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The Future of Facility Maintenance Technicians

Digital Information, Augmented Reality and Remote Support

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Over the last few decades, significant technological advancements have improved equipment condition monitoring. The increased local and remote condition monitoring capabilities, in addition to building monitoring and automation systems in the areas of alarm monitoring, vibration analysis and diagnostics, lubricant analysis, ultrasonic and infrared monitoring, have provided organizations with significant cost savings and many reliability improvement opportunities. Although the innovations in the monitoring capabilities have yielded very positive results, maintenance leaders have also been striving to advance the support provided to maintenance technicians. The goal of maintenance leaders is to deliver maintenance and repairs of facilities infrastructure and equipment effectively and efficiently.

There are several ways to develop a maintenance technician's level of knowledge; training, standardizing maintenance processes, streamlining procedures and tasks, establishing supporting systems or resources, and utilizing new technologies and tools. All of these actions taken will achieve the intended result. The primary goal has been to enable the maintenance technicians to get a few steps further than they would get by themselves to efficiently and effectively deliver maintenance.

However, the complementary approaches of improving condition monitoring capabilities and providing additional support and resources to the maintenance technicians, have not always intersected seamlessly. The field's maintenance technicians are often not fully aware of the knowledge gained through equipment monitoring. Additionally, the technicians may not have access to the resources required to perform the appropriate maintenance and repairs. Providing relevant information to the field maintenance technician at the point of use has become a key focus area that will supplement the demands in the future.

There are three areas where efforts are likely to be focused by organizations to support the maintenance technicians in the future; facility digitization and digital twins, augmented reality and remote support.

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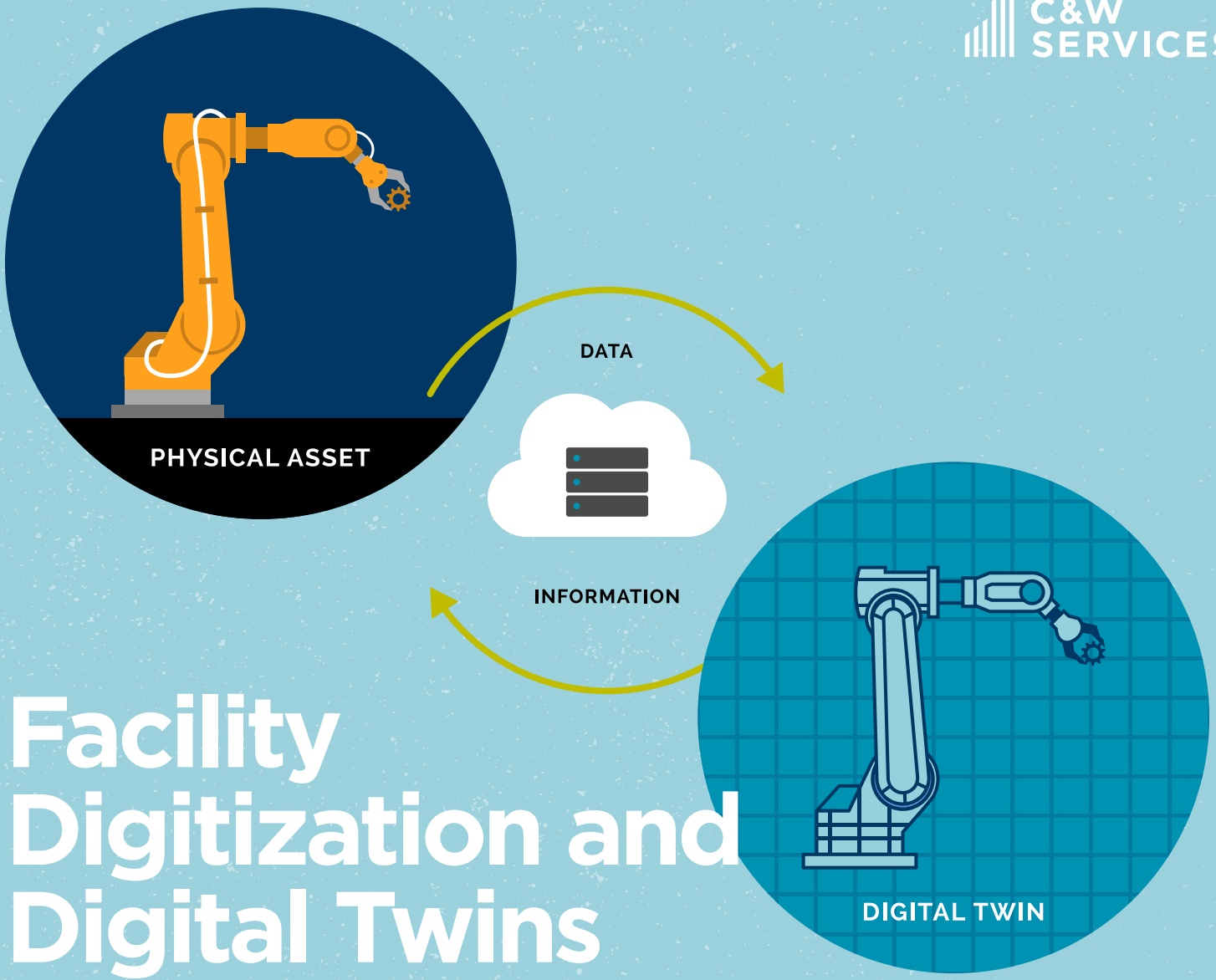

