SIEMENS

Siemens Advanta

MAINTENANCE 4.0

Leveraging digital technologies
for new business opportunities

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1 EXECUTIVE SUMMARY

Benefits at a glance: Maintenance 4.0 enables companies to maximize the useful life of their production equipment, avoid unplanned and minimize planned downtimes, increase process and people safety, reduce energy and resources consumption and save costs.

Client expectations and demands for asset availability and reliability are constantly increasing. Companies struggle to keep up with those expectations and meet them at a reasonable cost.

The evolution of key technologies and computing power in recent years has unleashed new opportunities like condition monitoring, failure prediction, remote diagnosis and repair. These technologies significantly enhance the capabilities of maintenance service providers while realizing new efficiency gains.

This paper aims to give an overview on:

- Key fields of innovation for Maintenance 4.0
- Main benefits of applying Maintenance 4.0
- Client stories and best practices
- Key recommendations for successful digital transformation in this area

In most industries the cost of maintenance accounts for around 10 to 25 percent of total operating expenses. Especially capital-intensive industries like power and construction face the challenge of keeping these expenses under control.

A study by IndustryWeek in collaboration with Emerson found that unplanned downtimes cost industrial manufacturers an estimated 50 billion USD annually.[1]

To cope with these challenges, some companies have started on their digital transformation journey. According to the International Data Corporation (IDC) worldwide spending on new technologies and services is estimated to reach 2.3 trillion USD in 2023.[2]

Maintenance service providers are heavily investing in digitally transforming their operations. This gives them the opportunity to differentiate themselves from competitors and thereby realize untapped revenue and cost potential.

Source: [1] International Data Cooperation, IDC Press Release, 28 Oct 2019. Accessed 23 Oct 2019;
[2] IndustryWeek and Emerson, WSJ Custom Studios. Accessed 29 Oct 2020.

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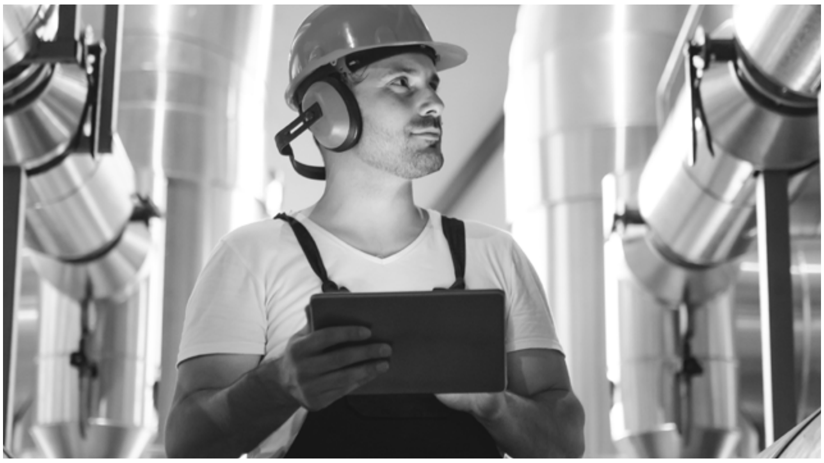
2 MAINTENANCE 4.0 – THE DRIVING FORCES



Trending: The demand for highly available, reliable and high performing production facilities drives the path toward digital transformation.

Maintenance is all about the maintaining and upkeep of an asset to ensure continuous and safe machine operation for as long as possible. Maintenance 4.0 still strives for the same goal by now making use of the power of digital technologies to drive asset reliability and efficiency. However, there is more to the story. We see three major trends that will put new demands on maintenance service providers in the near future:

An increasingly competitive environment

While industrial services are more and more difficult to differentiate on a product level since they are often treated as commodities, they are becoming increasingly attractive for stable revenue streams and high profit margins. Competitors including OEMs as well as new market players from rising countries such as China have seen the potential in the industrial maintenance market and tried to grow their market share in recent years.

Need for high asset availability, reliability and throughput

Asset owners and operators ask for highly professional maintenance to ensure reliable operations, preserve the asset value and safeguard competitiveness. Estimates show that unplanned downtime can cost a company as much as 260,000 USD an hour and result in a loss of customer trust and productivity.[3]

New subscription-based service business models

Subscription-based services, where customers no longer buy the product and maintenance contract separately, but rather just buy the operation of the machine (pay per use) – are on the rise. This shifts the risk of operation and thereby the responsibility of maintenance activities completely to the supplier. What Rolls Royce once started with "power-by-the-hour" for its turbines, offering customers an hourly rate for each hour of engine usage and taking the responsibility for covering the installations, check-ups, maintenance and decommissioning of the engine, has now also been adopted by other industries. Ultimately, the great benefit for the customer lies in not having to worry about any maintenance activities for their machines. The supplier on the other hand profits from securing regular subscription payments.

