WHITE PAPER

AI, DIGITAL TWINS AND METAVERSE: THREE IS COMPANY IN THE FACTORY OF THE FUTURE

Forget yesterday's production bottlenecks and siloed information. Industry 5.0 is here, and it's revolutionizing how manufacturers operate.

Traditional factories struggle with inefficiencies, limited flexibility, and a lack of real-time insights. Industry 5.0 addresses these challenges head-on by building upon the foundation of Industry 4.0 technologies (big data, robotics, automation, IoT). This next generation of manufacturing leverages cutting-edge advancements in Artificial Intelligence (AI), Digital Twins, and the Metaverse to create a truly collaborative, data-driven, and hyper-responsive production environment.

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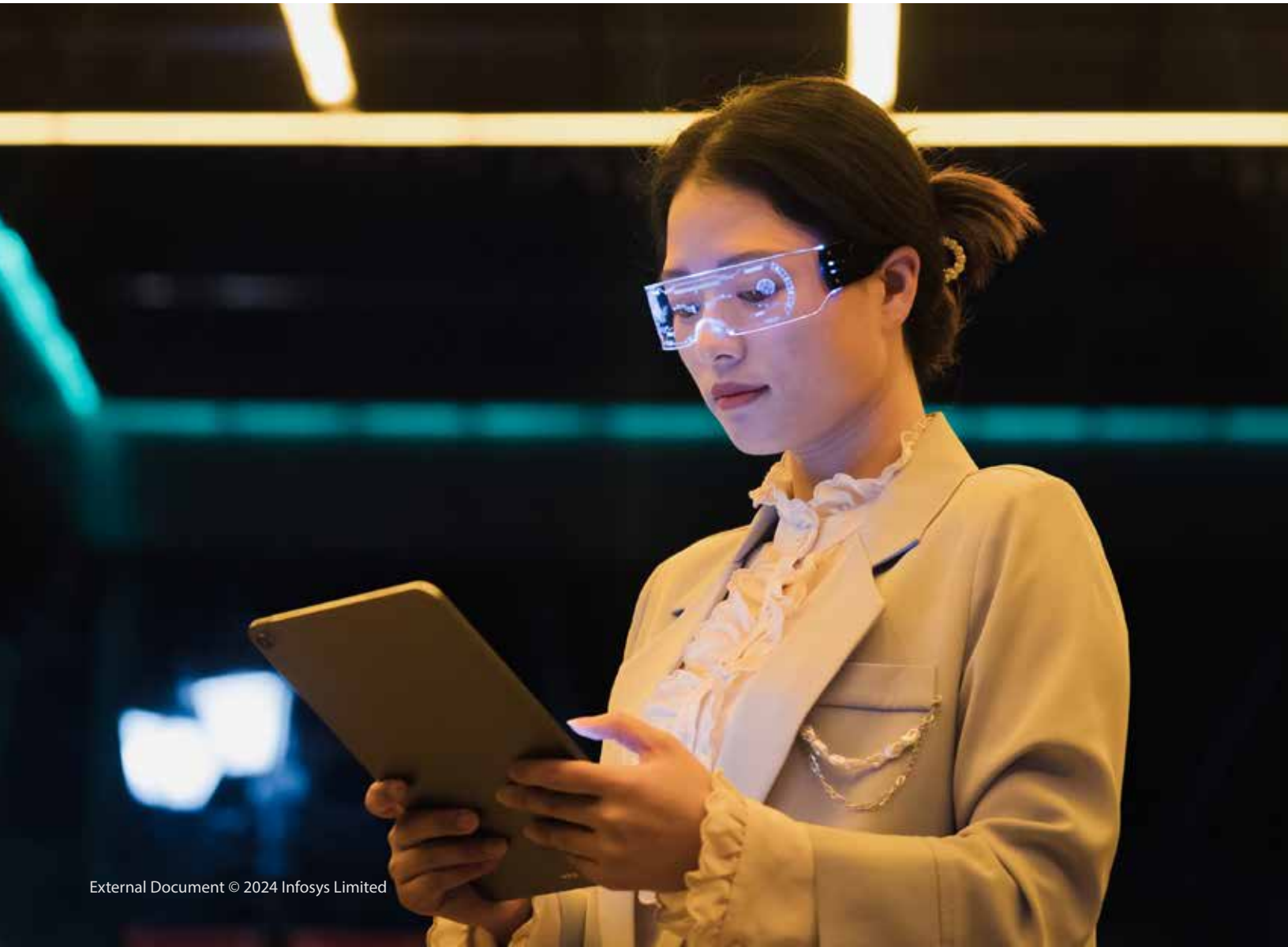
Twin Gains with AI: Production Quality and Equipment Health

