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VIEW POINT

INDUSTRY 4.0: A LOOK INTO THE FUTURE OF MANUFACTURING

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INSIGHTS

- By 2026, half of G2000 companies will implement GenAI, resulting in a 5% efficiency gain
- Industry 4.0 processes and technologies demonstrate tangible benefits, such as reducing machine downtime by 30% to 50%
- AI-powered cobots showcase a strong potential to accelerate efficiency and worker satisfaction across factories, warehouses, and distribution centers
- Automotive manufacturers embrace the D2C route, deploying AI tools and solutions to analyze customer data and maximize order value
- Smart processes, GenAI integrations, and human-centric design will outline the future of manufacturing while focusing on net-zero operations

With it being one of the earliest adopters of technology, the *AI-fication of the global manufacturing market will only grow in a bid to make factories smarter and operations more efficient. From large-scale AI-powered automation to predictive maintenance to supply chain optimization, the use cases of AI — and most recently, generative intelligence — are expanding and garnering positive sentiments. Industry reports suggest that the manufacturing sector will invest upward of $20.8 billion in AI by 2028.*

This explosive growth can be largely attributed to the advent of Industry 4.0 (expected to grow over 20% CAGR between 2024 and 2032), which emphasizes smart factories and automated manufacturing systems, deeming AI adoption a critical part of the process. Take, for instance, the rise of AI-driven cobots that can boost manufacturing flexibility and agility. According to a kitchen manufacturer, the deployment of cobots helped them reduce welding time by 50%.

The high investment in manufacturing AI also comes from the need to drive innovation and productivity at reduced costs — as intelligent analytics capabilities enable businesses to shift to predictive maintenance, which lowers maintenance expenses and downtime costs. With predictive analytics, companies can also enhance their supply chain management, which can improve their overall customer experience.

Our research also shows that 28% of manufacturers believe GenAI will be instrumental in streamlining product development and design. In comparison, 21% are sure its most positive impact will be increasing operational efficiency and automation.

As this interest surrounding AI evolves, there will be a greater focus on accessible industrial data — simply because AI workflows can be significantly improved with the right contextual data. For instance, AI models can be easily trained on diverse and localized data sets before initializing product prototyping for more accurate and targeted outcomes. This can enhance product quality and ultimately deliver a better user experience.

This spotlight on AI and data presents a golden opportunity to glean intelligent insights that can drive performance improvements, cost reductions, and enhanced efficiency across the entire manufacturing lifecycle.

Looking ahead, the manufacturing industry is primed to capitalize on these advancements and AI potential, unlocking boundless possibilities. Here are some emerging themes and focus areas that hold immense promise in the near future.

1 GenAI Boom Across the Value Chain

Manufacturers are prioritizing GenAI for its disruptive potential across the value chain. GenAI applications, trained on vast industrial data sets, are taking enterprises closer to realizing their dream of a "factory of the future." Based on these trends, a significant shift in manufacturing operations, driven by GenAI, can be expected by 2026.

IDC predicts that half of G2000 companies will implement generative artificial intelligence within the next two years, resulting in a 5% efficiency gain through improved data management and operator support.

As such, here's a closer look at some of the most interesting use cases:

Accelerated Product Design Prototyping:

Generative AI can significantly expedite the product prototyping phase by analyzing vast amounts of historical and current data to generate product designs for prototypes. This leads to fewer iterations, ultimately resulting in a faster journey to the final design.

Effortless Product Catalog Creation:

Generative AI, when trained with product master data, can ensure content syndication and user-friendly product catalog creation that includes images and videos. Natural Language Processing (NLP) can then be employed on top of this to generate relevant product descriptions and other content that effectively highlight key features and benefits.

Text-to-Image Design Generation:

This application will enable the creation of swift product designs that adhere to both engineering and manufacturing best practices and standardizations. GenAI can easily combine basic design sketches, 3D models, and engineering plans to generate the optimal design based on targeted needs.

Intelligent Contract and Agreement Management:

Generative AI can extract critical information such as pricing details, key clause attributes, and expiry dates from lengthy contracts. This facilitates swift review and identification of areas for potential enhancements or safeguards.