Facility Digitization and Digital Twins

In facility maintenance, a broad spectrum of infrastructure and equipment data and information availability currently exists, impacting the quality of maintenance technicians' work. Only a small percentage of complex facilities (generally regulated or manufacturing) have the relevant data and information available. There are many non-industrial/manufacturing sites where the data and information may not exist. However, even if the data exists, it may reside in various systems and be challenging to locate by the maintenance technician. Additionally, the data may or may not be digitized. The unavailability or difficulty accessing and finding creates a situation where the maintenance technicians do not leverage or benefit from the appropriate information to perform the maintenance and repairs.

Unstructured "technician notebooks" augmented the lack of data and information. Maintenance technicians have created notes over time while working on the facility equipment. Although the tribal knowledge gained over time supplemented the maintenance technicians, the information was not documented in the systems of record appropriately due to a lack of focus.

Proactive organizations have realized this significant deficiency, exacerbated by

experienced technicians retiring from the workforce. The organizations are expending substantial efforts to digitize the available facility data and information and make it readily available to the newer technician workforce.

The primary goals of facility digitization are to identify the relevant information needs for the facility, capture the required information digitally and provide the information to the maintenance technicians at the point of use.

Examples of data and information that can be digitized and provided seamlessly to technicians may include the following: facility layouts, equipment location, spatial data, technical data and manuals, condition monitoring and analysis results, training aids, and external references.

A fundamental change that we can expect to see is that the technicians of the future will have access to facility infrastructure, equipment, and equipment-related information digitally when needed, a supplemental resource that today's technicians typically do not have.

Currently, facility digitization entails digitizing facility layouts in 2D or 3D, pinpointing equipment locations within structures, and providing asset views, attributes, and other asset-related details in the digitized facility. A simple explanation is that any stakeholder will have the ability to view the equipment virtually in a 2D or 3D space and access the relevant details remotely. Creating this capability will eliminate the need for a physical presence to view the information in front of the equipment.

Going beyond facility digitization, the creation of digital twins is the next logical step. Currently, the digital twin concept varies from a tactical perspective, and the "definition" of a digital twin differs significantly.

The most straightforward understanding of a digital twin is that it can virtually access any digital documentation (operations, maintenance, production, financial, etc.) available and assigned to the equipment.

