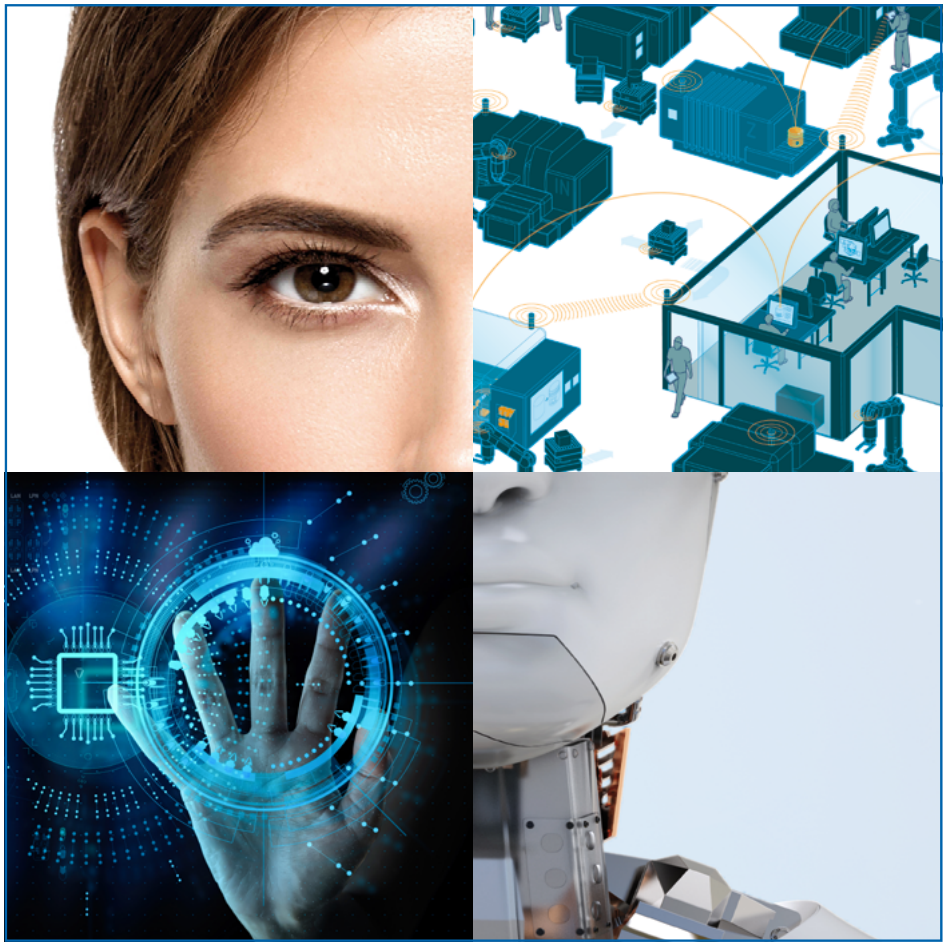
ZVEI:
Die Elektroindustrie

Digital Industry Services



German Electrical and Electronic Manufacturers' Association

Digitale Industry Services

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1 Introduction

Throughout the entire life cycle of machines and plants there is a great need for industrial services, which are increasingly being influenced, changed and extended as a result of digital transformation. Building on the Industry Services Guidelines, this brochure, published by the Service Marketing working group of the Automation Division at ZVEI, provides an overview of the development of digital industry services and includes significant application examples from industrial practice.

Digitalisation is penetrating all areas

Starting with the further accelerating technological developments in the area of information technology in recent years, the digital transformation has now reached all areas of society. This particularly concerns industrial companies, which are progressively implementing individual digital solutions in all enterprise areas in the face of increasing competition and cost pressure.

Integrated app-based communications interfaces are increasingly shaping the interaction between humans and machines. The application gives rise to a change in the life cycles of plant components, where an increasing proportion of software requires regular updates to optimise performance and assure serviceability. Products and services are increasingly merging. The application covers everything from function and service through to solutions with services as an integral component of the function.

Digitalisation in the industrial environment

In the industrial environment, the digital transformation is giving rise to the digitalisation of traditional industry services such as condition monitoring and remote support. In addition, new digital services are emerging and developing that are counted among the core elements of Industrie 4.0.[1] For example, virtual and augmented reality solutions allow virtual training and commissioning with digital twins. Further application fields include predictive maintenance and energy analytics. Digital industry services therefore also make it possible to develop new business models to market services in the context of event-oriented order placement and contractual agreements.

The key to future business success is to be found in internet-based communication in industry, on the basis of IIoT (Industrial Internet of Things) networks and cloud-based solutions that guarantee secure, real-time-capable applications. Automated, service-based communication between system components, and between processes and providers over the Internet is increasing enormously. This is resulting in a lasting change in the working world of those employed there. Human involvement is increasingly of a monitoring and controlling nature, thus making staff qualifications more and more important for operation and service.

