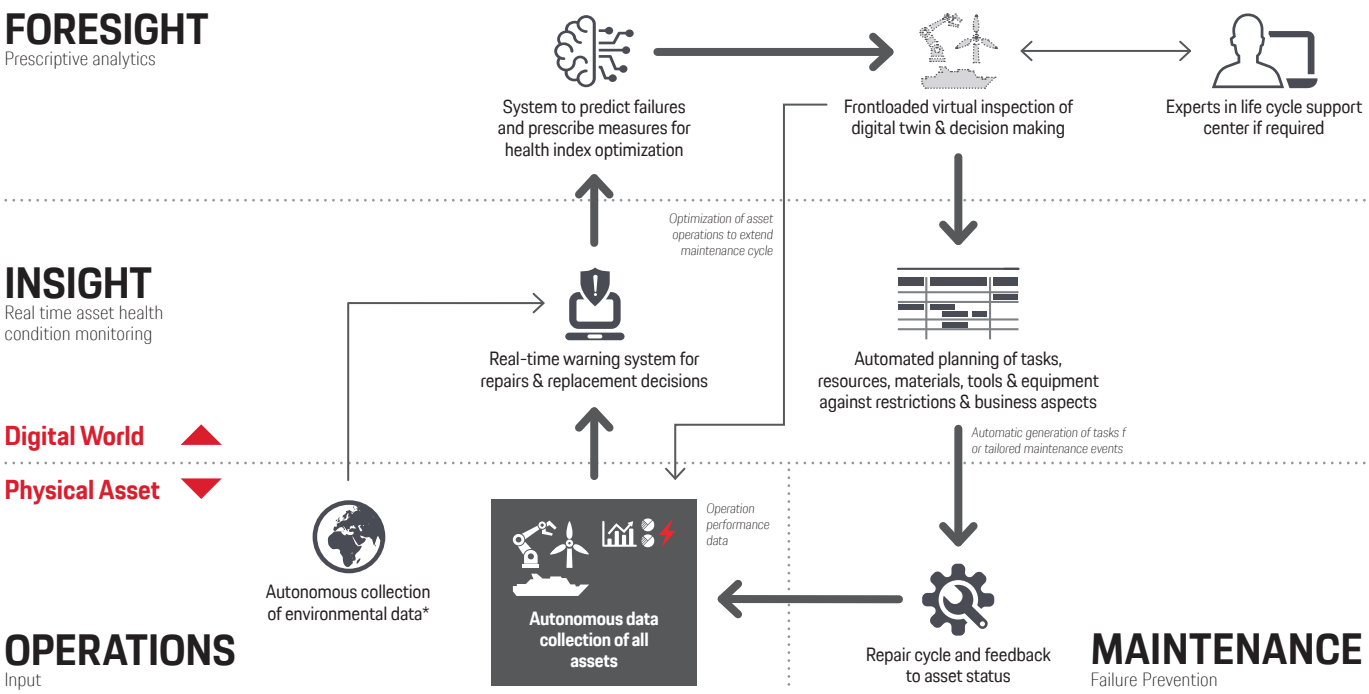
	Aircraft MRO*	Train maintenance	Automotive equipment maintenance	Mining maintenance	Wind park service
Maintenance costs**	10%	21%	10%	19%	23%
Secondary costs	400k €	25k €	20k €	2.5k €	8k €
	per cancelled long haul flight	per cancellation	per minute line stop	per hour downtime	per day of standstill
Potential***	↘ 30%	↘ 20%	↘ 20%	↘ 40%	↘ 20%

* MRO = maintenance, repair & overhaul | ** As % of operating costs | *** Potential reduction of maintenance costs through implementation of predictive system
Fig. 1 Potential overview for maintenance cost reduction across five industries
Source: Porsche Consulting

