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How deep tech can fuel the evolution of the manufacturing industry

By Rakesh Prasad, ET CONTRIBUTORS • Last Updated: Sep 09, 2023, 11:06 AM IST

Synopsis

Within the manufacturing domain, deep tech ecosystems are essential for keeping the engines running, bolstering shop floor operations and seamlessly integrating back-end and front-end functions, positioning companies for unrivaled success.

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As deep tech gains prominence, India is emerging as a significant hub for technological advancements.

Deep tech represents a captivating fusion of cutting-edge science and revolutionary engineering. It encompasses a wide array of advanced technologies, such as artificial intelligence (**AI**), machine learning (**ML**), nanotechnologies, quantum computing, and more empowering organizations to address intricate problems, ignite innovation, and build commercially viable solutions - shaping a sustainable and intelligent tomorrow.

Within the **manufacturing** domain, deep tech ecosystems are essential for keeping the engines running, bolstering shop floor operations, and seamlessly integrating back-end and front-end functions, positioning companies for unrivaled success. The possibilities of deep tech in the manufacturing domain are fascinating. A remarkable example of this prowess is the lab-grown 7.5-carat green diamond, a gift from PM Modi to Jill Biden. This exceptional diamond not only mirrors the chemical and optical properties of earth-mined diamonds but also boasts an impressively low carbon emission rate, signifying the potential of deep tech in promoting sustainable manufacturing practices.

Another intriguing advancement is the emergence of 'lab meat' and 'cultured meat,' where scientists have mastered the art of manufacturing meat in laboratories. This breakthrough holds the promise of revolutionizing the food industry, promoting eco-consciousness and offering a sound alternative to conventional meat production practices.

As deep tech gains prominence, India is emerging as a significant hub for technological advancements. Government initiatives like the Atal Innovation Mission, Niti Aayog, and Startup India are fostering accelerators and incubators to nurture deep-tech innovations. Deep tech is transitioning from being an option to a vital necessity in various fields, including healthcare, education, industrial manufacturing, and more. Listed below are some of the most promising applications that deep tech can bring forth in the manufacturing realm.

Pioneering a path to secure workspaces

Deep tech ecosystems can revolutionize the manufacturing industry, unleashing the potential of deep learning models like Convolutional Neural Networks (CNNs), Deep Reinforcement Learning (DRL), and Recurrent Neural Networks (RNNs). These models can drive transformative safety measures in automated and robotized agile-production environments. With CNNs at the helm, manufacturers can identify irregularities or unsafe practices in real-time, ensuring immediate intervention to prevent accidents. DRL can empower autonomous systems to continuously learn and refine their decision-making, creating adaptable safety protocols that protect workers in hazardous conditions. Meanwhile, RNNs can analyze sequential data, predicting workers' attention, fatigue, and distraction levels. By monitoring vital signs and physiological indicators, manufacturers can proactively address risks before they escalate.

Keeping wear-and-tear and counterfeits at bay

The convergence of Industrial Internet of Things (**IIoT**) and Cyber-Physical Systems (**CPS**) will revolutionize manufacturing practices, particularly with the integration of advanced sensors and actuators. By harnessing the power of advanced sensor technology and integrating robust tagging systems, manufacturers will gain unprecedented visibility into their products' lifecycle. The integrated sensors will continuously monitor the performance of products, detecting subtle signs of wear and tear in real-time. This will enable predictive maintenance, ensuring timely interventions to prevent costly breakdowns and downtime. Moreover, This will also play a pivotal role in combating counterfeiting. Each product will be uniquely identified, making it virtually impossible for counterfeiters to replicate or tamper with genuine items. This level of traceability will instill confidence in consumers, strengthening brand reputation and fostering trust.

Spurring innovation, inspiring new products

Deep tech ecosystems will unlock the gateway to additive manufacturing (AM), ushering in a new era of lucrative products. Design for AM (DfAM) will take the center stage, becoming an emblem of ingenuity and innovation for product development engineers. This paradigm shift will urge engineers to embrace unconventional approaches and break free from the constraints of traditional "subtractive" manufacturing methods. Armed with a powerful toolkit, engineers will

breathe life into their boldest concepts with unprecedented speed and precision. Rapid prototyping will evolve, refining and perfecting ideas at an unparalleled pace. As a result, product engineers will have the capability to craft bespoke solutions tailored to individual preferences and business needs. For example, in the medical field, AM technologies such as 3D printing can be leveraged to create patient-specific implants, prosthetics, and surgical instruments. By using AM, medical professionals can design and manufacture implants that perfectly match a patient's unique anatomy, leading to better outcomes and improved patient satisfaction.

Clearing the path for optimal routes and smarter travel

Within the realm of the deep tech ecosystem, quantum computing emerges as a revolutionary force, offering manufacturers a quantum leap in optimizing their truck fleets and streamlining logistics operations. Quantum computers harness the power of quantum bits or qubits, which can exist in multiple states simultaneously, enabling parallel processing of vast information with remarkable efficiency. Through the prowess of quantum computers, manufacturers can examine the shortest origin-destination pair for truck routes, unlocking unprecedented speed and precision in their deliveries and returns. What once demanded an astronomical number of computations on traditional computers, can be now accomplished with breathtaking simplicity on quantum machines, reducing the number of steps to a fraction. For manufacturers, this quantum advantage will mean faster, smarter, and more agile logistics.

Way forward

In the dynamic world of technological breakthroughs, deep tech will surge forward as the harbinger of the future, its influence expanding like wildfire. As it will gain momentum, almost every aspect of smart manufacturing will appear ripe for disruption. While it may not directly impact consumers, its profound impact on manufacturers will be undeniable. By harnessing the potential of deep tech, manufacturers will be able to propel their operations towards resounding success, multiplying their return on investment, and presenting customers with avant-garde products and services that ultimately benefit them. With deep tech ecosystems as its foundation, the manufacturing industry will be ready to embark on an extraordinary journey, amplifying hardware production, deploying intelligent robots capable of mobility and decision-making, adopting smart materials that champion environmental sustainability, and venturing into various uncharted territories.

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