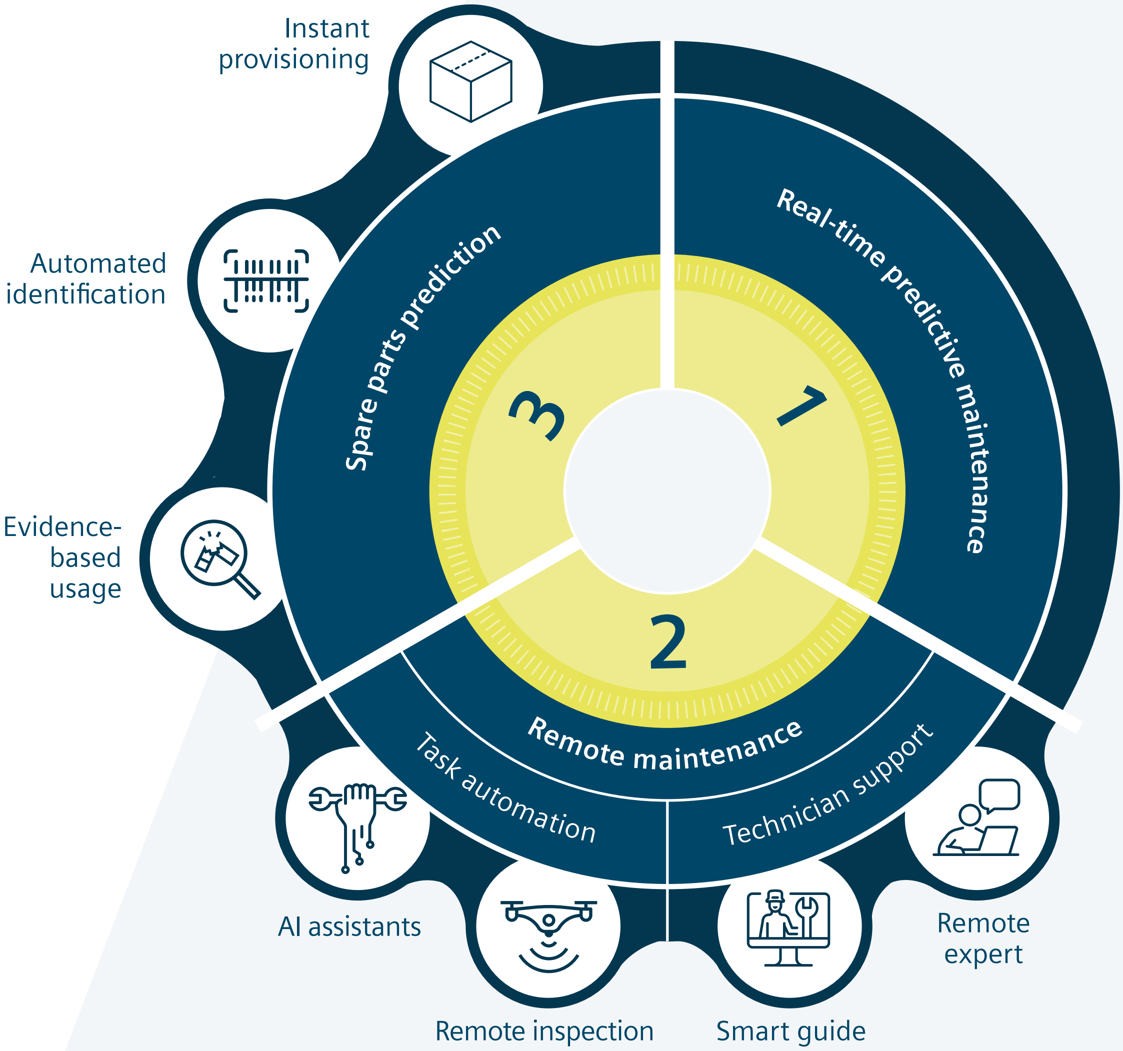
Source: [3] IIOT World, Graham Immerman, 14 Nov 2018. Accessed 29 Oct 2020.

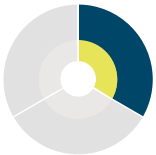
3 KEY FIELDS OF INNOVATION

As previously mentioned, Maintenance 4.0 is all about making use of new technologies and tools to enrich traditional maintenance activities and improve assets. In this paper we want to highlight three specific areas:

- Real-time predictive maintenance
- Remote maintenance
- Spare parts prediction

Keep in mind, all of these innovation fields are enabled by IoT and underlying technologies such as sensors, remote connectivity, data analytics and AI, edge computing, simulation and digital twins, augmented, mixed and virtual reality, mobile devices and wearables, autonomous systems and robotics, additive manufacturing, cloud and cybersecurity, just to name a few.