Artificial Intelligence technology continues to attract huge investments from the manufacturing industry, and is expected to take the global AI in manufacturing market from $3.2 billion in 2023 to $20.8 billion by 2028. Combining with automation solutions, sensors, analytics, and the Internet of Things, AI is a critical enabler of several benefits: Collaborative robots, or cobots, are working safely with humans on the shop floor to enhance productivity and efficiency across a wide range of operations, from picking spare parts to gluing and greasing to packing finished products. AI agents schedule complex production lines to maximize throughput while keeping changeover costs in control, to ensure timely delivery of products. AI gathers datasets from across factory equipment and processes (temperature, vibration, chemical changes, noise, etc.) to evaluate the health of production assets, enable predictive maintenance, and in certain cases, prevent failure.

And now, in the leading factories around the world, AI and digital twins are setting new standards for precision and quality: Image recognition technology is used to spot defects in equipment and products. Generative AI models are being trained to predict the likelihood of an item being defective. A factory digital twin provides a virtual replica of physical operations down to the last detail, so manufacturers can simulate any process or production asset before operationalizing it in the real-world. For example, using digital twins, they can test-fit tooling or rework a process to improve productivity or even the quality of the end-product. Renault expects that digital twins, a key part of its pioneering industrial metaverse project, will be a major contributor to improvement in quality and a 60 percent reduction in warranty costs.