Digital services in the life cycle

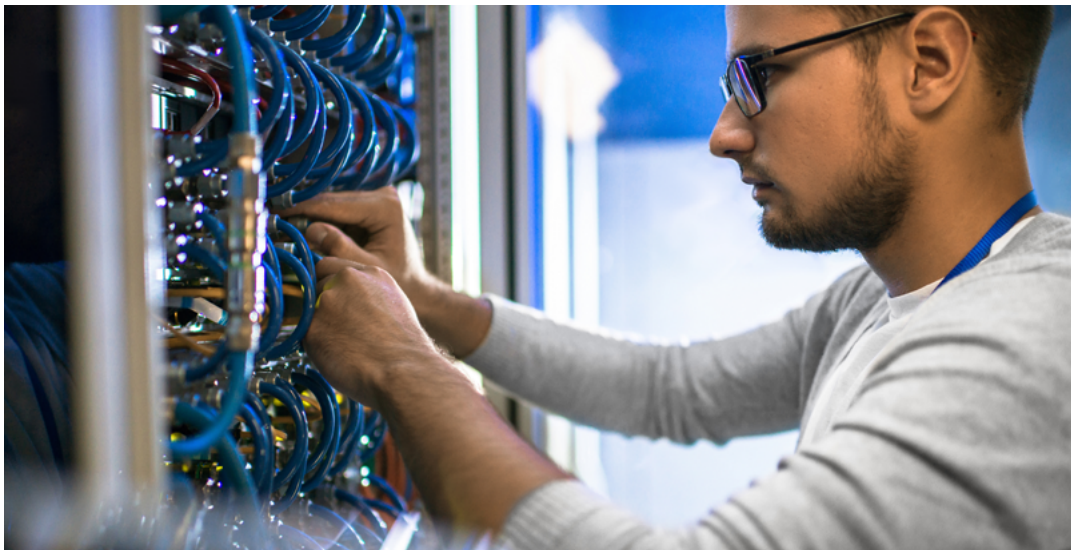
Mechanical and plant engineers, systems integrators, distributors, and the users and operators in various industries rely on high-quality industry services that provide efficient, application-specific support for the use of and interaction between products and systems. They demand reliable solutions that are supported by the manufacturer throughout the life cycle of the machines and plants.

In the Automation Division at ZVEI, the members of the Service Marketing working group have set themselves the task of presenting the digital transformation in industrial services for customers. They provide a concise description of the range of digital industry services. Selected examples explain concrete solutions, together with their benefits and added value for users.

[1] "Industrie 4.0" (Industry 4.0 (I40)) is a national strategic initiative from the German government through the Ministry of Education and Research (BMBF) and the Ministry for Economic Affairs and Energy (BMWI). It aims to drive digital manufacturing forward by increasing digitisation and the interconnection of products, value chains and business models.

It also aims to support research, the networking of industry partners and standardisation.

2 Infrastructure services



Source: Seventyfour – adobe.stock.com

2.1 Network services

Description

Reliable, powerful and secure industrial networks based on field bus, Industrial Ethernet and wireless technologies are a prerequisite for the productive operation of machines and plants. In the context of the increasing digitalisation of assets, processes and services, network infrastructure needs to meet new requirements. Communication in the Internet of Things is characterised not only by rapidly growing data volumes and increasing requirements with regard to performance and speed, but also by increasing network complexity.

The implementation of an Industrie 4.0-compliant network requires both future-proof network components and professional services, regardless of whether it is for a new or existing industrial network. It is vital here to take a holistic approach that takes both industry-specific requirements and local circumstances into account. Depending on the extent of the network infrastructure required, such a procedure may be divided into the following network services.

- Assessment
  - Documentation of all requirements (customer-specific, processes, technology)
  - On-site inspections or site overviews, stocktaking
  - Performance measurements and weakness analysis for existing networks
- Design and planning
  - Network topology, technologies, quantity structures and spatial expansion
  - Performance, security, maintenance, availability and administration
- Implementation and commissioning
  - Configuration and parametrisation
  - Creation of a digital twin/simulation of performance or network faults
  - Commissioning services for speedy commissioning and smooth operation
- Optimisation and operator training seminars
  - Network analysis, diagnosis and optimisations
  - Training plant staff to ensure operation and maintenance

Application cases

- Creating an Industrie 4.0-compliant industrial network
- Upgrading existing networks in the context of the digital transformation of assets
- Network expansion and modernisation
- Network validation with optimisation recommendations

Customer benefits

- Sound network expertise straight from the manufacturer
- Speedy project processing by experienced network specialists
- Assured availability of networked machines and plants
- Operation of a flexible and future-proof industrial network

Source: kiri – adobe.stock.com

2.2 Virtualisation

Description

The introduction of information technology to the industrial environment has made innovative concepts such as system virtualisation available in this area too.