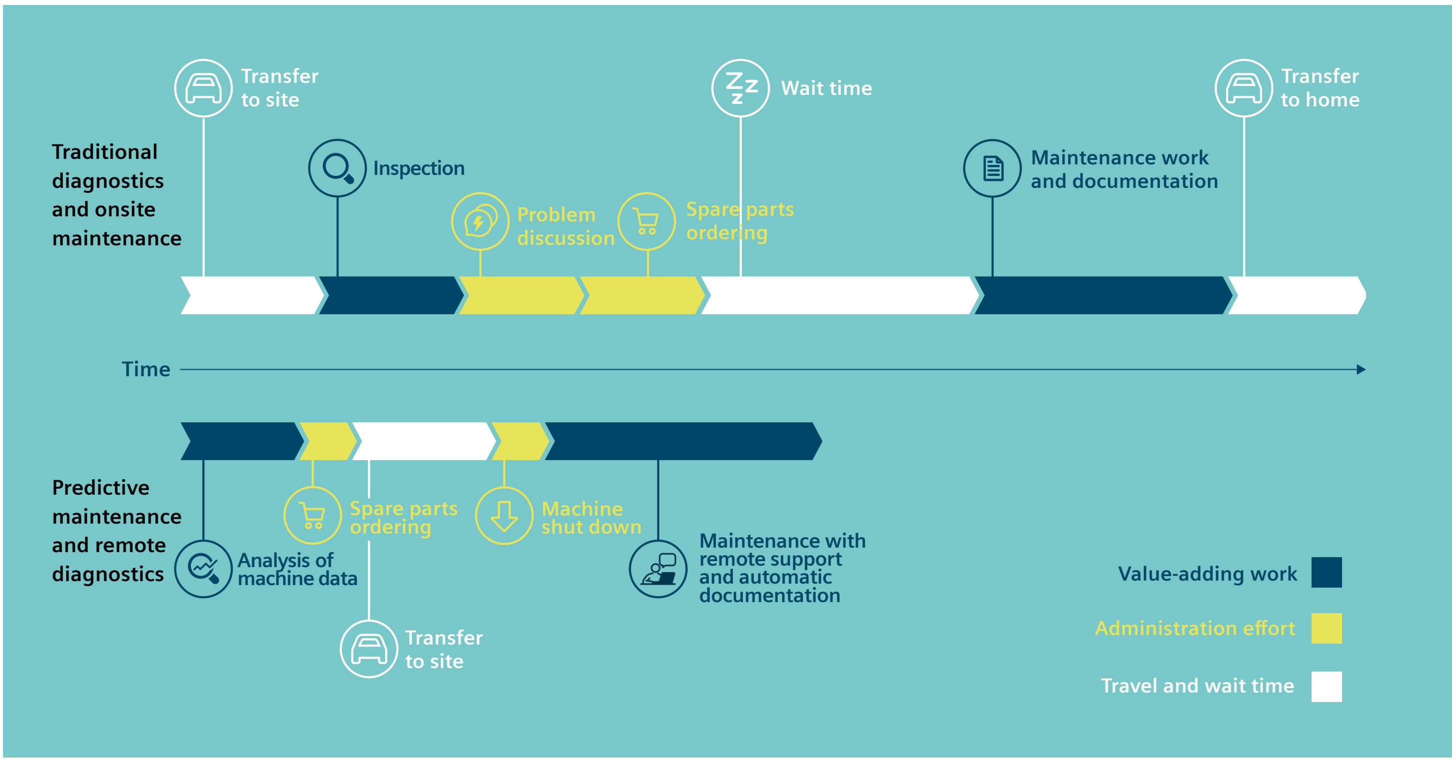
3.1 REAL-TIME PREDICTIVE MAINTENANCE

In the past, maintenance operations were focused on the provisioning of efficient and fast break/fix with some portion of planned maintenance based on defined schedules of product, unit or component condition. New technologies now provide options to move from unplanned emergency maintenance to real-time monitoring and condition-based and predictive maintenance. This is achieved by connecting sensors to products, thus enabling real-time data transmission. Here, we differentiate between real-time condition monitoring, where alerts are given based on pre-established rules and critical levels, and continuous real-time monitoring, where alerts are sent based on predictive techniques.

Predictive maintenance techniques are designed to help determine the condition of assets in order to predetermine optimal downtimes. This is possible because new analytics capabilities help anticipate outages and coordinate maintenance activities accordingly. The overall goal is to prevent unexpected equipment failure and plan downtimes for time slots that are less critical or less costly.

The schematic diagram below shows the potential efficiency increase in traditional maintenance processes resulting from predictive maintenance activities combined with remote diagnostic tools. Not only are wait times eliminated, but activities like inspection and spare parts ordering are also reduced significantly.

The combination of predictive maintenance and remote diagnostics results in a significant increase in machine as well as personnel efficiency.



"REAL-TIME DATA AND THE KNOWLEDGE WE GAIN FROM IT IS MORE VALUABLE THAN CASH."

Statement by a Vice President of Operations for a leading medical products supplier[4]

Investing in predictive maintenance is certainly a strategic move and requires top management commitment. It demands careful selection of the right machines and an assessment of maintenance strategies including a solid business plan. The decision whether to move in this direction mostly depends on the end customer's willingness to pay for it. Generally speaking, machines that are especially critical for your customer's operation with high machine investment should be considered first.

However, in many other cases it might make sense to stick to predetermined or reactive approaches and try optimizing your internal processes and supporting tools instead.

Switching strategies: shifting from a reactive to a more proactive approach to reduce unexpected failures.

Source: [4] IQMS, Manufacturing Blog, 30 Jul 2018. Accessed 29 Oct 2020.

3.2 REMOTE MAINTENANCE

Remote maintenance techniques help ensure high machine uptime through fast support at a low cost.

Remote maintenance comprises monitoring and diagnostics of asset conditions as well as remote problem resolution. Asset conditions not only include traditional operational parameters, but also extend to asset security and its proactive management.

In recent years, new technologies have arrived on the market that support maintenance experts in identifying and solving maintenance issues more precisely, faster and more efficiently. As of now, we see great potential in remote expert collaboration tools, digital technician support through AR, automation of maintenance tasks like inspections or using drones or robots to perform remote maintenance, just to mention a few.

Digital technician support of maintenance staff

What seemed like science fiction a decade ago is now becoming commonplace: digitally supporting field and factory workers by using wearables, real-time collaboration, digital companions and augmented reality to guide maintenance technicians through the processes step by step. The potential for improvement offered by these technologies strongly varies depending on complexity of the tasks and the expertise of the field worker.