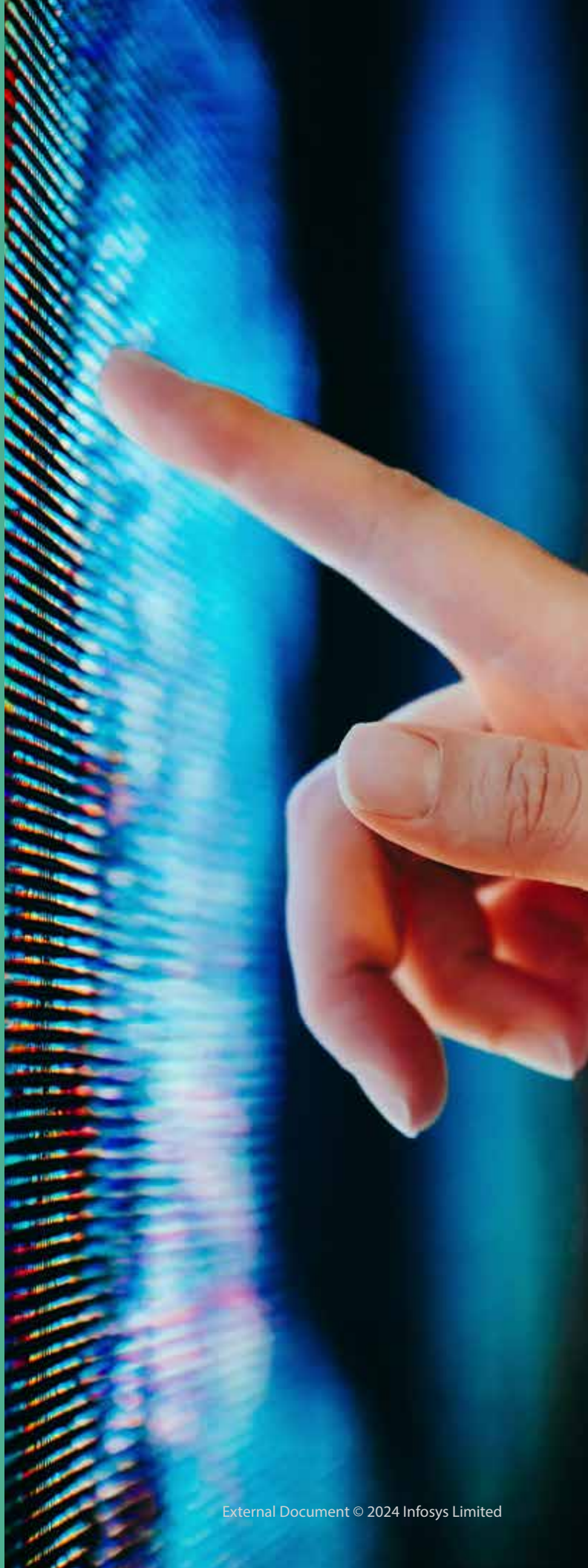


Flawless Production in the Metaverse

After hosting blockbuster games and rock shows, the metaverse is attracting quiet attention with its industrial use cases. **BMW Group**, one of the first automotive manufacturers to join the Metaverse Standards Forum, is leveraging the Metaverse to address challenges in three areas: vehicle readiness, in-car experience, and virtual ecosystems. Nissan Motor Company, with **an innovative metaverse platform**, is working to educating visitors on traffic safety norms and safe driving practices. **Boeing is another company betting big on the metaverse**, with plans to build its next aircraft there; the idea is to create a digital twin of the aircraft and its production system, and simulate complex processes before implementing it all in the real world. The gains in efficiency and productivity from digital twins can be incredible: for example, when **Siemens used a digital twin to simulate its digital native factory** in China right at the start, it managed to increase capacity by 200 percent and productivity by 20 percent.

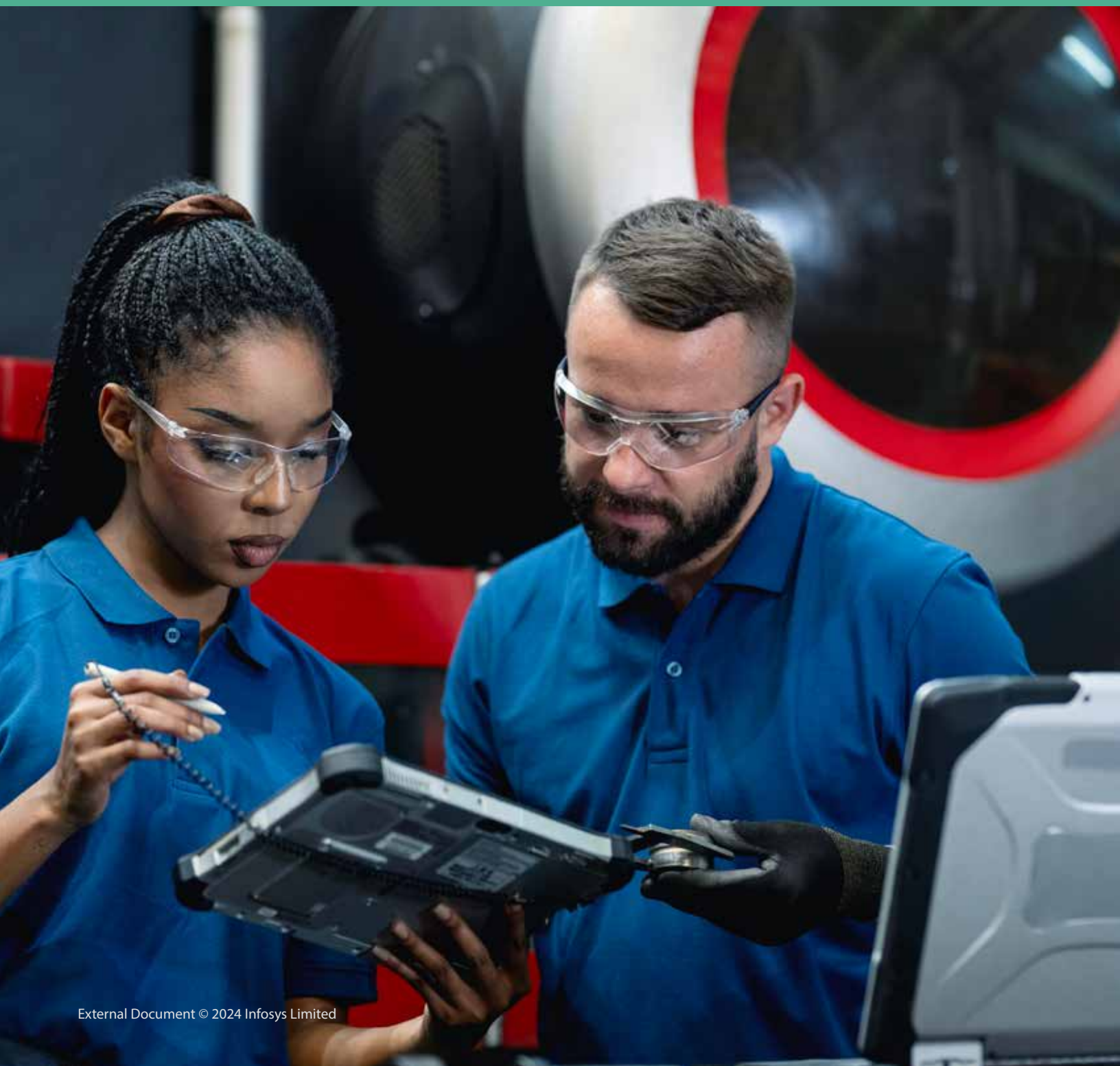
Further, the industrial metaverse improves upon the predictive maintenance enabled by other technologies by providing visibility into all the processes and systems impacted by the equipment concerned. The metaverse can also improve the efficiency of maintenance operations by providing a space where distributed service teams can gather to collaboratively tinker with a digital twin of the equipment under repair.

