



GENERATIVE AI IN MANUFACTURING: 4 THINGS YOU NEED TO KNOW

Here's what you need to know to advance your own AI strategy.

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INTRODUCTION

Generative AI is revolutionizing the manufacturing sector, driving unprecedented levels of innovation and efficiency. When implemented at scale, gen AI can identify inefficiencies and suggest improvements, leading to optimized production processes. It can streamline complex product design and supply chain processes, promoting greater innovation and faster, more cost-effective product delivery. It can enhance supply chain resilience, improving demand forecasting and optimizing inventory levels to reduce disruption. It can help manufacturers minimize waste and optimize resource usage, supporting sustainability goals and circular economy models while decreasing costs. And ultimately, it can drive higher profits.

For these reasons, more than **70% of manufacturers** plan to invest in AI systems over the next two years. This surge in investment is reflected in global spending on gen AI, which is **expected to skyrocket**¹ from nearly \$16 billion in 2023 to \$143 billion by 2027.

As with any technology, however, gen AI comes with its own set of risks and challenges, causing manufacturers to approach it with a mixture of excitement and caution. Key concerns include the security and governance of sensitive data, the complexity of integrating the technology into existing systems, and the difficulty of sourcing skilled AI/ML experts in the industry. These challenges necessitate a well-thought-out approach to AI adoption that balances innovation with risk management.

The first step to realizing the full potential of gen AI is a strong data management strategy. Without data, AI systems lack the foundation needed to provide recommendations for process optimization, make accurate supply chain predictions, and drive effective decision making. Proper data management helps ensure that the information fed into AI models is accurate, relevant and up to date, enabling the technology to deliver its full benefits.

In this ebook, we explore how manufacturing companies are leveraging gen AI to drive profit, addressing the challenges they encounter when adopting AI, and navigating the evolving AI landscape to stay at the forefront of innovation and ahead of competitors.

How Gen AI Powers Conversations with Data

Gen AI applications are built on top of large language models (LLMs). LLMs are deep neural networks trained to understand the meaning and structure of human language by exposing them to enormous volumes of data. With the right training data, this allows any user to have back-and-forth conversations with the AI about almost anything.

The ability to “converse” with gen AI models in a natural way minimizes the need for special syntax or technical expertise, removing many barriers to AI adoption. Gen AI’s ability to interact conversationally and summarize content drawn from a deep well of data allows it to be applied across a wide range of business use cases.

LLMs are often trained primarily with internet data. Due to the breadth of training data and the nature of these LLMs generally, they may “hallucinate” (i.e., provide incorrect responses) when providing outputs. To deliver more value in the manufacturing industry, it is ideal for foundation LLM to leverage proprietary datasets, typically through processes like fine-tuning or retrieval-augmented generation (RAG). These processes require very little investment as compared to training a full LLM.

GEN AI USE CASES FOR MANUFACTURING COMPANIES

Only **17% of manufacturers** in a recent industry survey said they use generative AI regularly. But that's about to change. According to the **National Association of Manufacturers Board**, "all possible futures for modern manufacturing in the U.S. involve AI. This technology is a game-changer, and it will continue proving itself to be an essential partner on the shop floor."

Gen AI applications can be used in virtually every part of a manufacturing company because they often require only natural language inputs, meaning that even nontechnical users can deploy them. This simplicity makes possible a range of applications across the business, including, but not limited to, the following:

SHOP FLOOR EFFICIENCY

Gen AI harnesses data from multiple sources to increase efficiencies in production processes. It can monitor energy systems in real time and analyze data to predict failures and provide suggestions on how to optimize energy usage. Gen AI can also analyze shipping and logistics routes and processes and suggest changes to minimize transit times and costs. Conversational assistants can provide real-time updates on autonomous vehicles and robots and answer queries about their operation and performance. In addition, they can enable managers to easily access the data in maintenance logs and service records, and manage and schedule maintenance. With text processing, users can receive automated updates of maintenance records and generate detailed repair documentation. They can also automatically generate and update technical manuals, standard operating procedures and escalation handling procedures.

QUALITY CONTROL

Gen AI enables manufacturers to maintain rigorous quality control while continuously improving their processes. Gen AI can monitor processes in real time to alert managers about deviations that may cause issues in the production line. Through sophisticated anomaly detection algorithms, AI can identify product

defects or inconsistencies by analyzing production data, ensuring that only high-quality products reach the market. Conversational assistants facilitate quick access to maintenance logs, enhancing issue tracking and allowing teams to respond promptly to quality concerns. Text processing and generation allows for the creation of up-to-date technical manuals and standard operating procedures (SOPs) that align with the latest quality standards.