Streamlined R&D Patent Summary Generation:

Generative AI can assist IP teams in efficiently analyzing existing patents, literature, and research publications, providing concise and contextual summaries of relevant content. This will accelerate the entire patent filing process by enabling rapid external patent website crawling and content summarization.

Supply Chain Optimization and Inventory Management:

Real-life supply chain and inventory management scenarios often draw on vast quantities of data. Generative AI will be instrumental in generating synthetic data to simulate real-life scenarios along the supply chain to predict demand fluctuations and optimize models. This can determine required inventory levels, identify the most suitable suppliers, and prevent stock-outs. Additionally, generative AI can be leveraged to assess supplier risk and establish informed and proactive communication channels with suppliers for early risk mitigation.

2 Smart Manufacturing for Smarter Ecosystems

Industry 4.0 technologies, processes, and systems will continue to reshape manufacturing well into 2024 — encouraging the growth of more interconnected and intelligent manufacturing ecosystems. This positions the industry at the forefront of digital innovation, powered by technologies like AI, IoT, cloud computing, and data analytics.

Driven by the promise of increased efficiency, reduced costs, and superior product quality, industries like automotive, aerospace, electronics, and pharmaceuticals are rapidly integrating smart manufacturing into their operations.

But why are manufacturers sold on the smart dream? McKinsey reports hint at tangible results — indicating the potential to lower machine downtime by 30% to 50% and minimize quality-related costs by 10% to 20%, among other benefits.

Governments are also incentivizing the growth of smart manufacturing. For example, President Biden's Bipartisan Infrastructure Law allocated $50 million to states, specifically to improve the accessibility of smart manufacturing technologies and high-performance computing for domestic manufacturers.

This shift towards smart manufacturing will thus see an increased convergence of IT and OT processes to break down traditional silos and support a responsive ecosystem where data-driven production lines thrive. In a smart ecosystem, manufacturers gain real-time visibility into their entire operation. Consider production line data that can be seamlessly integrated with your enterprise resource planning (ERP) systems. This will allow for immediate adjustments to production parameters based on real-time insights, thus increasing process efficiency and resource productivity.

Since smart manufacturing relies on a network of connected devices and sensors and is driven by the Internet of Things (IoT), with IT/OT convergence, these devices can easily integrate with existing IT systems — enabling centralized data collection, analysis, and control. Thus, in a cognitive ecosystem, manufacturers can easily gain visibility into production operations, inventory, and supply chains, empowering traceability, self-healing actions, better productivity, and intelligent decision-making.

3 A Data-Driven Journey to Net Zero Operations

There's increasing pressure on manufacturers to go green and comply with ESG mandates. One because it breeds credibility among stakeholders and customers, and two because it positions them for future success. There is also the need to align with evolving trade agreements — for instance, the United States-Mexico-Canada Agreement (USMCA) mandates 75% local content thresholds for automotive manufacturing.

Recently, it has also been realized that embracing sustainable practices can reduce costs through optimized resource utilization, increased use of recyclable components, and waste minimization. Technologies brought forth by Industry 4.0 (IoT, smart sensors, wireless connectivity and automation) and driven by data and AI can help realize this vision sooner — serving as critical enablers on the mission to achieving net zero operations.

Strategic implementation of these technologies can impact sustainability across the value chain, right from the product conceptualization stage to the final stages of manufacturing and distribution. The right approach to this is by standardizing data to drive AI initiatives such as environmental reporting and monitoring, and process and resource optimizations while readily adhering to regulatory compliances.

For example, real-time sensor data from the factory floor can be looped with AI to analyze daily energy consumption and identify improvement areas. Or, AI can also be utilized to analyze shipping data and weather patterns from multiple sources to optimize delivery routes, thus reducing fuel consumption and emissions during distribution.

4 Human-Centric Manufacturing With Cobots

The cobots have arrived at the manufacturing frontlines, as the industry grapples with worker well-being and a lack of skilled labor. Building upon the advancements of Industry 4.0, this year will see a rise in meaningful collaborations between humans and machines within the digital ecosystem. This translates to the widespread adoption of collaborative robots or cobots across factories, warehouses, and distribution centers.

Cobots can work alongside human factory operators to take over repetitive, tedious, or hazardous tasks such as picking, packing, or handling dangerous materials. For example, cobots can be deployed to lift heavy car parts and hold them steady while human workers secure the fastening. Or, they can also be used in food processing facilities for lifting and stacking boxes precisely, freeing up human workers for tasks requiring more dexterity and problem-solving skills.