Porsche: The efficiency master uncovers a new way

Managing assets with predictive analytics—a journey Porsche embarked on in 2015—was primarily tailored to increase the efficiency of maintenance work in asset-dominated production areas. Porsche's first project with Porsche Consulting focused on the Macan's body shop, equipped with 387 robots and emitting more than 70.000 data sets per day. Armed with information on production planning and around two billion data points covering the previous production year, the search for further availability levers commenced. With the help of big data analytics and specially developed algorithms, Porsche is now able to predict equipment failures eight hours in advance. Consequently, maintenance technicians get alerts that help them plan their work; spare parts are ready when required; and technical documentation is available in QR codes found on each robot. The result: an output of 21 cars per hour instead of 18. Despite decades of human technical experience, this outcome would not have been possible without data-driven recommendations. A clear paradigm change for Porsche: from execution based on human experience to trust in smart systems[1].

Vision to boost paradigm change "trusting in smart systems"



* Live performance data, additional sensor information, influencing data like weather, load, etc.
Fig. 2 Vision for a future Predictive Asset Management system
Source: Porsche Consulting

[1] Source: Porsche Consulting Magazine 18, p. 22

A concise vision aligns all stakeholders

Porsche Consulting comes with a proven approach, acting as the strategist and integrator for all stakeholders translating and connecting data scientists with hardware oriented production and maintenance specialists. A key success factor on the journey is a clear vision for a tailored Predictive Asset Management strategy. Finding the right strategy requires a profound knowledge of the asset operating model including investment type, utilization patterns, and environmental parameters. There are quite a few stakeholders affected: from production planning to day-to-day operation, maintenance planning and execution. And not to forget the IT department to access all required data silos to the experts that master machine control units and know where to find the data files associated with past analyses of isolated problems. All activities to achieve the vision then follow a clear roadmap in line with the organization's balanced scorecard. For instance, the mid-term, two-year roadmap for an offshore wind park service provider revealed potential cost reductions of more than 4 million € per year while stabilizing turbine availability at the same time.

Data structuring and analytics — too complex for human brains

Before sophisticated analytic capabilities can be applied, the entire physical system needs to be mirrored in a data model, known as a digital twin, which is typically fed from numerous data sources. Approximately 80 percent of the analytical effort is required to find data points relevant to asset condition, get them in the right granularity, and match all data points to an overarching model. Data sources are numerous: from classic ERP production planning and control data to machine control unit parameters, quality findings, and maintenance information as well as external information such as climatic conditions and the countless Excel® spreadsheets needed to run the operation. With a structured and cleansed data model, Porsche Consulting's state-of-the-art analytic approaches begin detecting dependencies and anomalies at a speed impossible for humans; artificial neurons process calculations 100,000 times faster than their biological counterparts.

Deep dive: analytic approaches to generating insights

Now the machines do their magic. A clear visualization of the findings is essential, making them transparent and comprehensible for the stakeholders involved. Nevertheless, people must continue to decide on actions to be taken in practice, increase their data knowledge, and trust the machines. Fully autonomous operation in which robots control and repair robots or assets is, according to Porsche Consulting, still a few years down the road.

1. Overall system focus
Event-based process analysis to identify correlations and potentials end to end and throughout the entire value chain. For example, a Bayesian network—an advanced analytics approach also used in cybersecurity—connects all parameters, finds correlations, and detects influencing factors for a set system goal. This method works even if the amount of data is relatively low such as 10,000 heterogeneous but high-quality data points.

2. Critical asset focus
Signal-based condition monitoring - the traditional method most people use - is capable of foreseeing and preventing anomalies for critical individual assets. To find anomalies, however, the signal-processing method requires large numbers of data sets—typically one million or more of data sets before the algorithms are able to learn and differentiate the bad from good.