Depending on the level of worker support, several use cases can be differentiated:

Remote expert collaboration:
In a first step, real-time collaboration technologies may help maintenance workers to get faster expert support when needed. Audio and video conversations, sharing high-resolution images and relevant information with offsite key experts can aid in assessing unforeseen situations faster and making the right decisions. The technologies produce various benefits – and implementing those technologies is low-hanging fruit in most cases.

Smart guidance:
Using augmented reality to guide field technicians during comprehensive inspections can speed up the entire inspection process and improve process quality. Via smart glasses maintenance workers are provided with all necessary information such as task lists, work order information, service manuals, digital twin and spare parts catalogue data in a seamless overlay on real-world objects when they need it. The main advantage is that workers do not need to refer to checklists, notebooks or tablets (all handheld) but always have all relevant information in their field of vision, their hands free for the actual task. For a long time, smart glasses were seen as a marketing and sales tool with limited use in industrial environments. Now, with new wearable solutions that comply with relevant industrial norms and safety requirements, more and more use cases are being implemented in the field. Highly complex and comprehensive standard inspection processes can be improved in particular.

Digital automation of maintenance tasks

Remote inspection via drones:
Autonomous systems such as robots or drones have seen a lot of progress in recent years thanks to advancements in the military domain and consumer industries. They are also becoming increasingly attractive for supporting the inspection of infrastructure assets, where assets are at a remote location or not easily accessible for workers, for example. Typical use cases include the inspection of overhead lines or

Man and machine: Remote maintenance allows real-world conditions to be sensibly combined with virtual elements and processes to be networked effectively.

pipelines, which require a lot of traveling. Inspecting chimneys, offshore wind farms or ventilation shafts can be very dangerous for the worker. Here, robots and drones can make things not only more cost effective, but much safer as well. Regular or thermal cameras, light/laser detection and ranging technologies (LIDAR/LADAR) are used to capture digital imagery. These dynamic images together with computer vision algorithms are then used to inspect objects. Machine learning algorithms correlate the identified state over time to automatically identify defects, degradation of equipment or conditions of surrounding physical objects.

Siemens is already using this technology for digital monitoring of pipelines in large oil fields. Drones can measure the depth of cover (soil) over buried long-range pipelines to avoid dangers to pipeline integrity. Furthermore, they detect changes and trends in the pipeline depth of cover and leaks.

AI assistants/bots:
These are tools that are primarily used for customer interaction in hotlines or chatbots. They are human-like, language and industry-specific and they learn fast. Their true benefit lies in repetitive tasks like in Remote Expert Centers, where they can have a significant impact on reducing call volume. This enables maintenance staff to focus on high-value activities and complex requests. However, the more advanced these technologies get, the more they can also take over nonrepetitive tasks.

AI bots may only partially substitute labor, but are rather useful in supporting maintenance staff for an improved customer experience.

CLIENT STORY: REMOTE OUTAGE SERVICE

In 2015, Siemens Energy faced a major remote outage request from one of its clients in Libya. An already existing long-term maintenance contract between Siemens and the Libyan state-owned utility tasked the respective Siemens Service Organization with ensuring the continuous safe and reliable operation of its gas turbines. At the respective time, an outage of the gas turbine was scheduled and needed to be executed. However, due to political and safety reasons, Siemens was not able to perform the outage with its own service technicians physically present onsite. Instead, a solution was developed which was based on self-designed, highly sophisticated, rugged real-time collaboration equipment together with preparatory training of client personnel in Germany. With remote guidance via audio and video collaboration provided by an expert center in Germany, the client's (less skilled) technicians onsite were able to perform the outage even though they had never executed one by themselves before. Afterward, Siemens was able to identify 75 of these maintenance intervals that could be performed remotely, adding up to a three-digit service revenue volume over the following five years.

A brand-new remote support concept for operators that was initially intended to simplify access to expert support, drive cost efficiency and improve operational output has shown its strength even more in times of restricted access to locations and limitations in human interactions, as seen during the COVID-19 pandemic where this concept helped to keep people safe and operations running.

3.3 DIGITAL SPARE PARTS IDENTIFICATION AND PREDICTION

In most industrial companies the spare parts business contributes a large share of revenues with high profit margins – especially for non-commodity spare parts. However, we see this success as largely dependent on an efficient organizational setup and a high level of customer satisfaction. Accomplishing both targets demands that organizations focus more on transparency and fast spare parts supply. Technologies like evidence-based spare parts usage, automated part identification, additive manufacturing and end-to-end (E2E) data transparency can help in achieving these targets.

Evidence-based spare parts usage:
As an analysis with one of our clients showed, 80% of spare parts exchanged and returned to the repair center by field technicians were mistakenly identified as broken and therefore replaced unnecessarily. This indicates that many other companies are in a similar situation: unnecessarily exchanging spare parts resulting in unsustainable use and needless expenditure.

As a result, evidence-based spare parts usage aims at ensuring that only the spare parts on a device that are proven to be faulty will be replaced. Here, a tool assists service technicians with searching the database for the specific machine error occurring onsite and provides them with statistical information on common faulty parts and parts that are often changed out mistakenly. Ultimately, this helps to reduce the NDF (No-Defect-Found) rate and increases the sustainability of spare parts usage.

