How the industrial metaverse is shaping the future of the manufacturing industry

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The increasing use of the industrial metaverse is accelerating digital transformation in the manufacturing industry.

Overview

- The industrial metaverse enables real-time monitoring and simulation in virtual spaces, as well as more efficient risk management and simplified product development.
- Challenges include investments in technology, talent development, and data security.
- To successfully implement the industrial metaverse, an adequate level of digitalization and a step-by-step approach are required.

The metaverse represents the latest in a long line of digital innovations and has the potential to revolutionize people's work and lives. The communication metaverse has provided immersive experiences that expand individual interactions in social and entertainment contexts. By contrast, the application of the metaverse in the industrial sector — the industrial metaverse — creates a completely unique value by transforming real business processes and operations into a digital form, thereby accelerating efficiency and innovation.

The industrial metaverse offers a virtual reality space that replicates the real world and allows real-time simulations to test multiple scenarios. Its key features include seamless data integration and advanced simulation capabilities. A digital twin, for example, is the digital counterpart of a physical asset or process represented in a virtual space. This digital twin can simulate assets and processes from a variety of industries — from manufacturing to energy, construction, and transportation — enabling real-time monitoring, scenario testing, and optimization.

Metaverse in industry: Initial successes already visible

The positive impact of these new technologies is already noticeable in risk management, acceleration of product development, and preventive maintenance.

A digital twin combined with artificial intelligence can optimize processes by predicting urgent maintenance needs or identifying bottlenecks in production lines. Furthermore, visualizing an entire supply chain in a virtual space facilitates quick decision-making and risk management. The industrial metaverse is now also serving as a tool for sustainable decision-making: it helps reduce the environmental impact of industry by visualizing resource consumption and emissions, leading to more eco-friendly operational planning.

Industrial metaverse vs. smart factories

While both the industrial metaverse and smart factories are prime examples of the evolution of digital technology in manufacturing, EY differentiates between them. Smart factories focus on optimizing specific production processes, primarily using the Internet of Things (IoT), artificial intelligence (AI), and robotics to quantify and optimize operations in actual production lines. Smart factories also enable real-time monitoring and analysis of production data, contributing to productivity increases and quality assurance. Their added value lies in the consistent quality, speed, and flexibility resulting from a continuous focus on performance enhancement.

In contrast, the industrial metaverse utilizes technologies to replicate the real world in a digital format and the convergence of new technologies, enables more advanced forecasting and testing activities. It provides a human interface that allows for the creation of immersive 3D environments to simulate workflows, training processes, and design decisions. Analyses in a 3D space also allow for multidimensional visualization of products and processes for more detailed analysis based on larger data sets. Preliminary simulations and tests also enable the manufacturing industry to try out different scenarios and proactively address potential issues.

Benefits of the industrial metaverse

The industrial metaverse offers several benefits, including:

- Efficient risk management: Simulations during early product development can identify potential issues, allowing companies to manage risks efficiently in the product development and production processes.
- Enhanced training opportunities: Practical training based on virtual reality accelerates the development of new employees or inexperienced workers by demonstrating realistic processes in a simulated environment.
- Mitigation of current labor shortages: The industrial metaverse enables the remote operation of physical devices in real-time, alleviating the challenges of labor shortages.
- Sustainable economic activities: The industrial metaverse supports planning to minimize environmental impacts, such as optimizing energy consumption or reducing waste, by quantifying environmental burdens and simulating them in a virtual space.
- Streamlined product development: The use of digital twins at every stage of the engineering process can shorten development processes and reduce costs by identifying and correcting specific component or process issues early before they spread to other areas.

Companies should also recognize previously underutilized scenarios and emerging opportunities for overall optimization. The BIM method (Building Information Modeling) is widely used in the construction design field. However, in the future, there will be room for more effective applications in construction and maintenance management. Additionally, user-friendly tools for small and medium-sized enterprises are also conceivable. This developmental approach can fill any gaps and contribute to the success of the industrial metaverse.

Challenges in implementing the industrial metaverse

Although the industrial metaverse offers potential for productivity and efficiency gains in product development and manufacturing, several challenges hinder successful implementation:

- Technology investments and talent development: The introduction of the metaverse requires advanced technical skills. There is a need for investments in new technologies such as augmented reality (AR), virtual reality (VR), AI, and 5G, as well as securing and training talent in their use.
- Data security: The metaverse generates vast amounts of data that become critical intellectual assets for companies. Security measures to prevent information leaks are crucial.
- Improving user experience: Expertise in design and usability to develop understandable and user-friendly interfaces is key to maximizing the benefits of metaverse adoption.
- Considering social impacts: Companies must also respond to societal changes and impacts, such as changes in work styles due to the normalization of remote work and the digitization of education.

Companies tend to make decisions based on short-term metrics such as return on investment (ROI). This includes increased sales or reduced costs, while investment budgets are often allocated on an individual organizational basis. While it is often assumed that current activities are sufficient, consideration must be given to whether current systems and processes can be maintained in the medium to long term, given an aging workforce and talent shortages. A general assessment of optimization should also be made beyond the individual optimization of specific departments, encompassing design, production technology, manufacturing, and maintenance.

Strategies that consider all these factors are necessary for the future development of the metaverse. Companies that successfully navigate these challenges will be able to realize new business opportunities.

How the industrial metaverse can benefit from digital transformation

A clear long-term vision and objective are crucial for companies implementing the industrial metaverse. This paradigm shift can fundamentally change traditional business models as new technologies merge with the future of business. Implementing the industrial metaverse requires strengthening IT infrastructure, training employees, adapting management philosophies, and establishing cloud services. Leaders must demonstrate leadership skills for these initiatives and ensure close collaboration between various departments and stakeholders. Consequently, implementing the industrial metaverse requires not only the adoption of specific technologies but also a strategic perspective for organizational transformation and future leadership.

Conclusion

The industrial metaverse will launch a new era of product development and manufacturing by facilitating real-time simulations and streamlining the product development process. This technological leap promises to revolutionize the sector with unequalled competitive advantages.

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