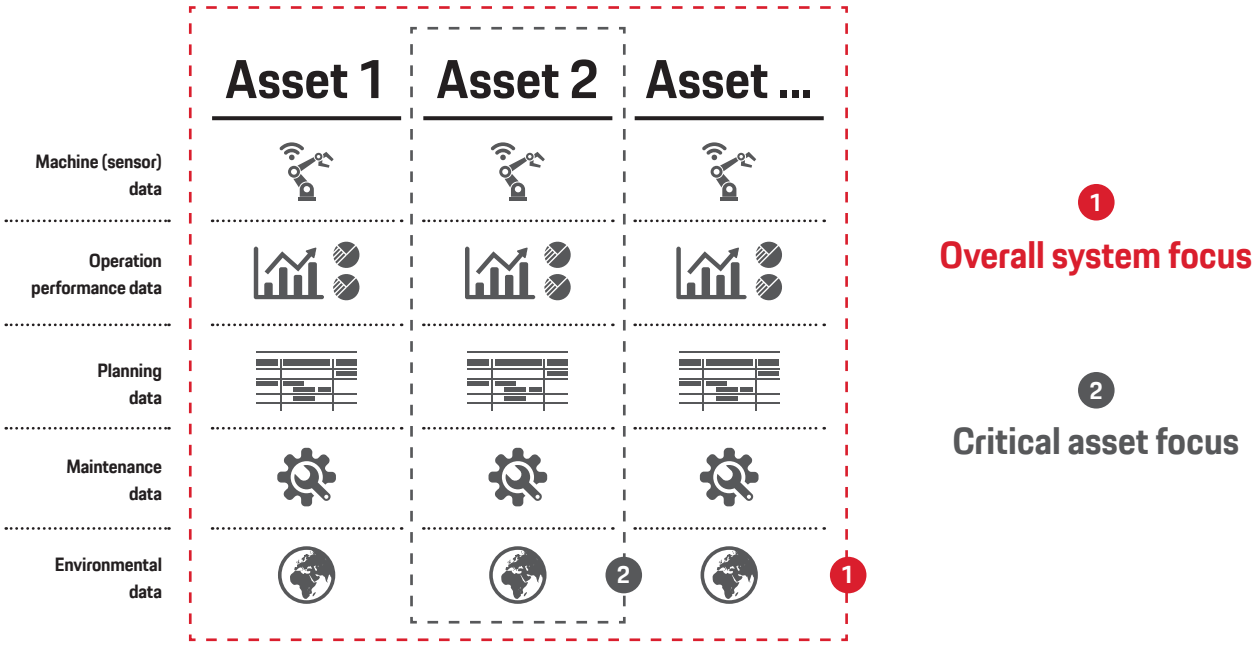


Fig. 3 Two analytic approaches to gain maximum insights
Source: Porsche Consulting

Showcases prove its effectiveness and profitability

As tangible results early on are important for management buy-in to further drive the digital transformation and roadmap execution, the selection of the right showcases is crucial. Asset criticality, improvement potential, and asset-related data availability and quality form the basis for selection. Furthermore, the results should be achievable within a relatively short timeframe, typically a few weeks. Applying artificial intelligence in a crop seed plant identified measures to reduce production losses by 17 percent. Bayesian network analytics, for example, suggested allocating "critical" corn hybrids to "healthy" production lines, resulting in fewer seed losses, reduced downtime, and more accurate forecasts of spare part requirements. Corn hybrid criticality is influenced by parameters such as moisture, size, ripeness, and origin, whereas production line healthiness is determined by asset setup, machine age, and maintenance condition. This is just the beginning, however: successfully implemented showcases are the trigger to scale the approach throughout the complete facility, across similar plants, and throughout the entire company.

