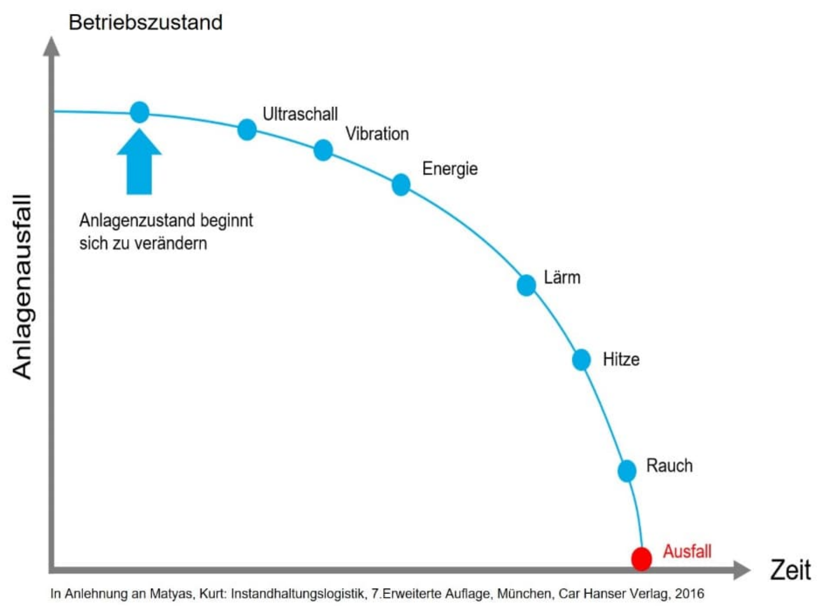
FUTURE OF MAINTENANCE

Smart sensors for predictive maintenance

Predictive maintenance is on the rise. Using IoT (Internet of Things)-supported and smart sensor technology, it helps to prevent plant failures and thus increase operational reliability.
IoT is one of the main drivers of Industry 4.0 and describes the growing digitization and networking of devices and systems. In order to digitize maintenance, reliable data is needed that is collected via smart sensors. The evaluation and analysis of this data provides important information in context, making it possible to make forecasts about the condition of the equipment. In addition to the industrial environment, the possibilities offered by IoT have already proven themselves in the "Smarthome" and "Connected Building" segments.

Three challenges in the building

Modern buildings are usually technically complex. Various technical systems and equipment operate in parallel and are interdependent in their functions. The control units are often manufacturer-specific, so that "interoperability" - i.e., data exchange between the systems - is one of the major challenges. For cross-trade and meaningful data analysis, large amounts of condition data are generated that need to be tracked continuously. Processing these large volumes of data is the second major challenge. In order to be able to derive a forecast of the condition of a technical plant and, based on this, the need for maintenance - in the sense of "predictive maintenance" - the essential data on plant conditions and malfunctions must be analyzed. The development and introduction of such data analysis and forecasting tools is the third major challenge.



Indicators of impending equipment failure. Image: Canzler

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Smart, IT-based sensors that can be installed to complement a building control system can provide additional relevant data such as current room usage data and room temperatures or elevated temperatures in electrical cabinets, unusual vibrations from chillers, etc. A major advantage is that these sensors can be easily retrofitted and that they then provide digital data wirelessly to central control units via WLAN. Smart sensors are also found in modern technical devices such as coffee machines or cleaning robots. The data they send can be processed directly in data analysis tools. Via direct data exchange, even the various technical systems and devices can communicate with each other and control themselves. Smart sensor technology thus paves the way for "predictive maintenance" and "automation".