As the metaverse matures, it will go from improving manufacturing to transforming it by enabling innovative production processes, enhancing agility and independent decision-making by creating visibility across operations, detecting risks and recommending timely resolution, and promoting intelligent operations with the ability to learn, self-correct, and respond like never before.



Test in the Virtual, Best in the Physical

In the factory of the future, digital twins of production processes, and even the plant itself, are used along with AI algorithms to simulate and test multiple (in the thousands!) production scenarios in the virtual world. This helps to optimize process and material flows, lower resource consumption, identify bottlenecks early, and thereby enhance cost efficiency, allow flexible production planning, minimize disruptions, improve production decisions, and boost competitiveness in the physical world. For example, GE Vernova currently manages an extensive portfolio of 1.2 million digital twins of jet engines, offshore oil rigs, wind farms, and other power generation equipment. Leveraging the real-time monitoring capabilities of its digital twins, the company has **helped its customers save up to USD 1.6 billion.**



Partner to meet challenges

The convergence of AI, digital twins and metaverse holds unlimited potential for the factories of the future, provided they manage to overcome its challenges. In the case of digital twins implementation, integration with other systems is often tricky due to the existence of multiple legacy technology siloes. Also, scaling a digital twin project enterprise-wide can be a problem from a consistency and resourcing perspective. Data-related challenges, such as protecting security, privacy, and confidentiality, and ensuring that the results of algorithms are fair, accurate and free of bias, are among the top concerns in AI implementations.

Since making the required changes in capabilities, processes and organizational culture to overcome the above challenges can take years of effort, manufacturing companies may want to work with a partner to accelerate their journey. They should look for a partner with proven expertise in these technologies – AI and engineering platforms for building digital twins, various digital accelerators etc. – and strong relationships across creator-partner ecosystems that they can tap to create their metaverse environment in a secure manner. Finally, they can leverage the partner's ecosystem connections to scale ideas from pilot to production in a seamless manner.

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At Infosys, we have leveraged a digital twin of chiller plants and command center to reduce per capita energy cost by 50%, cut down lighting cost for campuses by 62%, and reduced electrical load by 44% for buildings, thus utilizing the technology to augment our sustainability efforts.

Digital Twin can be used to predict the remaining life of a turbine blade on a specific aircraft engine with great accuracy. This allows the application of condition-based maintenance (CBM) to manage a specific engine, rather than wasting time with the usual periodic approach. It also determines the remaining life of the turbine blade after each flight or a set of flights, by evaluating operational and environmental data and customer needs.

A leading manufacturer of agricultural equipment sought to revolutionize their customer experience and sales strategy. Their existing platform relied on indirect data collection through a mobile app, limiting its effectiveness. Infosys partnered with them to develop a Minimum Viable Product (MVP) on the Azure Platform, enabling direct device-to-cloud connectivity. This MVP unlocks a new era of possibilities, including two-way data exchange, 3D digital twin technology, and advanced data processing capabilities. This enhanced connectivity empowers the agri-tech major to offer a wider range of services to their customers, ultimately fostering increased customer satisfaction, equipment efficiency, and the potential for significant revenue growth through innovative service offerings.

Infosys developed a predictive maintenance solution for spindle machines of an automotive OEM on the Cloud. This solution separates data collection from existing control systems, uses standardized protocols, and performs edge processing and analysis. Machine learning models identify deviations in vibration and current patterns, predicting potential failures. The open and scalable platform allows for knowledge and solution replication across plants. By proactively predicting failures and remaining machine life with 90-95% accuracy, this system can save European plants up to EUR 3 million in five years, reduce spare parts inventory, boost productivity through less downtime, and improve overall equipment effectiveness (OEE).