As a result, the systems used can be serviced, maintained and modernised much more efficiently, thus opening up substantial potential for optimisation.

Virtualisation separates a computer's operating system and user software from its hardware and makes them available in the form of virtual machines (VMs). An additional "hypervisor" software layer makes it possible to execute several VMs and takes care of the dynamic distribution of hardware resources to the VMs.

Appropriate virtualisation services make it easier to get started with this future-oriented technology. The lifecycle service for all system components that is necessary for such a virtualisation solution is usually provided from a single source in a coordinated and user-oriented manner.

Application cases

- Lasting simplification of plant expansions
- Future-proof modernisations with digital/virtual infrastructures
- Central plant administration and maintenance
- Consolidation of existing computer systems

Customer benefits

- Greater system flexibility and availability
- Lower effort for system upgrades/updates
- Fast and cost-effective expansion of system components using ready to-run templates
- Optimum use of available hardware resources
- Reduced costs during the system life cycle thanks to improved energy efficiency

3 Technology services

Source: dusanpetkovic1 – adobe.stock.com

3.1 Cloud computing – software as a service

Description

Software as a service (SaaS) is a sub-area of cloud computing, as are infrastructure as a service (IaaS) and platform as a service (PaaS). The SaaS model is based on the principle that the software is operated by an external IT service provider and can be used by the customer as a service. To use the software services, users simply require a web-enabled computer and an Internet connection to the external IT service provider.

The IT service provider makes the IT infrastructure (hardware and corresponding software application) as well as the platform on which the software is provided available as a necessary resource. This includes, for example, computing power, memory space and networks.

Software as a service therefore provides a ready-for-operation cloud-based software platform with pre-installed applications. Substantial cost savings can be achieved by setting up and configuring a standardised development environment, as is typically used in a SaaS solution.

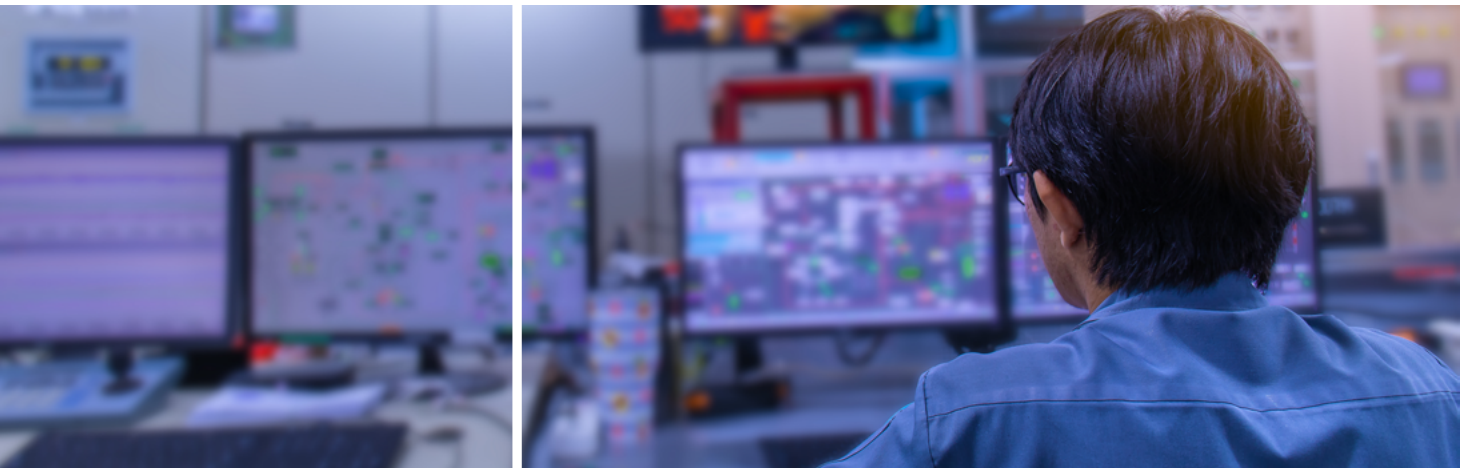
SaaS makes it possible to use software in the cloud for a limited period of time with flexible content. This gives rise to requirement-oriented pricing models that limit investment costs to actual usage.