Automated part identification:
Most maintenance operations involve the repair or replacement of a part. However, the on-time delivery of the right spare part often constitutes a bottleneck within the maintenance process. In order to keep up with rising customer demands for accelerated maintenance performance, the parts identification process during or prior to maintenance work is a key lever for successful maintenance. Auto identification technologies already exist that help eliminate high clarification times. These technologies support the automatic, unique identification and clarification of required spare parts using visual part identification methods. For this method, the technician takes a picture with the app, which then compares the RGB-depth image with the corresponding CAD model from the connected database. The app suggests a small selection of matching spare parts to the technician, considerably simplifying the selection process of the right spare part. Ideally, the technician can then order the part through a connected web shop interface directly from the supplier.

Instant part provisioning via additive manufacturing:
Over an asset's life cycle, spare parts often constitute a significant portion of its cost. Therefore, utilizing new technologies that optimize design, production, storage and supply of spare parts can create significant improvement potential. One of these technologies is additive manufacturing, also known as 3D printing, in which components are built layer by layer (additive) on the basis of three-dimensional design data. For example, Airbus has made use of this technology and started replacing its standard seat belt buckles with 3D-printed ones in its A380-800 airplanes[5]. This reduced the overall part weight by half and saves more than 3 million liters of fuel over the plane's lifecycle. And this is just one example of the beneficial uses for this technology.

Source: [5] Oceanz, Aerospace. Accessed 17 Nov 2020.

Additive manufacturing potential benefits: 3D printing may ensure parts availability, fast production of small batch sizes and reduced storage costs.

Further benefits include:

- Ensured parts availability and reduced storage costs: Spare parts can be produced very quickly, and in small lot sizes as well. Thus, parts can be printed when needed. This reduces the need to procure and store larger quantities of a part over long timespans to ensure its availability throughout the lifecycle.
- New opportunities for modernizations and upgrades of assets: Additive manufacturing makes it possible to create new part designs with efficiency, stability and functionality by overcoming limitations imposed by classic manufacturing technologies.

Although additive manufacturing technologies are highly promising, the business case varies widely across industries and assets. Therefore, making the decision to use traditional means versus additive manufacturing must be evaluated individually part by part. In addition, companies need to be prepared for the investment in new know-how and technologies. The ability to create and manage the digital part models and having an integrated tool chain from design to production are essential prerequisites for making meaningful use of the technology.

4 KEY PILLARS OF TRANSFORMATION FOR YOUR ORGANIZATION

In order to prepare your service organization for growing customer demands, you need a holistic view of Maintenance 4.0. This includes a review of your business strategy and model, improved staff education and knowledge availability, adapted processes and organizational setup, and last but not least, taking care of asset security management.

Business strategy and model

New technologies can make your existing business model more attractive. But more will be affected than just your existing business – technologies can be the starting point for a portfolio shift.

With the adoption of new technologies into your operations, more data becomes available, enabling you to generate more insights not only into customer and machine behavior, but also your own performance. It helps you steer your organization in a more efficient way and better shape your service offerings to meet client needs. All of these gains will allow you to adapt your business strategy and model toward a data-driven maintenance business.

Staff education and knowledge availability

Virtual learning and competence development:
Maintenance 4.0 requires companies to develop or acquire new skills more rapidly than they are accustomed to doing. Most companies have no track record in areas like data analytics or digital automation of maintenance tasks. Since these data and technology requirements emerged fairly quickly in the past few years, the market is also lagging behind in adapting the training curriculum. On the other end, the demand for software skills as a basic requirement for maintenance technicians is becoming increasingly important. Companies need to think of ways to develop these essential skills internally. Offering employees the chance to further their own skills doesn't just fill critical capability gaps, it's also a powerful tool for attracting and retaining talent.

Experience management and knowledge digitalization:
In addition to building up knowledge, it needs to be made universally accessible. New digital technologies – especially knowledge graphs and Natural Language Processing (NLP) – show significant potential to leverage this essential domain knowledge. Typical use cases include the analysis of service or maintenance reports and the classification of tickets. Start by implementing proof of concepts to identify the most promising use cases for your business, validate their business potential and understand the most important business requirements.

Process and tools

The potential of new business models can only be harvested if the operational activities are adapted accordingly.

Organizations need to integrate their service value chains and harmonize their often fragmented tool landscape. Processes might not be designed modularly end-to-end. However, we see a strong demand in this area.

A clear roadmap is key: When transforming an organization, a sound strategy needs to balance established processes, structures and employees with implications of innovation and cybersecurity.

The growing level of digitalization especially makes speeding up processes and driving efficiency and competitiveness within the organization a crucial step. Furthermore, we see that successful service and maintenance organizations are very good at continuously learning and improving their decision making based on knowledge gained in the field. The growing availability of data will foster and enrich that knowledge – and making use of it in an integrated way will be a key differentiator in the future.

Organizational setup

Unfortunately, there is no one true path that is easy to follow – a sole optimal blueprint for service organizations does not exist. But there are many proven elements which help to adapt the service organization to specific business environments. The setup is highly dependent on a number of decisions you have to make: It could involve target setting and incentives, the profit-and-loss model and value flow, or your desired reporting and performance management. The responsibility split between regions and headquarters as well as between service and system business also needs to be considered.