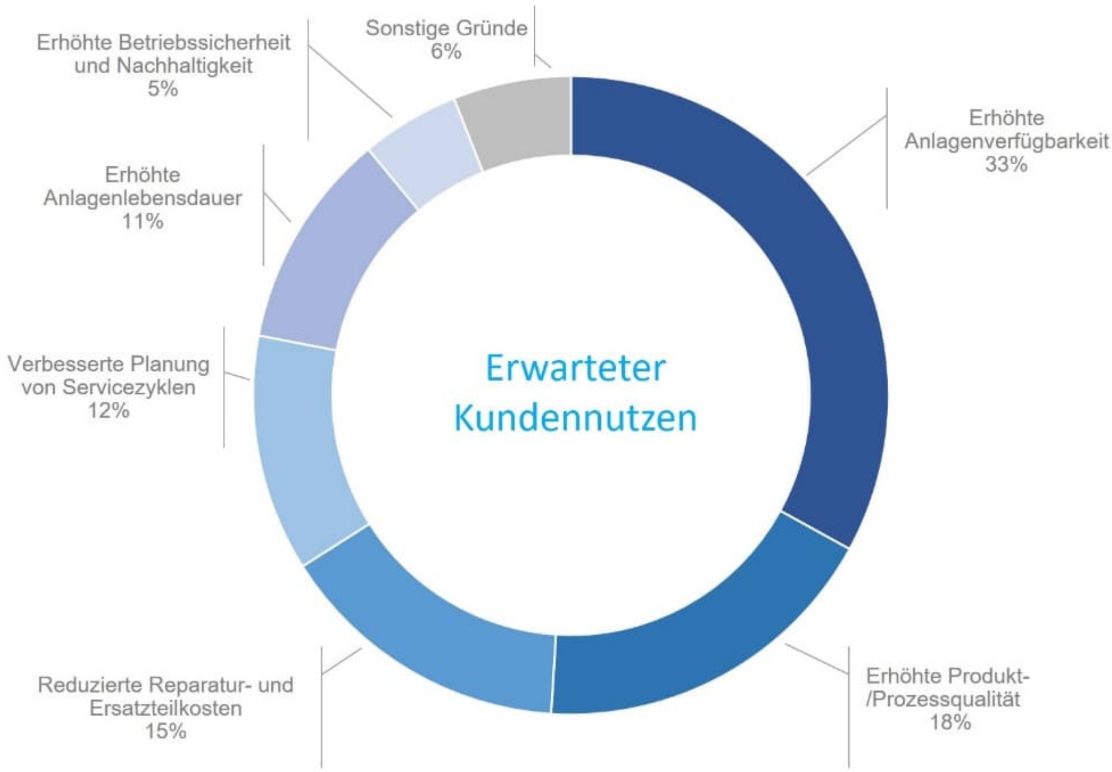
Acting instead of reacting in building operations

Targeted sensor technology and data analytics make facility management smart. But which goals and which applications are technically possible?

- Smart maintenance: Intelligent digital plant monitoring using smart sensor technology and data analysis serves to increase plant availability, minimize the risk of downtime due to malfunctions, and reduce maintenance costs.
- Digitized building cleaning is still in its infancy: Basically, this aims to optimize cleaning processes. The dynamization of these processes involves providing services specifically when they are required, thus ensuring rapid responsiveness, e.g., via direct communication with the cleaning staff. Robots are used flexibly and independently of personnel when cleaning large areas such as airports, trade shows or infrastructure buildings. Similarly, climbing drones can make cleaning large window facades and facades easier and more efficient.
- Building security: Thanks to smart sensor technology, comprehensive access monitoring is ensured from the outside. In practice, digital locking systems are increasingly replacing manual systems. Intelligent people guidance systems regulate access as well as the control of elevators and take over the location of people.
- Optimized room utilization can be realized by means of smart sensor technology that determines data on current occupancy and frequency of use. Furthermore, room conditions can be adapted to the number of people. For example, by monitoring temperature and air quality. In addition, it is possible to control the room parameters using IT via a display or smartphone.
- Smart building is what makes location-independent operation of technical building equipment possible in the first place: For example, the responsible facility manager can set certain parameters from the office, another location or from the home office via his laptop. In terms of optimized operation, the system registers which usage is taking place where in order to control the technology accordingly. The analytics running in the background provide forecasts for predictive control and for automated processes in the building.

Early detection by means of monitoring and data analysis

Currently, measures are initiated by plant reactions and planned via a maintenance plan in e.g. annual cycles. Only when there is a malfunction or defect is action taken: so-called reactive maintenance. But action is required if high plant availability is to be guaranteed. At best, critical events and operating states can be identified in advance, and the faults classified and evaluated. Only then is it possible to act with foresight: If a malfunction occurs, the ability to react is accelerated if the required spare parts can be procured in good time and made available quickly. The IoT plays a major role here. Smart, networked technical systems and devices offer a wide range of data that can make a major contribution to intelligent and predictive operation. These include, for example, fill level sensors on coffee machines and soap dispensers or sensors on machines, motors and pumps that record measured values such as temperature, acceleration and vibration. The more data that flows in from different devices and plants, the more insights and correlations can be generated from the data.