Application cases

- Engineering and test environment – quick and easy use of a ready-for-operation engineering environment
- Software migration and upgrades – software that is available centrally, with no installation effort
- Operator training systems – individual software allows the simulation of entire process technology models in the cloud
- Flexible use of ERP systems that are linked to other applications such as asset management systems

Customer benefits

- Low investment risk
- Transparent IT costs
- Speedy implementation
- Reduction in IT process complexity
- Mobility



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3.2 Remote services – collaboration

Description

Remote services are the method of choice in a plant's operating phase when there is a need for fast support from experts without time-consuming travel. The primary goal here is to use remote access to check the defined functions of a device in a machine or plant and restore them where necessary.

However, remote collaboration services can be used for a wide range of services. Alongside purely reactive support, this technology is enjoying increasing acceptance in the area of engineering and commissioning.

Collaboration with the engineer on site allows the transmission of documents and also parametrisation by the remote expert. The changes made can be verified in a straightforward manner and digitally documented.

How does remote service work?

The continually increasing networking with new technologies allows secure, user-friendly remote access to computers, servers and machines. Today, modern gateways interconnect different networks, machines and people over the Internet.

As a result, it is possible for specialists in separate locations to commission and service a plant in collaboration with employees on site.

A wide range of connection methods using the Internet are available for restoring the connection. What is important here is that the methods are future-proof and ensure IT security. The corresponding services for targeted implementation are described in corresponding sections: "Infrastructure" and Security".

Application cases

- In the event of malfunctions, service engineers can provide customers with remote support in rectifying the errors without having to be there on site themselves.
- Experts in the back office can provide assistance with commissioning and setting up the device. The steps necessary for this can be performed directly by a service engineer from afar or in collaboration with an employee on site.
- Remote maintenance provides support during maintenance and inspection work. In the process, the necessary settings on the machine can be directly verified with the staff on site. Any spare parts that are required can be identified beforehand and delivered in advance.

Customer benefits

- Experts can provide fast and precise support for malfunctions by means of remote access as if they were working on site.
- Complex maintenance scenarios can be resolved more quickly thanks to collaboration with specialists.
- Repair work and troubleshooting in plants are performed in an efficient, cost-effective and environmentally friendly manner as a remote service.
- Modern, web-based connection technologies support reliable, user-friendly and efficient documentation of the manner, time and duration of the tasks performed.

Source: zapp2photo – stock.adobe.com

3.3 Remote services – augmented reality

Description

Augmented reality entails extending the real world by adding virtual content. This new technology is widely known from the games industry. For use in the industrial environment, in particular in the area of maintenance, however, practicable equipment and software are necessary.

Companies such as Telekom, Apple, Google and Facebook are already developing augmented reality applications – also for their own service teams. However, industry service providers also want to draw on the advantages of augmented reality.

An innovative remote service using augmented reality is characterised by increased efficiency during commissioning, maintenance, repair and troubleshooting. To begin with, signposts guide engineers to a certain device in a plant. This saves time in searching for the correct component. Next, further instructions are progressively displayed – via text, video image or live chat – to ensure correct execution. Images and information can be recorded and assigned to the respective component in conjunction with the CMMS plant documentation.

For implementation, the image of reality is recorded by cameras and extended in the next step by adding digital content. Whereas this content is still integrated into the screen in the case of industrial tablets, the use of data glasses leaves the employee's hands free for their work. Texts and transparent images are shown in the service engineer's field of vision, or the instructions are provided as audio messages from the experts in the back office.