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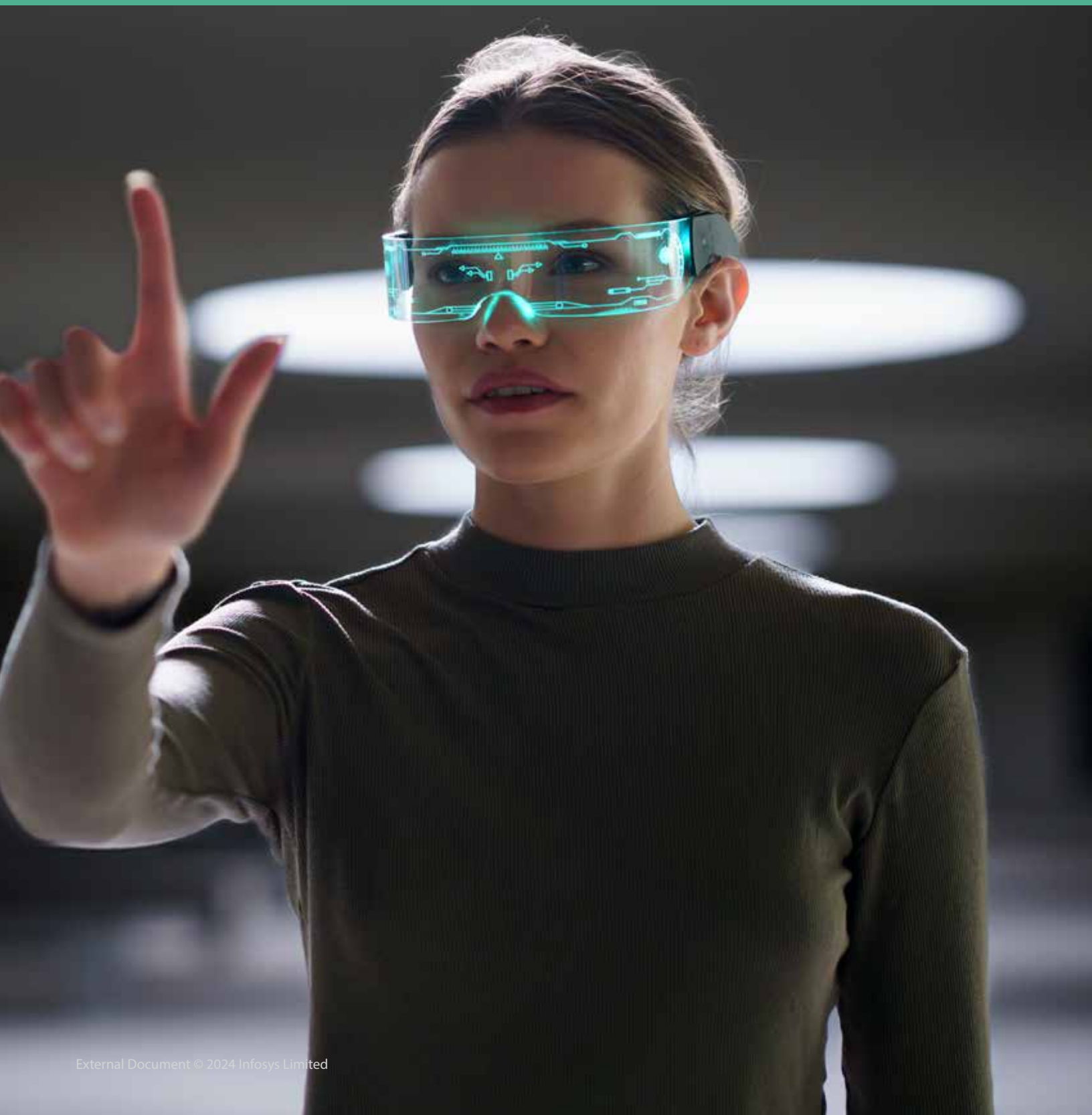
Forward fast

The days of traditional manufacturing are numbered. This time belongs to the factory of the future, one that is connected and integrated, and where massive data is exchanged between equipment, systems and people to enable highly automated and intelligent operations. Leveraging advanced technologies, such as AI, digital twins and metaverse among others, the factory of the future ensures manufacturing enterprises stay relevant and competitive. This is why they should waste no time in embracing it.



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