To enhance the efficacy of cobots, machine learning will play a key role. Audio, video, and image data captured from human-machine interactions on the factory floor must be used to continuously train and refine cobot behavior.

Furthermore, the advent of cognitive AI will augment cobots with more complex capabilities. These advanced cobots will soon be able to recognize and respond to speech commands, facilitating a more natural and intuitive human-machine interaction within the factory environment — thus, opening the doors to improved efficiency, safety, and worker satisfaction.

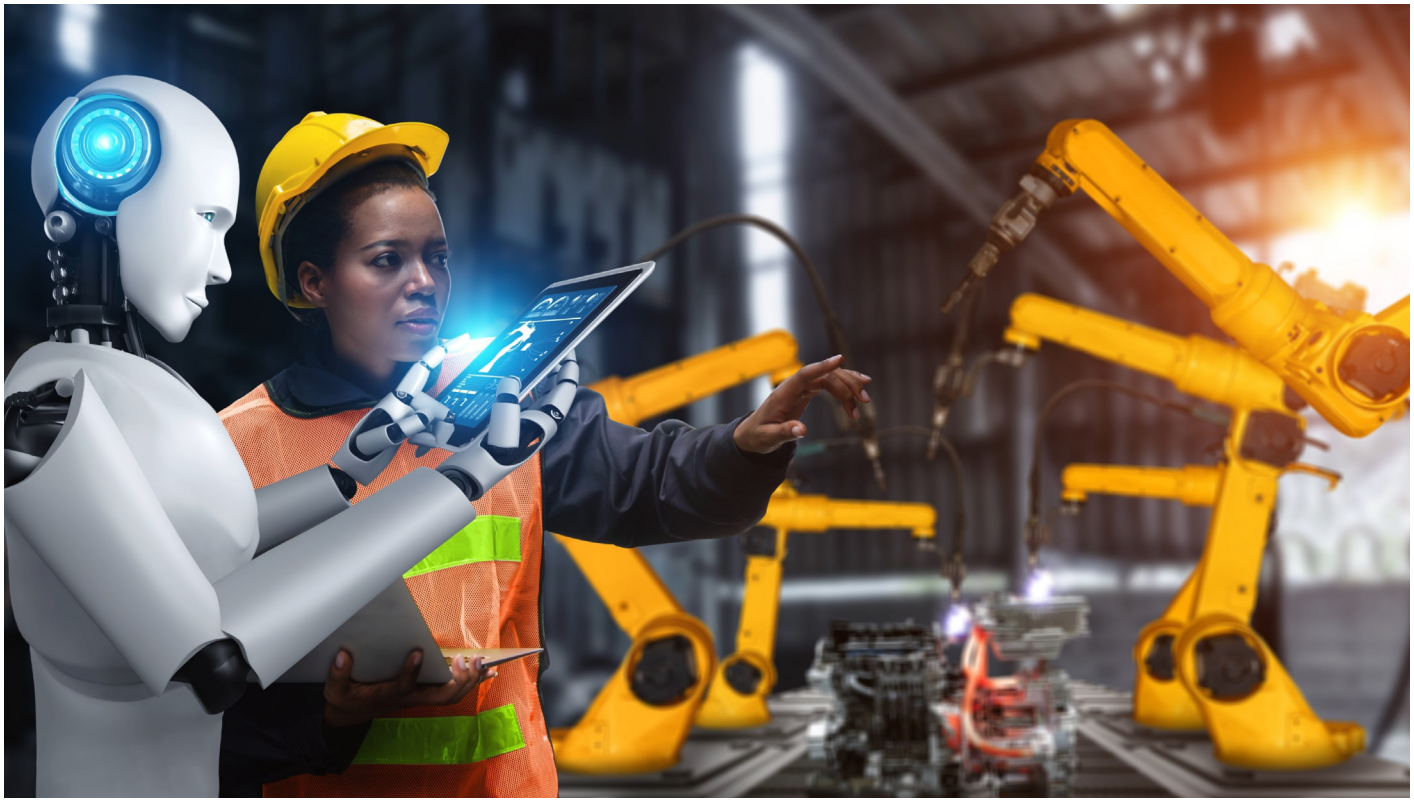
5 Engaging D2C to Build Brand Loyalty

Traditionally, manufacturers relied on a trusted network of dealers and distributors to reach consumers. However, like retail, they are warming up to direct-to-consumer (D2C) models — posing exciting new avenues for engagement and sales. For example, many car brands, including luxury vehicle company BMW, are shifting to D2C models, allowing them to bypass traditional dealerships and sell directly to consumers online. This also limits the need for physical showrooms, and now brands can invest in selected showrooms for unique experiences while pushing sales through their website or app. This can potentially lower prices for customers while streamlining their purchase journey.

So, how does this impact manufacturing?

While presenting powerful opportunities, D2C also presents significant challenges. Manufacturers are now solely responsible for managing all aspects of the customer journey, including marketing, order processing, fulfillment, shipping, and customer support.

To navigate this wave effectively, manufacturers must leverage targeted data to segment customers and gain deeper insights into their preferences for developing hyper-personalized experiences. From implementing intelligent chatbots to assist customers to offering curated product recommendations and delivering personalized content and communication — they must utilize AI tools and solutions to analyze rich customer data and increase customer satisfaction, cultivate brand loyalty, and maximize order value.



Overcome the Roadblocks Along the Way

This decade will see manufacturing organizations focus on building a cognitive core that will automate the end-to-end manufacturing, distribution, and aftermarket processes to become more intelligent, sentient, and resilient to adverse macro and micro economic factors. But, there are obstacles they must overcome to achieve this vision:

One of the most persistent challenges is the availability of quality data at scale for AI use cases. Data, as has been established, is the key ingredient in the recipe for transforming this industry and making it future-ready. Thus, going forward there needs to be a conscious and continuous effort in this direction.

With multiple regional and country-level regulations in place across Europe, India, and the US, data privacy and security are at the center of data collection, handling, and consumption. With the recent AI boom and experimentation with cognitive use cases, there is a pressing need to ensure unbiased and ethical AI usage.