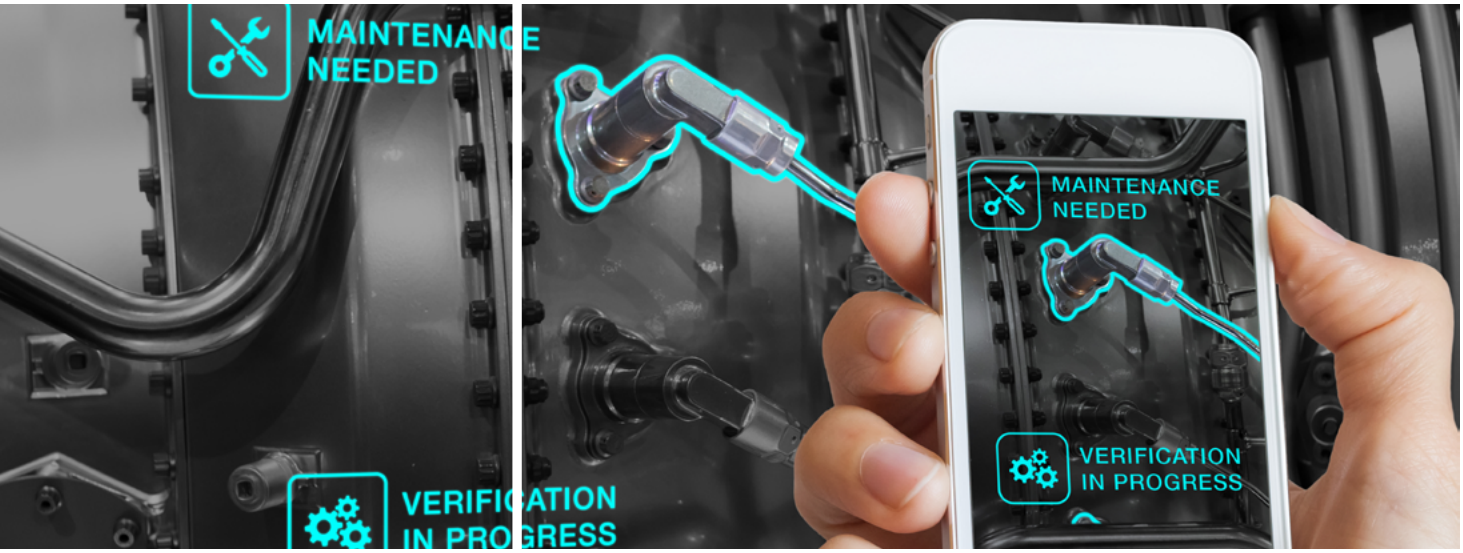
Application cases

- Commissioning: instructions for devices from assembly and cabling through to defining settings. The instructions explaining what needs to be done are provided step by step by means of virtual content, which may for example be placed over reality in data glasses.
- Inspections and maintenance: instructions for inspection and maintenance can be defined device-specifically. A video transmitted to a support engineer makes it possible to provide live instructions for troubleshooting, inspection or maintenance.
- It is possible to navigate in production plants and locate measuring points using defined site maps.
- In the event of malfunctions, service engineers can provide customers with targeted remote support in rectifying the errors without having to be there on site themselves. The efficient use of augmented reality technology saves time, reduces costs and also facilitates communication between the customer and engineer.

Customer benefits

- Faster installation, commissioning and maintenance
- Fast location of components during maintenance and troubleshooting – even by new or untrained employees
- Straightforward digital documentation of measures during commissioning and maintenance

4 Advanced analytics



Source: NicoElNino – stock.adobe.com

4.1 Predictive services

Description

Predictive service strategies for technical systems aim to constantly monitor states in order to avoid failures. Furthermore, they aim to ensure uninterrupted availability through the implementation of planned maintenance measures while maximising process and product quality.

On the basis of real-time plant, machine and process data, targeted measures are determined to proactively maintain and repair machines and plants before any significant losses in quality, malfunctions or damage actually occur.

In the process, the state of the components in operation is determined and the future state progression is forecast. Parameters, models and corresponding specifications regarding use are a prerequisite here. The time and scope for optimum maintenance measures can be derived from this.

The use of predictive services is particularly attractive in areas that require a high system availability, as machine standstills there may be extremely costly. Possible failure times and costs are thus significantly reduced, if not completely avoided.

Application cases

- General predictive maintenance of machines and plants
- Optimisation of machines with regard to operation, consumption and wear
- Visualisation of a wide range of operating data
- Management and remote maintenance of machines

Customer benefits

- Higher availability
- Lower operating costs
- Higher productivity
- Easier operation and monitoring
- Central data as the basis for different analyses and actions during operation and maintenance

Source: NicoElNino – stock.adobe.com

4.2 Energy Analytics

Description

The analysis of machine and plant energy consumption enables operators to pinpoint great energy-saving potential and thus increase the efficiency of their plant. By detecting and avoiding peak loads, substantial savings can be achieved in network usage charges. However, load management is also necessary for this. Furthermore, it is possible to detect faults at an early stage by means of performance comparisons with other machines or plant parts.

Energy analytics require a database or cloud solution that saves the consumption data collected for the connected assets over an extended period of time and makes the data available for the analysis. The greater the degree of granularity in the consumption data available, the more effectively an analysis can be performed.

In the wake of ISO 50001 certification, a suitable system is required to record energy consumption. Consumption data is therefore often already available and must be prepared for the analysis. This analysis may be performed automatically using algorithms that are tailored to the process, or manually by comparing the consumption data.

Often, contract models are offered where the analysis service is remunerated via the energy saving, typically in the form of a percentage of the actual saving.
A typical service package for energy analytics may contain the following components:

- Recording of consumption data and secure transmission for the purpose of storing the data, preparing the data and performing the analysis
- Generation of automated reports, for example using a dashboard in a web portal
- Experts for energy analysis assess the reports and give recommendations on reducing energy consumption

Application cases

- Transmitting measurements to consumers via traditionally networked meters
- Providing the consumption values of intelligent assets (e.g. frequency converters and multi-function measuring devices)
- Setting up a prescribed system to monitor energy consumption

Customer benefits

- Reduction in energy costs thanks to optimisation
- Transparency with regard to energy consumption
- Early fault detection thanks to increased recording of performance
- Professional energy management service with minimum resource requirement
- Saving in terms of network usage charges in connection with load management
- Tax saving in connection with optimisations in the context of ISO 50001

Source: pichitstocker – stock.adobe.com

4.3 OEE (overall equipment effectiveness) analytics

Description

Achieving a continuous improvement in terms of the productivity, quality and efficiency of production and manufacturing processes is the primary goal of integrated, end-to-end plant management. One central measure of the efficiency of the plant as a whole is the OEE (overall equipment effectiveness), which is made up of a wide range of factors. As a holistic approach, the OEE makes the plant condition transparent and pinpoints potential for improvement.