The expected customer benefit from predictive maintenance according to a survey by Roland Berger in cooperation with VDMA (2017). Image: Canzler

Goal: Complete networking

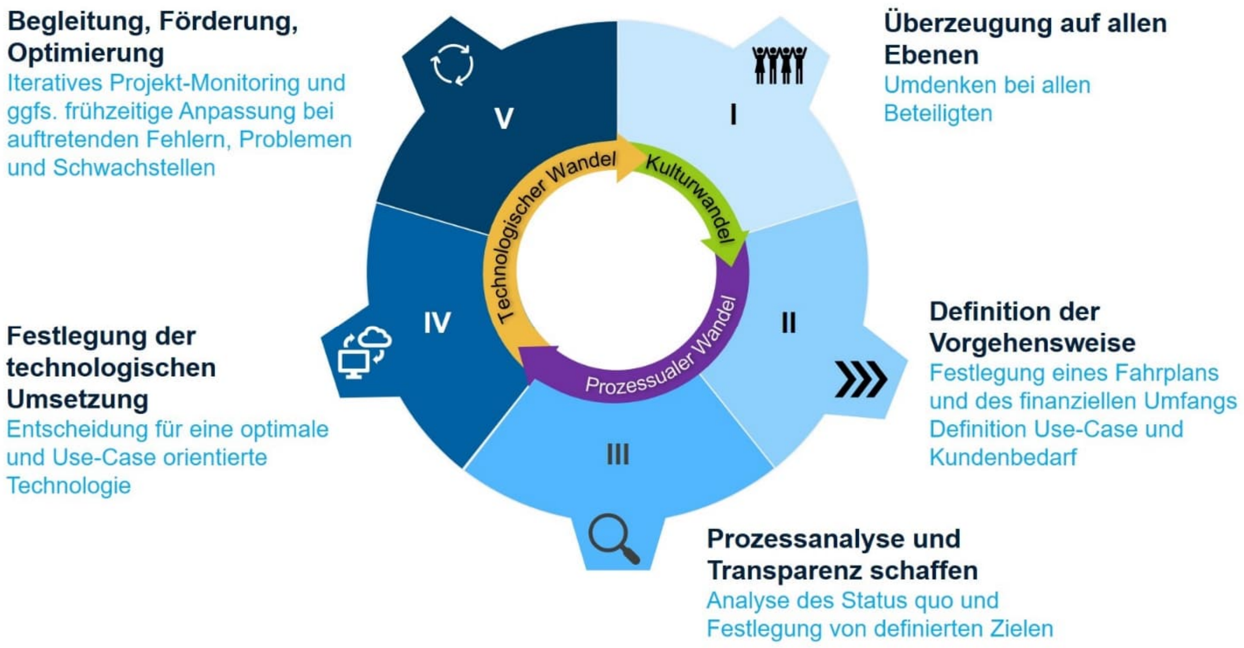
This type of data generation and processing is incredibly valuable for the future. Monitoring the operating status reveals possible changes in the condition of the plant at an early stage. In addition to the operating status, monitoring provides information about the degree of wear and tear on the plant. Increased energy consumption, heat, noise or even smoke development prior to plant failure can be indicators of this. This can be compared to an older car, where the engine starts to sputter before it fails completely. Elevator manufacturers are already pursuing a similar concept today. They have developed a kind of "predictive maintenance" for elevator systems, some of which uses smart sensor technology to enable a form of remote maintenance. These can already be found as isolated solutions in what is usually a highly complex technical construct of a property.

The goal of digitization must be to network the entire technology in a building. This could be realized by means of digital tools and sensors. The central storage of different building data and the provision via a data platform make it possible to generate holistic, cross-facility and property-wide evaluations and to create transparency by means of intelligence. Thus, patterns can be identified on the basis of the permanent data collection and the data analysis running in the background, from which a probability of occurrence and a forecast for the failure risk of facilities can be calculated. This enables technicians and facility managers to plan maintenance in line with demand. Thanks to early detection, faults and damage can be remedied before they occur, thus optimizing availability. In addition to simplified, location-independent control, a key advantage is the networking of the devices. They inform each other about their location, their operating status and what they are doing or not doing. This enables other devices to react to them. In a further thought, communication in the sense of data exchange between the devices or technical systems is made possible. The continuous flow of information can realize the self-control of devices and machines, within predefined limits, for standardized activities or sequences of activities (processes).