The more complex definition of the digital twin, "A digital twin is a virtual representation of an object or system that spans its lifecycle, is updated from real-time data, and uses simulation, machine learning, and reasoning to help decision-making."1

This definition provides two unique perspectives:

1.) Digital twins are virtual entities reflecting the actual equipment performance and update based on real-time data. Machine learning capabilities will analyze and enable optimal performance parameters.

2.) Digital twins are virtual entities that can be simulated to understand the variations in operational performance under varying conditions.

The current status of digital twins at facilities is somewhere between the simplest definition (virtually accessing assigned information) and the complex definition (accessing real-time information/simulating equipment under various scenarios). However, the facility technicians of the future will be more exposed to digital twins, the configuration of which is based on the organizational needs and business strategy.

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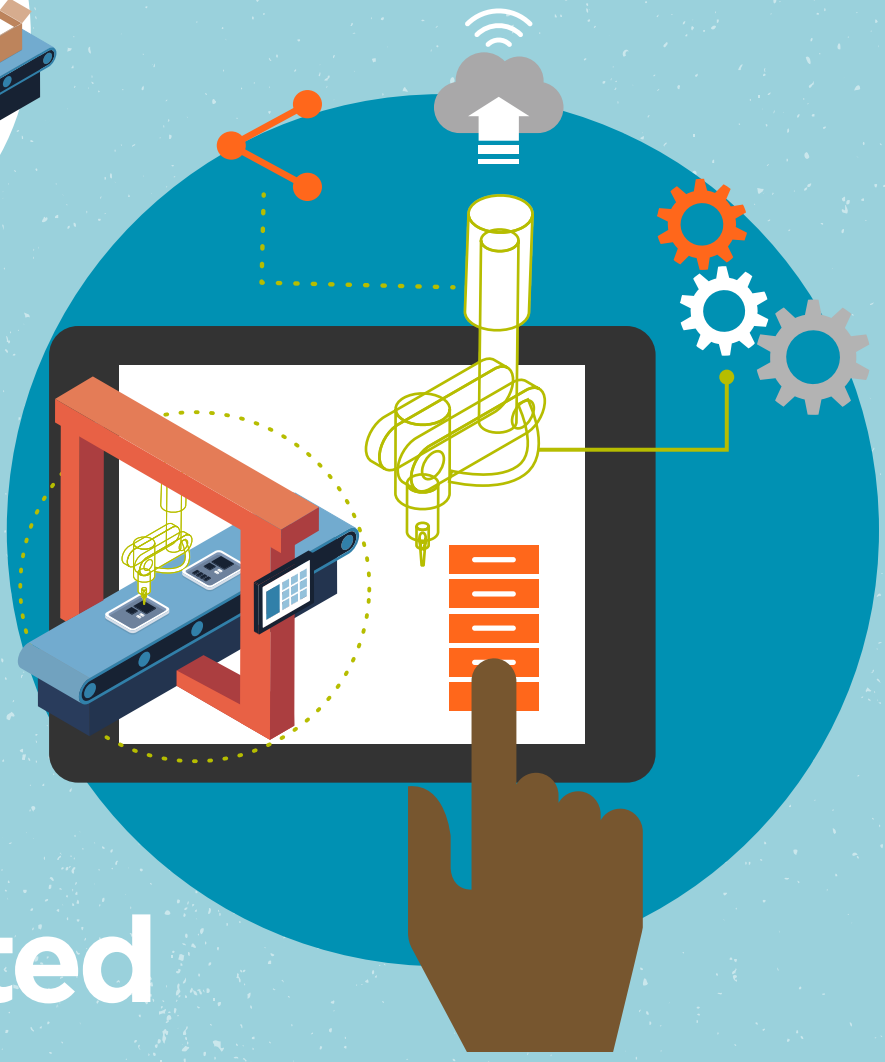

Augmented Reality

Actively driven by the fourth industrial revolution, innovative Augmented Reality (AR) solutions are gaining significant inroads into the maintenance world. The AR solutions are becoming essential tools in the maintenance technician's quiver.