SUPPLY CHAIN AND BUSINESS PLANNING

Gen AI equips manufacturers to navigate complex supply chain and business challenges with more agility and precision. It can analyze historical data and emerging trends and provide accurate predictions of future sales, facilitating manufacturers in optimizing inventory levels and avoiding stockouts or overstocking. AI facilitates supply risk management through supplier performance analysis, allowing companies to monitor key metrics and identify potential risks early on. It also evaluates geopolitical factors that may impact supply chain stability, helping manufacturers develop proactive strategies. Documentation and reporting capabilities automate the generation of repair documentation and ensure service records are comprehensive and up to date. They also aid in creating and updating SOPs to reflect changes in supply chain processes, enhancing overall efficiency and adaptability.

CHALLENGES FACING GEN AI IN THE INDUSTRY

In a highly regulated industry where protecting intellectual property is crucial, gen AI may pose additional challenges around data privacy, security and compliance. Organizations may also grapple with difficulties implementing the technology effectively and adapting their business to optimize gen AI's effectiveness.

DATA CHALLENGES

- **Securing data during training:** Organizations planning to use their proprietary data to fine-tune an off-the-shelf foundation model could risk exposing that data to other users of that model, depending on the security of their training environment. The training data may include personally identifiable information (PII) and/or intellectual property.
- **Securing data during use:** Because some gen AI systems may learn based on the prompts entered by their users, individuals could inadvertently share personal or proprietary data while using them. That data could then be subsequently exposed to people outside the organization.
- **Managing regulatory compliance:** Beyond addressing issues of data privacy and security, manufacturing companies will need to ensure that any outputs generated by gen AI are compliant and consistent with industry expectations and government regulations — human review remains an important tool.



TECHNOLOGY CHALLENGES

- **Managing technical complexity:** Very few enterprises possess the resources to develop their own LLMs. This is why most organizations will fine-tune or run customizations on top of pretrained foundation models (such as GPT4, BERT, LLaMA or Mistral AI) using their own data. But even then, data science expertise will be required. The foundation model must be fine-tuned specifically to the organization's data, requiring expertise in model governance and gen AI development.
- **Meeting high resource demands:** Developing a foundation model requires enormous amounts of structured and unstructured data, which must be stored and managed within a cohesive environment such as a data lake. The training process will also require significant amounts of computing power, typically massively parallel banks of GPUs.
- **Minimizing data movement across applications:** Fielding requests for AI-powered apps from every business unit puts pressure on internal developer teams to create siloed copies of data, and opens data risks when teams onboard third-party apps with LLMs that access their own data. A modern cloud-based data platform, where the data and the LLM remains within a governed boundary, is a more secure approach to scaling adoption of gen AI applications.

ORGANIZATIONAL CHALLENGES

- **Realigning your workforce around AI:** Whether gen AI systems will increase employee productivity, replace some workers or simply automate many routine tasks, the ways in which it may free up employees' time to perform more strategic work will likely vary from one organization or department to the next. Either way, organizations must consider how to manage what is likely to be a fundamental shift in how their labor force functions.
- **Preventing AI hallucinations and other inaccuracies:** Gen AI systems may occasionally produce content that sounds true but isn't — a phenomenon known as a hallucination. This may pose compliance risks and may even open the door to legal implications. Manufacturing companies must take special care to fact check any materials produced by gen AI systems to ensure that hallucinations do not slip through the cracks.
- **Mitigating intentional misuse and abuse:** Gen AI models can be maliciously used to generate deliberate misinformation, posing a compliance risk, or they may be prompted to generate code with intentional "back doors" that make an enterprise vulnerable to cyberattacks. Ensuring proper guardrails around AI use within the enterprise is critical.
- **Avoiding algorithmic bias:** Concerns about inherent bias have plagued ML models for years, and gen AI is not an exception. Insufficiently diverse or poorly vetted training data can taint the outputs produced by gen AI models. For example, a model trained on historical loan performance data skewed to a particular demographic may produce unfair creditworthiness assessments for individuals who are not members of that demographic. Training data lineage is important to consider before relying on a model to make decisions.
- **Training your workforce to use AI the right way:** It is likely that all employees will need to adapt their workflows to accommodate gen AI tools. But in addition to teaching workers how to use these tools, education in the ethics of how and when to use AI will likely be required.

MANUFACTURING COMPANIES REQUIRE A ROBUST DATA STRATEGY

The fundamental ingredient in every enterprise AI strategy is data. An AI model is only as good as the data upon which it's been trained. But that data cannot exist in a silo — or multiple silos. It needs to be clean, reliable, accessible and governable.