Asset security management

With the digitalization of industrial facilities, assets and processes that used to be in a closed environment are now connected with each other as well as the outside environment. This makes cyber attacks, from both the outside and inside, a risk that needs to be managed. To defend businesses from the growing number of cyber threats, cybersecurity (i.e., ensuring the confidentiality, integrity and availability of data and assets), becomes an integral part of a maintenance organization. To address this topic, a growing number of industrial security standards are emerging. The regular check for infected assets is becoming an ever more common task for maintenance organizations, as are regular visual inspections. Typical measures include establishing transparency on current assets, potential cyber threats and their impact, and deriving and implementing special measures. Those measures include – among others – enhanced processes, trainings, or technical measures such as the installation of technologies for defense (e.g., firewalls, enhanced access control) and detection (e.g., virus scanners or honey pots).

THE WAY TO TRANSFORMING YOUR ORGANIZATION:

5 MAIN BENEFITS OF MAINTENANCE 4.0

The human factor: Maintenance 4.0 simplifies the work of operators and increases their safety.

Implementing a smart maintenance process for infrastructure equipment can create several benefits for operators and users alike. Not only can the use of IoT lead to better performance and optimized operations (hence, saving you money), it can also increase service quality and enhance security, which are all valuable benefits to attain. Further benefits include:

Higher asset availability:
When Maintenance 4.0 is properly integrated into other business-critical processes of a company, unscheduled downtime of critical equipment is reduced to almost zero. This will ultimately lead to better service quality, which has a positive impact on users' perception of the service.

Reduced operational costs:
Operating expenditures (OPEX) are a key business driver for any company. Driving operational costs to an optimal level improves the bottom line and, if done right, also impacts business sustainability in a positive way. With Maintenance 4.0, companies can monitor their equipment in a predictive manner and avoid excessively costly emergency repairs, reduce penalty fees due to poor maintenance quality, and minimize spare parts inventories and maintenance personnel.

Enhanced safety and security:
Companies go a long way to ensure that the highest safety levels are achieved in their operations, but the human presence in itself is already a risk. By implementing remote or virtual methods to conduct maintenance and repairs, companies can avoid:

- **Hazardous situations for maintenance personnel**
- **Physical presence of third-party operators or OEMs onsite to provide maintenance on their equipment**

Optimized resource management and sustainability:
Implementing Maintenance 4.0 can lead to more accurate planning for spare parts and equipment repairs, freeing up important monetary resources that are usually kept as inventory. Furthermore, using virtual technologies to conduct repair activities lets technicians save travel time and improves their availability for other crucial activities.

Overall, having a solid understanding of these benefits is crucial in order to make the right prioritization decisions for your organization's efforts.

6 CLIENT STORY UPSTREAM DIGITALIZATION

In 2019, one of our clients from the Oil & Gas industry wanted to fully digitalize their upstream operation as part of their digitalization strategy to successfully face the macro challenges in the industry. The client also strove to improve operating KPIs like availability, reliability, efficiency and hazard exposure to increase production and lifetime of existing fields while reducing operating costs. To achieve these objectives, the task was to maximize use of digital technologies in the still largely manual operating field.
The overall vision was to have fully centralized monitoring and control of all assets across the value chain.

To turn this vision into reality, an integrated solution was developed including predictive operations and maintenance, drones, robotics, connected worker and CCTV analytics, digital twin and remote control together with an implementation roadmap and a comprehensive business case.

An advanced automation system, highly integrated with all relevant assets, can significantly reduce manual interventions in production. Learning algorithms monitor operator inputs for a certain period of time in order to learn the corrective actions and then intervene automatically. Control loop tuning software helps identify and resolve error-prone parts of the system.
AI-enabled applications for production modeling and gas lift optimization can improve production and increase revenue potential.

AI-enabled predictive maintenance applications support predicting failures in advance and acting on detected anomalies with limited operator intervention. Thus, the maintenance strategy on fields transitions from current preventive towards predictive modes.

The scattered data from headquarters and the field can be integrated into a digital twin solution that acts as the