Simplistically, AR solutions provide an interactive environment by layering information such as text, pictures, videos, graphics, dashboards, and other relevant information, in a real-world vision in real time. The goal of utilizing AR solutions is to present the necessary information to the maintenance technician on-demand at the point of use, enhancing the quality of maintenance service delivery.

AR solutions can present the digitized facility and equipment data and information such as SOP's/procedures, instructions, checklists, manuals, drawings, videos, job aids, and

other information to the maintenance technician. The data and information are presented to the technician while executing work on the specific equipment, enabling the technician to perform work efficiently with a high level of quality.

One critical gap in service delivery is that maintenance technicians cannot effectively utilize real-time monitoring data and analytics from predictive maintenance solutions. Maintenance technicians sometimes work without the diagnostic, monitoring, and analysis information or adversely work against the predictive monitoring recommendations as they may be unaware of them. AR solutions can tie the performance data and suggestions from the predictive analytics tools and present them to the maintenance technicians while executing a more holistic work approach.

AR solutions also supplement remote support, where the expert provides support to the field maintenance technician. The remote support entity can overlay the necessary information such as drawings, videos, graphics, manuals, and relevant information in the field of view of the maintenance technician for a more effective support provision.

Maintenance organizations are actively investing in AR solutions in a digitized age. The technicians in the future will consume and leverage data and information provided by these solutions and utilize AR technologies as part of their daily routines.