In order to achieve sustainable OEE, it is important that all relevant data from production, manufacturing and logistics is available, and also that process-specific expertise is mapped. This data (big data) can be obtained from databases, MES systems, control units or sensors. Setting up the additional infrastructure that is needed and setting up a connection to a cloud solution or a local data centre is an essential component of an OEE service.

Any software-supported compression and evaluation of the collected data is based on a defined data model. Visualisation using an OEE dashboard allows the results to be compared directly with the plant's key performance indicators.

The core aspect of the OEE service entails the expert analysis of changes or trends and the comparison with similar constellations for complex machines and plants. Recommended action for the sustainable optimisation of the OEE can be derived from this.

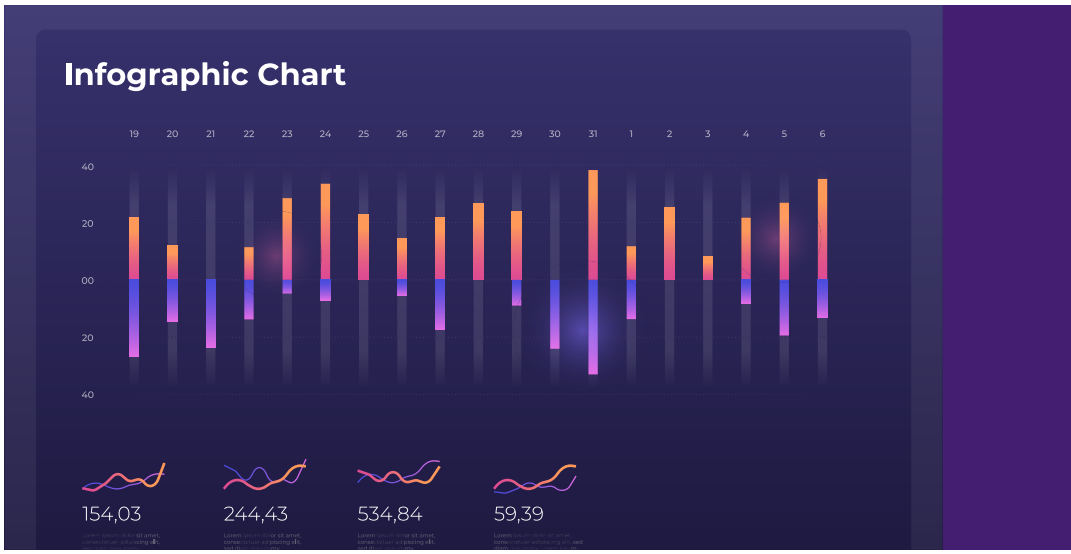
Application cases

- Avoidance of standstills, malfunctions or rejects in operation
- Increased output, for example in terms of quality or quantity
- Data-based optimisation of planning for manufacturing and production

Customer benefits

- Transparency with regard to the productivity, availability and performance of machines and plants
- Identification of potential for improvements
- Data-based suggestions for implementing the optimisation measures

5 Maintenance services



Source: dimakostrov – stock.adobe.com

5.1 Condition-based maintenance

Description

Condition-based maintenance is a condition-dependent maintenance concept. It is based on the continuous recording and monitoring of the relevant parameters of machines and plants, intelligent algorithms and the resulting corrective measures.

With a view to the large data quantities, innovative digital technologies such as edge computing for data preparation and/or cloud computing as an IT infrastructure for data storage and analysis can also be used here.

Condition-based maintenance requires suitable sensors and analysis software in order to interpret the data recorded in real time and, for example, trigger an alert.

The plant data and process values obtained are assessed by means of comparison with specifications regarding usage, parameters and models. Based on this, predictions can be made regarding the plant condition and/or faults. Measures implemented automatically (closed loop) increase the efficiency of CBM and lead to lower lifecycle costs for machines and plants.

Condition-based maintenance minimises unscheduled stops by detecting changed machine parameters at an early stage and helps to extend the life cycle, as deviations or faults can be detected before they actually occur.