End-to-end approach is key

Once the data-analytics phase is completed and showcases have revealed its potential, the next logical step is to design and implement an end-to-end prediction process. Following the asset specific vision, this process of permanent analytics feeds key performance indicators and alerts into the daily operations of the stakeholders. The starting point is automated data input that ensures all relevant information generated by assets, people, and the environment is fed into the analytics engine in a seamless and continuous flow. Predictive analytics then simulate a future asset health status based on planned utilization patterns. Once an irregularity is foreseen, typically short cyclic and ideally immediate, the management team in charge must verify effects and devise appropriate measures. Adequate communication paths and rapid escalation mechanisms must be established according to a clear classification of irregularities. Derived measures must be integrated into such operational processes as planning and control. To close the data loop, a feedback system evaluates the targeted effect of the implemented measures.

At Qantas Engineering, the joint project target was to forecast non-routine maintenance work that often disrupted promised aircraft service dates and/or increased short-term labor needs—a major cost driver. An end-to-end analysis of aircraft, flight, environmental, and maintenance data provided a accurate forecast and delivered input for the check-planning and control processes. In just four weeks of project work, one third of the non-routine workload—the most critical tasks—can be predicted with up to 90 percent accuracy and planned into the downtime, thereby closing the data feedback loop. The result: aircraft serviced on time, less additional labor costs, and a smoother supply chain distributing parts more accurately at the right time. And not least of all, stability for airlines and passengers as the ultimate consumers.

End-to-end implementation based on a tailored asset strategy

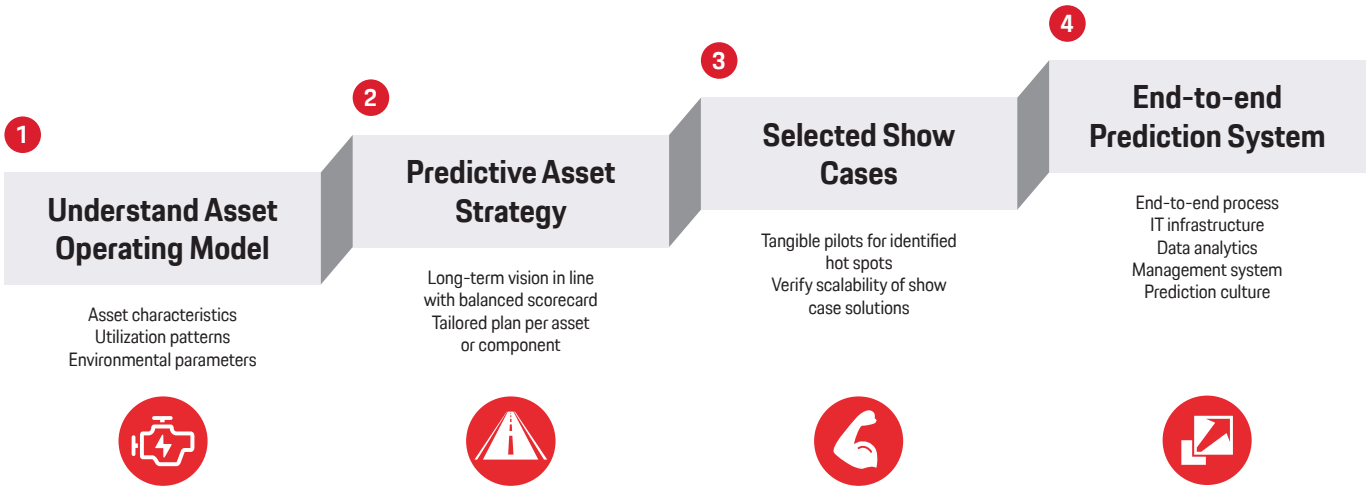


Fig. 4 Holistic approach to implement Predictive Asset Management
Source: Porsche Consulting

Let the data you have discovered, structured, and combined generate addidtional revenue for you

The described approach to Predictive Asset Management ensures relevant data is identified and utilized to predict future asset health. It also provides a holistic decision metric that optimizes overall operational efficiency. Results indicate as much as 30 percent improvement potential over asset lifetime availability, with an asset-individual sweet spot that balances operational needs and cost targets. Predictive Asset Management also offers the possibility of creating new, data-based business models.