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Learn more in our whitepaper
UPSTREAM DIGITALIZATION - A KEY STEP TOWARDS UNMANNED OPERATIONS
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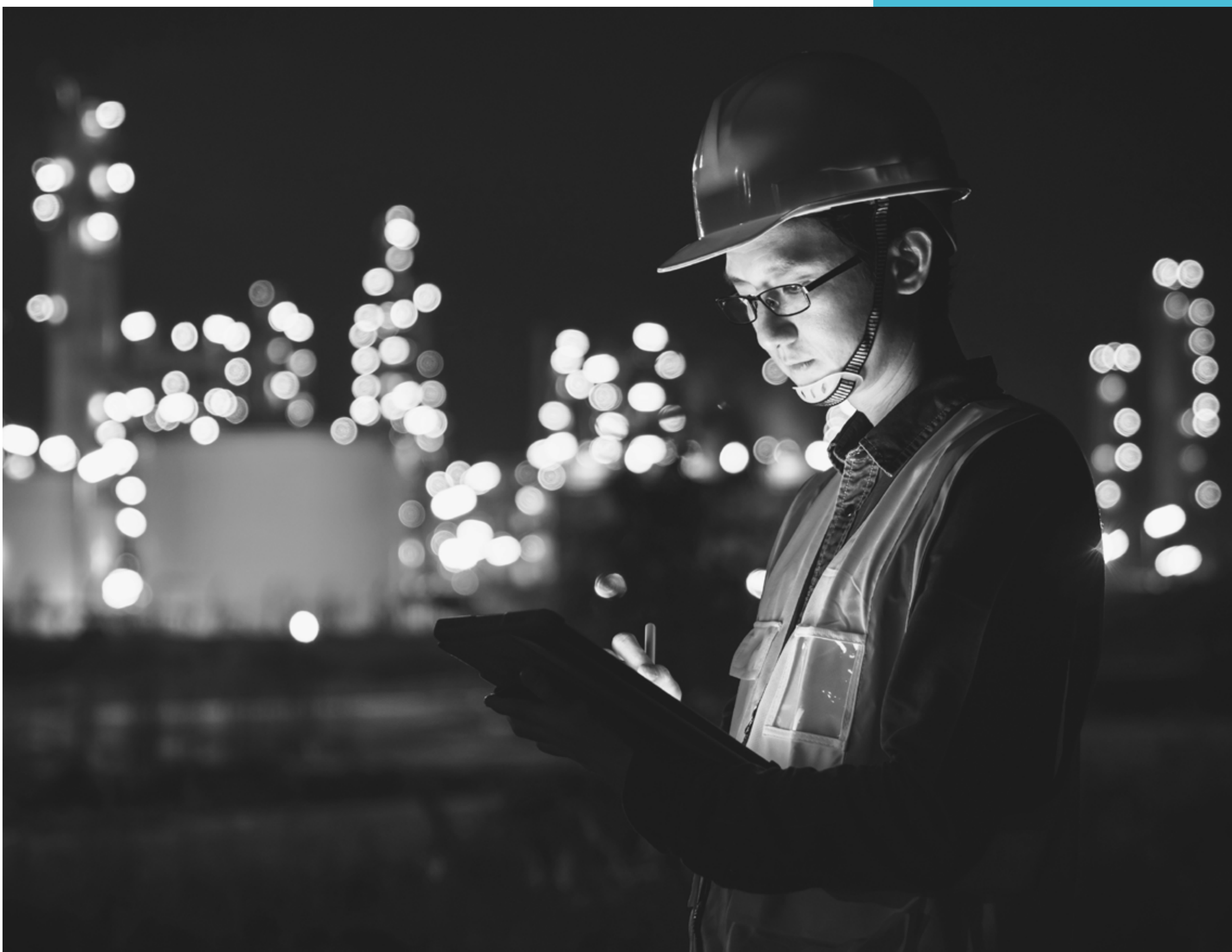
single source of contextualized data for all users by integrating the data from the various IT systems. This not only facilitates full transparency, it can greatly simplify planning and KPI reporting, and also give easier access to data and expertise in the field through solutions like connected worker. Drones and robots can be effectively used to replace surveillance and inspection tasks on field, reducing manpower and exposure to hazards.

All of these measures bear great potential for the client. For instance, they can reduce the permanent manpower requirement onsite by 80%, improve downtime by 5-6 days, increase asset reliability and save up to 5% of energy efficiency. Furthermore, CCTV, robots and drone usage are estimated to reduce human exposure and lead to 60-80% fewer hazards and accidents. Overall an increase of revenue by up to 15% is possible.

The vision: The client wanted to achieve fully centralized monitoring and control of all assets across the entire value chain.