Before any retail or consumer goods company begins to implement gen AI, it first needs to deploy a robust data strategy. Integral to an organization's strategy is a modern data platform that collects data in one place, secures it, shares it and allows the enterprise to apply uniform and granular governance policies to it. That platform may be cloud-based, which allows for easier collaboration between internal and external stakeholders, as well as the ability to ingest data from outside sources such as partners, agencies and third-party data vendors.

Here are three key steps you need to take to implement a robust data strategy:

1 BREAK DOWN SILOS

According to an IDC enterprise survey, 90% of respondents say their data is unstructured, and 50% say their company's unstructured data is mostly or completely siloed.² Keeping data siloed makes it harder to share, which impedes collaboration and slows the pace of innovation. Collecting data in one place is a necessary first step toward getting it ready for AI. A modern data platform can gather data in a single location and make it accessible for training purposes without compromising its integrity.

2 BUILD A FLEXIBLE, SCALABLE DATA INFRASTRUCTURE

Modern IT environments are rarely homogeneous, and this is especially true for manufacturing companies. Hybrid on-premises and multi-cloud architectures are the norm. Regardless of the diversity of cloud and on-prem systems in the mix, companies across the industry need the ability to coalesce huge volumes of first- and third-party data, while also enforcing strict data governance and security policies. A modern data platform is critical for securely sharing and analyzing data across the organization without compromising any sensitive or proprietary information, or running afoul of security mandates.

3 LEVERAGE MODERN DATA CLOUD PLATFORMS

Modern cloud-native platforms like Snowflake offer several key advantages over legacy solutions. They make it easier to collaborate with internal and external partners in a secure, governed manner. By applying robust governance policies across enterprise data, manufacturing companies can preserve customer privacy, monitor data access on a use-case level, and revoke access when policies are violated. Support for cloud-native technologies such as serverless computing and containers makes it compatible with all major cloud platforms, avoiding lock-in and the onerous ingress and egress fees many vendors charge to move your data between clouds.

Snowflake Cortex: The Smart Way to Build Apps Powered with Gen AI

As manufacturing companies capitalize on the potential of gen AI apps to drive innovation, they'll look to create their own customized models using data they can control. **Snowflake Cortex** is an intelligent, fully managed service that hosts and serves industry-leading LLMs, ML models and vector functions. Snowflake Cortex allows you to analyze your proprietary data quickly and securely, then build custom AI apps, such as document chatbots, around that data.

Snowflake Cortex is a solution we used to build key applications in the Snowflake Manufacturing Data Cloud, including Document AI (which extracts structured data from PDF files, in public preview), Snowflake Copilot (an LLM-powered coding assistant tailored to your data), and Universal Search (a discovery tool for data clouds).

Using Snowflake Cortex's library of serverless SQL and Python functions, companies across the industry can quickly build contextually rich applications using the combination of LLMs and vector search functions (private preview). Coupling Snowflake Cortex with **Snowpark Container Services**, developers can quickly customize the AI infrastructure components, including any open-source LLM or vector database as well as other app components in Snowflake. This offers ultimate flexibility, from the application UI down to fine-tuning an LLM.

THE FUTURE OF THE INDUSTRY IS GENERATIVE

Gen AI facilitates a fundamental shift in organizational strategy. Companywide workflows, software and jobs will be transformed. Every member of the C-suite will need to consider how AI will impact their business.

It's also an exciting time for manufacturers looking for ways to rise above the competition. Gen AI solutions offer new capabilities that will enhance operational efficiency, drive innovation in product development and empower data-driven decision making. But getting there requires companies to get their data houses in order by adopting a modern, cloud-native data platform.

For more information on how to achieve your AI objectives, visit our [AI Data Cloud for Manufacturing](#). And if you want to take a deeper dive into gen AI, check out [The Essential Guide to Generative AI](#).





ABOUT SNOWFLAKE

Snowflake makes enterprise AI easy, efficient and trusted. Thousands of companies around the globe, including hundreds of the world's largest, use Snowflake's AI Data Cloud to share data, build applications, and power their business with AI. The era of enterprise AI is here.

Learn more at snowflake.com (NYSE: SNOW)



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CITATIONS

¹ IDC Report, GenAI Implementation Market Outlook: Worldwide Core IT Spending for GenAI Forecast, 2023–2027, doc #US51294223, October 2023

² IDC White Paper, sponsored by Box, Untapped Value: What Every Executive Needs to Know About Unstructured Data, doc #US51128223, August 2023