Best practices

Rolls-Royce aircraft engines collect weather data on transatlantic flights and therefore provide the most up-to-date meteorological information, which they now sell to airlines[2].

Siemens provides a reliability guarantee for Renfe trains in exchange for all operations data. The result: only one of 2,300 Velaro-E trains experiences a delay of more than 15 minutes on the Madrid-Barcelona route[3].

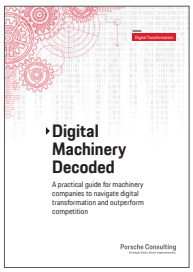
Porsche automotive racing provides inspiration for the potential of predictive analytics. Porsche's race engineers look 24 hours ahead to predict a race car's health status and suggest ways to achieve the optimal outcome in each competition. The compelling result: three consecutive victories for the Porsche 919 Hybrid at the world's most difficult 24-hour endurance race, Le Mans, from 2015 to 2017.

Fig. 5 Predictive Analytics in Porsche car racing as inspiration for a future state[4]

[2] Source: https://bit.ly/2vLaLMN
[3] Source: https://www.siemens.com/press/pool/de/events/2015/mobility/2015-06-uitp/praesentation-service-d.pdf
[4] Source: Porsche Motorsport Partnerportal 26.10.2018 Porsche GT Team Fuji 2018 Fuji: FIA WEC 6 Hours of Fuji 2018, (Photo by Jiri Krenek)

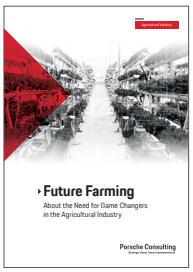
Further reading

Porsche Consulting regularly publishes reports and articles on major trends, innovations, and ways to keep companies competitive.

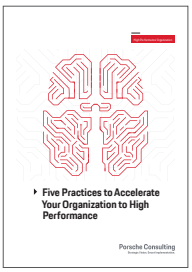


Study
Digital Machinery Decoded

Strategy Paper
Digital MedTech Transformation



White Paper
Future Farming



Strategy Paper
High Performance Organization: Speed up your organization

Strategy Paper
High Performance Transformation

Strategy Paper
Self-Driving Enterprise

Porsche Consulting.

Headquartered in Bietigheim-Bissingen, Porsche Consulting GmbH is a subsidiary of the Stuttgart-based sports car manufacturer Dr. Ing. h.c. F. Porsche AG. Founded in 1994, the company currently employs more than 600 people and is among the top 10 management consultancies in Germany (Lünendonk analysis). Active around the globe, it has offices in Stuttgart, Hamburg, Munich and Berlin as well as in Milan, São Paulo, Atlanta, Belmont (Silicon Valley) and Shanghai. Following the principle of "Strategic Vision, Smart Implementation," its experts support companies worldwide primarily with their major transformations, the improvement of their performance, and enhancement of their innovative capacity. Their clients are large corporations and medium-sized companies in the automotive, aviation and aerospace industries, as well as industrial goods. Other clients originate from the financial services and healthcare, consumer goods retail, and construction sectors.

Strategic Vision. Smart Implementation.

As a leading consultancy for putting strategies into practice, we have a clear mission: we generate competitive advantage on the basis of measurable results. We think strategically and act pragmatically. We always focus on people—out of principle. This is because success comes from working together with our clients and their employees. We can only reach our aim if we trigger enthusiasm for necessary changes in everyone involved.

Authors

Joachim Kirsch
Senior Partner

Claus Lintz
Partner

Fabian Schmidt
Manager

Robert Heiler
Consultant

Daniel Heinzler
Consultant

Contact

Joachim Kirsch
Senior Partner
+49 711 911 - 12861
joachim.kirsch@porsche.de

Porsche Consulting

Stuttgart | Hamburg | Munich | Berlin | Milan | São Paulo | Atlanta | Belmont | Shanghai
www.porsche-consulting.com