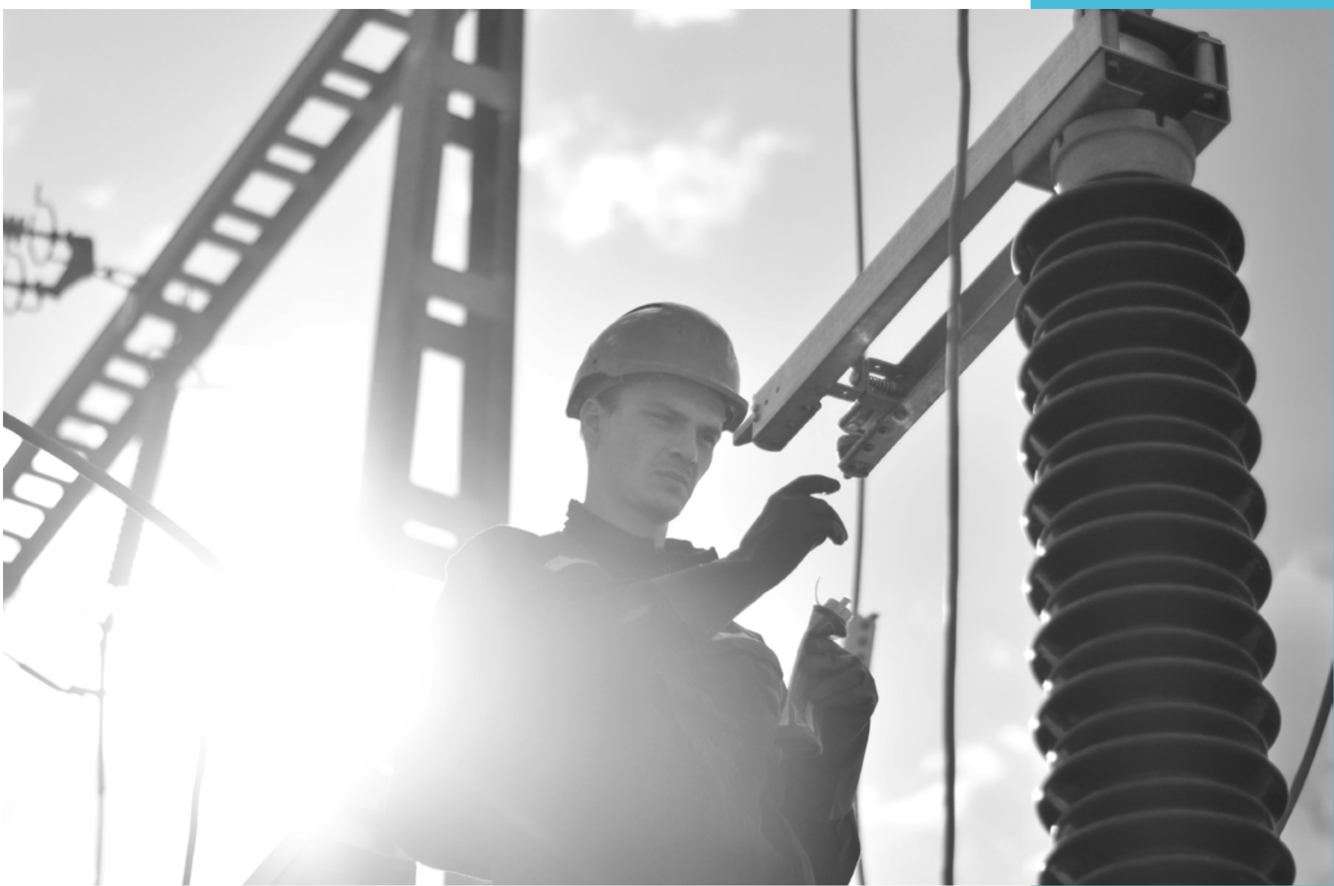
6 CLIENT STORY GRID MAINTENANCE OPTIMIZATION

Kärnten Netz GmbH, a leading electricity and gas distribution network operator in Carinthia, Austria, wanted to optimize its grid maintenance operations. The company serves about 400,000 Austrian customers and maintains a grid of around 18,000 kilometers, including 65,000 poles and 7,000 transformers.

Expected to advance a sustainable energy system while facing high maintenance efforts, the utility looked for support in identifying and implementing an innovative solution to better cope with its specific challenges:

- Increasing grid complexity driven by the growing amount of distributed energy sources
- Outage risk caused by environmental factors and higher stress on individual assets due to the integration of fluctuating sources
- Budget constraint and the desire to avoid or delay infrastructure replacements wherever feasible

Increasing maintenance efficiency: The AI-based system enabled the client to implement dynamic inspection schedules and improve staff management.



We supported our client by firstly identifying relevant influencing parameters and available data sources within their energy ecosystem. Later, we integrated and enriched the client's own data with available external data sources, like weather or GPS data. Working hand-in-hand with the experts from Kärnten Netz GmbH, Siemens Advanta helped systemize and interpret the data. We also co-created an outage prediction application based on techniques of Artificial Intelligence and our specific domain expertise.

The resulting decision support system serves the client to predict future outages and is used for optimized asset management that prioritizes maintenance on assets with the highest failure probability. The system's prediction accuracy of >90% for failures at named assets is exploited to optimize the utilization of maintenance resources, allowing it to move from static to dynamic inspection schedules for assets based on the system's predictions. In addition, we implemented a smart route optimization for workforce crews – navigating maintenance staff more efficiently. Altogether, maintenance efforts were reduced significantly, thus, paving the way towards more sustainable grid operations for our client.

Looking to the future: Siemens Advanta supports you in making your transformation a success.

7 SUCCESS FACTORS FOR YOUR TRANS-FORMATION JOURNEY

Investing into Maintenance 4.0 is, of course, a strategic move and requires top management commitment. It demands careful selection of the right use cases and an assessment including a solid business plan. We see three main success factors:

Show the added value to your customer

Despite all efficiency gains, you need to ensure that your customers also see the added value of these new solutions. Customer-targeted reports can be a good tool to show the improved service delivery. If you think about integrating remote technologies to your maintenance activities, keep an eye on retaining customer contact, a good relationship and focus on customer needs. Service will always remain a people business – remote tools and technologies can and should only be supporting elements.

Ensure the maintainability of your assets

Technical requirements for remotely accessing your products as well as restricting the possibility to read restricted information need to be incorporated as early as during the design phase.

Integrate cybersecurity measures

To defend your business from the increasing number of cyber threats, cyber security – i.e., ensuring the confidentiality, integrity and availability of data – becomes an integral part of any data-driven business. Reducing cyber risks is key to being perceived as a trustworthy partner. Therefore, we highly recommend early involvement of cyber experts, especially during the design and concept phase to minimize the potential exposure window.

All in all, Maintenance 4.0 bears a great potential to improve your service delivery, create new maintenance offerings and realize efficiency gains for your business.

ABOUT SIEMENS ADVANTA

Siemens AG (Berlin and Munich) is a global technology powerhouse that has stood for engineering excellence, innovation, quality, reliability and internationality for more than 170 years. Active around the world, the company focuses on intelligent infrastructure for buildings and distributed energy systems and on automation and digitalization in the process and manufacturing industries.

Siemens founded the new business unit Siemens Advanta on April 1, 2019 with its headquarters in Munich, Germany. It has been designed to unlock the digital future of its clients by offering end-to-end support on their unique digitalization journey. Siemens Advanta is a strategic advisor and a trusted implementation partner in digital transformation and industrial IoT with a global network of more than 8,000 employees in 19 countries and 89 offices. Highly skilled and experienced experts offer services which range from consulting to design & prototyping to solution & implementation and operation – everything out of one hand.

Further information is available on the internet at
www.siemens-advanta.com

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THANK YOU

To all contributors for their time and insights.