The relevant standards and guidelines, such as ISO standard 13373 on condition monitoring and diagnostics of machines or VDMA guideline 24582 on condition monitoring are applied.

Application cases

- Vibration monitoring for motors and bearings
- Load envelope curve for performance data (filter blocked/leakages)
- Deviations from ambient temperature depending on performance
- Optimisation of machines and plants

Customer benefits

- Avoidance of unscheduled stops
- Higher production quality
- Early fault detection may reduce costs for spare parts or prevent destruction
- Longer service life
- Installed sensors can be used in other ways where appropriate, for instance for process optimisation

Source: Theerapong – stock.adobe.com

5.2 Maintenance management services

Description

There is a broad range of applications for innovative digitalisation technologies in industrial maintenance. A particular focus is, of course, placed on reducing maintenance costs by integrating all processes. Other crucial factors for the successful use of a computerised maintenance management system (CMMS) include the optimisation of maintenance planning, improved transparency and traceability, and proper plant documentation.

CMMS describes the systematic support of maintenance processes using software. CMMS software manages maintenance-relevant information in a central database. The CMMS functions support the work processes of maintenance staff, including the integration of mobile service terminals (see Wikipedia).

The added value provided by maintenance management services lies in the provision of service standards and lifecycle information that are assigned to the corresponding system components.
Ageing products and services pose a substantial challenge, especially for asset management in industrial maintenance. Thanks to the provision and CMMS integration of information regarding the product life cycle, the obsolescence risk can be minimised by regularly assessing the installed base.

Application cases

- Integration of all maintenance processes into a plant-wide data platform
- Use of innovative digitalisation technologies for asset management
- Efficient maintenance to fulfil the respective maintenance strategy
- Mobile integration, for example, of industrial tablet PCs for on-site documentation

Customer benefits

- Lower risk posed by ageing thanks to cyclical obsolescence checks
- Longer service life of system components thanks to improved maintenance processes and service standards
- More effective coordination of part and device availability
- Improved transparency and traceability

Source: ProstoSvet – stock.adobe.com

5.3 Process optimisation

Description

In the area of maintenance for industrial plants, one common driving factor is cutting costs while at the same time ensuring high plant availability. Digitalisation allows straightforward ongoing data recording and evaluation thanks to connectivity and cloud computing.

The results gained from analysing industrial plant processes can be used to determine potential improvements in the maintenance processes. Thanks to the possibilities provided by digital technologies, this optimisation can be performed continually in an easy manner.

The maintenance strategies described in DIN 13306 distinguish between reactive, preventive and predictive maintenance measures. A practical implementation of a maintenance strategy for complex machines and plants may well include mixed forms that are tailored to the different maintenance requirements and accordingly take account of customer wishes or key performance indicators.

The analyses of the data available also allow the selective optimisation of aspects such as obsolescence, spare parts management or calibration methods. In this way, intervals and measures can be determined for each component and thus adjusted in the ideal way.

Application cases

- Maintenance optimisation
- Calibration optimisation
- Spare parts management
- Tool management

Customer benefits

- Maintenance costs are reduced thanks to processes that are adapted to actual requirements and simultaneous measures taken to safeguard and increase plant availability.
- The risk of an unforeseen device failure or component fault is reduced, thus ensuring plant availability.
- Optimised spare part and maintenance tool management reduces costs and time-consuming storage.

6 Consulting- & Training-Services

Source: metamorworks – stock.adobe.com

6.1 Consulting and training services

Description

Increasing digitalisation presents companies with new challenges with regard to their business models in general and the operational implementation of a digitalisation strategy with respect to changed processes and systems used.

It is often not quite clear which options are suitable in a particular industry, plant or process and offer genuine "digital" added value. Things become complex when companies specifically ask themselves what they need to do and how they should do it if they want to be "IIoT ready" (IIoT – Industrial Internet of Things) and become users of IIoT solutions

Digital transformation services address this requirement in the context of consulting, training and the integration, implementation and operation of digital technologies. They provide support in identifying the appropriate IIoT solutions in each case and may also be of use during implementation. If an existing plant is to specifically make use of the possibilities offered by IIoT, digital transformation services can help to first gauge the actual situation (as-is) and determine which optimisations are to be achieved (to-be), then define and implement suitable measures.

Application cases

- Support in digitalisation projects for plant parts, entire plants or certain process steps if no experienced in-house staff are available or external competence is desired
- Support in improvement projects in which IIoT can be used for process optimisations

Customer benefits

- Use of experience across industries and applications to find the optimum solution for the application case
- Adherence to schedule and budget
- Targeted selection of suitable measures, without being overwhelmed by the different possibilities, and thus saving time and money

Source: megaflopp – stock.adobe.com

6.2 Online training services

Description

The digitalisation of training services comprises various aspects. Alongside the learning media that draw on digital techniques, a distinction should also be made between digital formats and platforms and also training on everything to do with Industrie 4.0.