There is also the matter of an ongoing debate by policymakers who are pushing to frame regulations surrounding the design, utilization, and deployment of AI-based automated systems. Manufacturers of all shapes and sizes must be privy to these and adhere to them when implementing AI-based solutions and services — ensuring these are explainable, consistent, unbiased, and trustworthy.

In a connected ecosystem, data theft and cyber-attacks have emerged as threats to business survival and brand reputation. Manufacturers must prioritize securing R&D, IPRs, and factory and enterprise data from malicious attacks to prevent business disruptions — this will require adequate investments and efforts.

Several large manufacturing enterprises still run on legacy systems that are rich with a wealth of information. To harness the full capability of AI, these traditional systems need to be integrated and made a part of the AI value chain. More importantly, it has to be supplemented with the right data strategy and management policies to enable access, extraction, and proper processing of existing data to derive business insights and guide AI actions.

AI is still a growing field that completely reimagines the way we work. Hence enterprises must make change management an essential part of their company culture and vision to drive adoption. This would include rolling out upskilling programs for the current workforce and ensuring communication to keep them informed and assured.

Become Future-Ready at the Right Time

Manufacturing is ripe for a futuristic leap, building upon investments in data ecosystems, integrated cloud-based platforms, and AI-driven smart processes. This will be a collaborative journey fueled by robust partnerships with suppliers, customers, and leading technology vendors.

In the coming years, manufacturers will also be experimenting with GenAI use cases to push the boundaries of innovation and unleash greater scalability, ROI, and efficiency in production processes. However, the true differentiator will be in creating a sustainable data and AI operations framework that also delivers tangible business outcomes. This framework will encourage continuous learning, retraining, and the adaptation of ideas and solutions — outlining a future where AI remains a strategic tool for transformation, and not another latent technology.

Infosys Topaz is an AI-first set of services, solutions, and platforms using generative AI technologies. It amplifies the potential of humans, enterprises, and communities to create value. With 12,000+ AI assets, 150+ pre-trained AI models, 10+ AI platforms steered by AI-first specialists and data strategists, and a 'responsible by design' approach, Infosys Topaz helps enterprises accelerate growth, unlock efficiencies at scale, and connected ecosystems.
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