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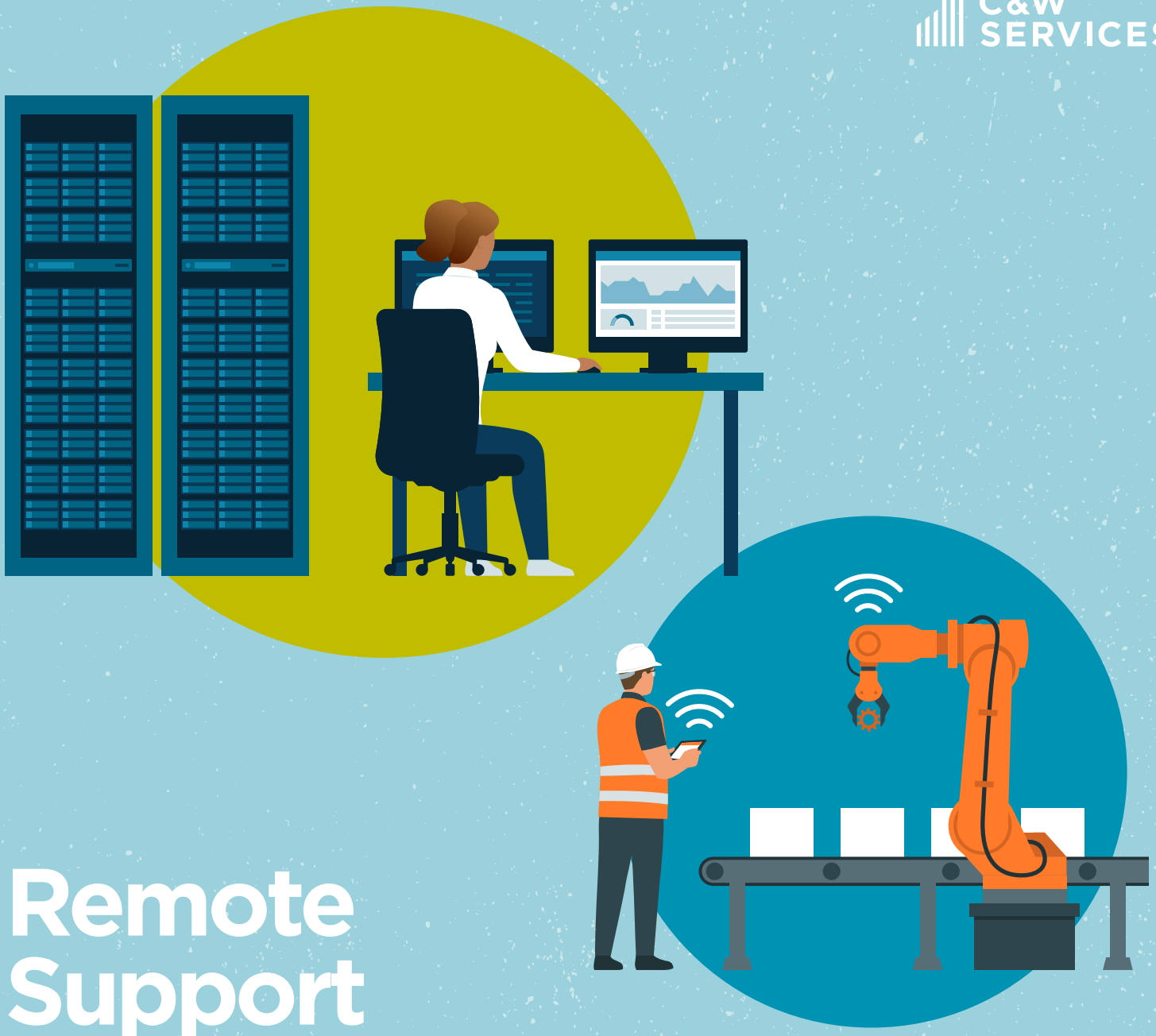
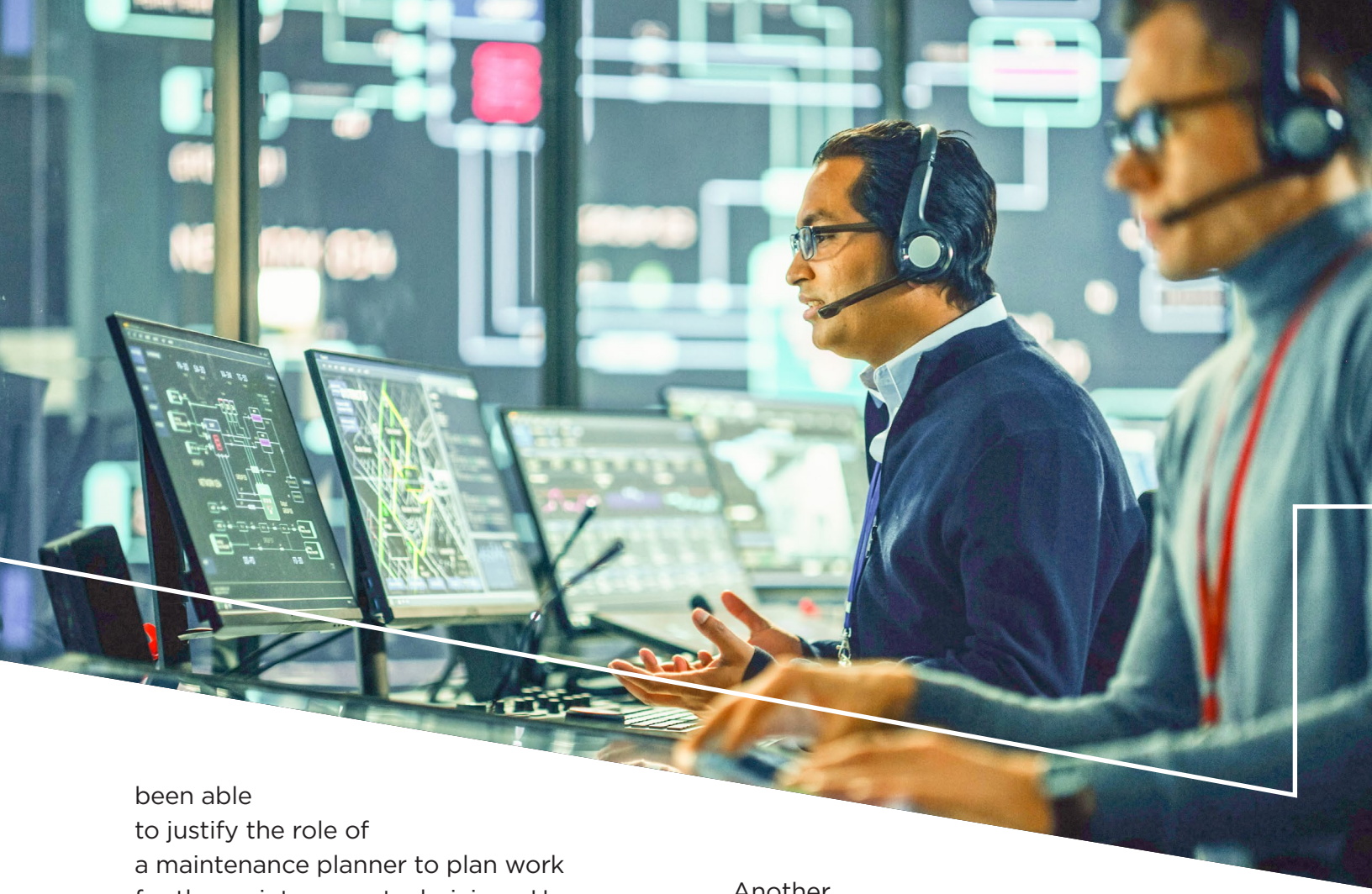