Traditional face-to face training seminars offer digitalisation topics such as digital twins, cloud computing, industrial security and virtual commissioning. The aim is to teach digital learning content to support the digital transformation of companies, in other words application in everyday working practice.

Online training services comprise a wide range of digital media and formats, from videos and blended learning seminars to e-learning seminars (web-based training seminars) with new methods of knowledge transfer. The various learning methods in combination with the possibility for users to learn wherever and whenever suits them allow individual and flexible training seminars.

In the case of digital learning platforms, the focus is on access to exclusive, tested digital training seminars for individual knowledge development. Intuitive user guidance and interactivity combined with digital assistants ensure lasting learning success for this online training offer.

Application cases

- Qualification and certification of employees
- Implementation of in-house training, for example using an operator training system (OTS)
- Targeted acquisition of expertise in the run up to project engineering
- Requirement analysis to determine the current level of knowledge and recommendations regarding individual skill development

Customer benefits

- Online training with certification in accordance with DIN EN ISO 9001 ensures quality standards
- Contemporary practical knowledge straight from the manufacturer
- Higher resource efficiency in planning, engineering and maintenance
- Individualisation and adaptation of online training seminars in line with competences and predefined learning goals

7 Security services

Source: ipopba – adobe.stock.com

7.1 IT security services – assess, implement, manage

Description

IT security is a basic prerequisite for using networked machines and plants. Especially when planning new, digitalised manufacturing or connecting existing plants to the "Internet of Things", it is important to draw up security models covering everything from analysis and planning to implementation and monitoring to safeguard the entire value chain against all risks resulting from networking. This safeguarding starts with people and covers a wide range of measures including the protection of individual networked machines against malware and measures to secure entire infrastructure areas against potential cyber attacks from both within and outside a company.

Application cases

The growing degree of digitalisation is leading to the increasing replacement of analogue bus systems by digital communications interfaces based on Internet technologies. As a result of production and IT being networked and merged to a greater degree, new risks are emerging here, such as possible data loss, misinformation, espionage and the sabotage of industrial systems. To ensure the availability of their own machines and plants, companies require reliable strategies to protect data traffic against the aforementioned risks. It is an advantage here to apply tried-and-tested approaches, drawing on expert knowledge from practice, to ensure real protection for production plants. In this way, appropriate sets of measures for the application case can be defined from analysis and planning through to implementation with simulated attacks, training seminars and continuous monitoring.

Customer benefits

- IT security concepts form the basis for the digital transformation of existing and new business models
- Security measures and organisational defence measures corresponding to the application case provide secure ground in digitalisation.
- Secure IIOT systems can be developed by selecting suitable sets of defence measures, detection measures and measures to react to possible weaknesses
- IT specialists from the production industry can draw on their wealth of experience to provide support in creating and evaluating necessary security concepts.

8 Summary and outlook

Clustering and examples of digital industry services

Progressive digitalisation is adding new offers to the available range of industrial services. Traditional services are increasingly being transformed by digital technologies. However, the differing content and terms used for innovative digital industry services are making it difficult for users to keep track of everything and clearly recognise the added value provided by offers.
The Service Marketing working group of the Automation Division at ZVEI has developed a cluster of digital industry services, in which it has defined several typical examples, application cases and customer benefits for each service.

- Infrastructure services
- Technology services
- Advanced analytics
- Maintenance services
- Consulting and training services
- Security services

The description of the services has been kept as generally valid as possible, which means that it does not contain any specifications for particular products or systems in automation and drive technology. This brochure does not provide a comprehensive description of the digital service portfolio. Rather, it provides guidance for companies based on selected digital service elements and their position in the overall portfolio of industrial services.

Digital drivers – technologies – trends

A few years ago, a strong trend towards digitalisation in industry was to be seen. A large part of the new digital technologies has now been specifically implemented in innovative products and services or has been incorporated into processes.

However, the possibilities for the digital enterprises have by no means been exhausted.

- The process of setting up networks to interconnect people, objects and intelligent assets is in full swing. Future-oriented technologies such as Industrial 5G are giving further impetus to this development.
- Algorithms for analysing huge quantities of data are becoming increasingly powerful and efficient for the continuous real-time monitoring and optimisation of machines and plants.
- Innovative methods in the area of “predictive analysis” allow improved predictions with a great accuracy and scope.
- Artificial intelligence (AI) independently learns (acts/responds) during technical processes (deep learning).
- Powerful AI allows actions – even cognitive activities – in real time.

For the industrial environment of factory automation and process automation, this also gives rise to great potential for optimising complex value chains in the future too. Digital industry services in particular make a key contribution here to helping companies stay competitive.

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