Change processes and personnel development

The future belongs to digital maintenance. In the future, the networking of data, systems and comprehensive but targeted data analysis will be an essential building block in facility management for the operation and maintenance of real estate and the technical systems and facilities in order to ensure operational safety and system availability, but also to increase individual user comfort. Facility management will have to transform itself in order to meet future customer requirements and to be able to implement IoT projects in the operator environment.

In addition to the change in IT technical equipment in facility management, a change process is inevitable at the employee level. The operator personnel must be further trained and future-oriented in order to be able to meet the increasing and changing requirements in the job profile of facility management. Facility managers become data managers.
For digitization projects to be successful, people must be convinced and involved. Understanding and acceptance must be promoted among all stakeholders, from management and executives to employees. A precise analysis of the actual requirements and needs with the involvement of the know-how bearers and decision-makers, the development of a concrete implementation plan "step-by-step" and the accompanying transparent evaluation form the basis.



Every digitization project is also the starting signal for a change process. Image: Canzler

Three steps to a digitization strategy

Step 1 - Preparation:

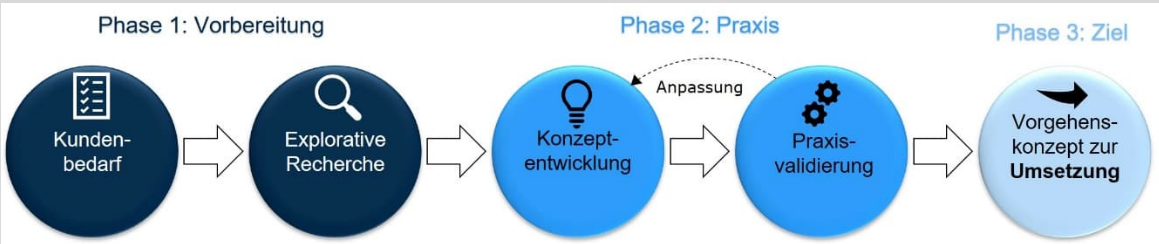
- -First, a needs analysis is carried out in which owners, users and operators determine their actual requirements. When companies or institutions are at the beginning, the rule is "as much as necessary, as little as possible" in order to achieve quick success. Here, external consulting companies can be very helpful with their "view from the outside" and their know-how, and can accompany the analysis process in a moderating manner. To this end, specific use cases must be developed for the customer that relate to the core business.
- In addition to determining requirements, the basic analysis also includes recording the existing IT infrastructure and the restrictions, e.g., in the question of the use of cloud platforms. This is elementary, since there are usually various trade- and plant-specific control systems. These often represent isolated solutions, as they cannot be networked with each other. In the future, large amounts of data from different systems, in some cases in different data formats, should be centralized and processed. This forms the basis for effective data analysis and efficient building and system control. To this end, discussions are being held with potential partners and suppliers, supplemented by market analyses and best-practice examples.
- The digitization of processes requires a change in thinking on the part of everyone involved. On the one hand, this requires the full support of the executive board and the management team, and on the other, the participation of employees as knowledge carriers. However, this should serve in particular to promote acceptance and motivation. Clear goals and transparent planning with manageable individual steps form the basis for this.

Step 2 - Concept and pilot project:

The information collected is used to develop a concept from which a digital roadmap emerges. This includes all the necessary steps and components, such as sensor deployment, communication paths, data storage and interfaces, and corresponding data analysis tools. This is followed by the practical validation, in which the pilot project is set up and tested as part of a test phase. The focus here is on the reliability of the system and whether changes can be communicated in real time. Only then are the possibilities for project implementation and the resulting added value identified..

Step 3 - Procedure concept for implementation:

On the basis of a user-centric approach with clearly defined use cases, a tailored solution and thus also demand-oriented planning can be made possible. This is a dynamic process that is constantly reviewed, evaluated and optimized with the help of an iterative approach..



Definition Use Case. Image: Canzler

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