Remote Support

The support to facility maintenance technicians is currently provided by a mix of internal and external resources. Maintenance planners (resources may not exist at every site), maintenance supervisors, local facility, or organizational subject matter experts generally support internally. Equipment manufacturer helpdesks or specialist sub-contractors provide external support. However, effective connectivity technology and tools may not exist or be provided to the maintenance technicians in the field, leaving them on their own to execute the work needs.

However, this area is rapidly growing. There have been significant advancements in connectivity tools and wearable technologies to support the maintenance technicians in the field. In addition to increased connectivity and improved technologies, the costs of the technologies and tools have been reduced to make them more viable.

For example, a single small site may not have



been able to justify the role of a maintenance planner to plan work for the maintenance technicians. However, by utilizing the remote connectivity tools, a maintenance planner can be funded and used by a group of sites to remotely plan work and support maintenance technicians for the smaller sites.

Providing remote planner capabilities also partially alleviates the exodus of experienced maintenance technicians from the workforce. Maintenance organizations can extend the tenure of experienced personnel retiring from the workforce by providing less physically taxing roles. They can be leveraged for a longer time by providing them with functions that can be performed remotely. The benefit is that experience can be retained for longer to provide planning and expert support for the less experienced new technicians.

Another example is that an external subject matter expert, such as a sub-contractor or manufacturer's technical support resource, can effectively be utilized by the field technicians. They can remotely connect with the maintenance technician in the field, interact, and provide on-demand expertise to the maintenance technician.

The maintenance technicians in the future will utilize more remote support to execute work in the field effectively. Maintenance organizations are already actively establishing the platforms and developing the capabilities to provide and leverage technology to connect field maintenance technicians with the appropriate expertise for reducing travel costs, efficient service delivery, faster resolution of issues, and improved quality of work.

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Summary

The maintenance industry's complex industrial and manufacturing sectors swiftly adapt and embed digital applications in day-to-day use. They are growing the innovative benefits of "connected worker" tools and technologies as the implications of downtime are paramount to the operations. The non-manufacturing side of facility maintenance is also keenly looking into them, albeit with a more conscious approach. However, the benefits of the connected worker tools and technologies are increasingly becoming more evident. They are slowly assimilating into the overall maintenance world.

As time progresses, maintenance organizations will integrate them into the business as usual practices. The maintenance technicians of the future will become heavy consumers and practitioners. However, sometimes the journey is not very smooth and requires proactive leadership and effective change management to make it happen.

REFERENCES

What is a digital twin? IBM. (n.d.). https://www.ibm.com/topics/what-is-a-digital-twin#Nam

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