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Generative AI in the manufacturing Industry

Introduction

Generative AI helps organizations create competitive advantage through unique capabilities.

The manufacturing industry is continuously evolving—striving to improve efficiency while reducing cost and improving the customer experience (CX). All this is set against a backdrop of growing customer expectations, rapid market fluctuations, and the rising need for sustainable practices.

Generative AI (gen AI) offers promising solutions to these challenges. By leveraging the power of gen AI, manufacturers can analyze large volumes of diverse data in real time to gain contextual insights. They can also evaluate designs quickly, thus improving efficiency and productivity, and drive down costs in the supply chain. It can also serve as a sort of co-pilot for operations and customer service organizations—again, boosting productivity while reducing the cost of errors.

What is gen AI?

Gen AI represents the forefront of artificial intelligence, focusing on creating contextually appropriate content. In general, the term refers to a type of neural network that can create updated content based on human instructions. The large language models that underpin gen AI have been trained on vast amounts (typically more than a billion parameters) of text data, enabling them to comprehend and generate human-like responses in natural language.

Instead of relying solely on historical data, gen AI focuses on generating new instances of data that resemble the training dataset. Gen AI algorithms, such as generative adversarial networks (GANs) or variational autoencoders (VAEs), learn underlying patterns and characteristics of the data and use this knowledge to generate new data points.

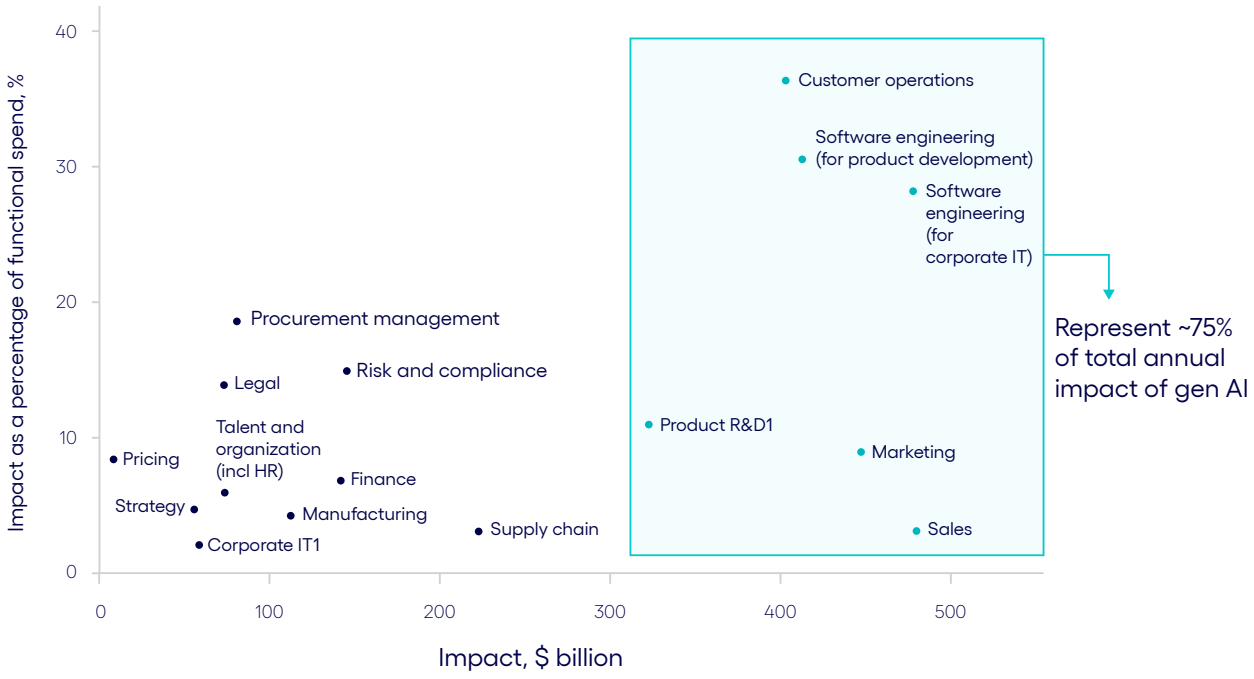
Fundamentally, gen AI tools perform four key things well:

- Generating new content with little or no guidance.
- Summarizing existing content in a manner that can be understood by the target audience.
- Holding intelligent conversations with a human-like understanding of various domains.
- Performing chain-of-thought (CoT) activities.

Gen AI potential for manufacturing industry

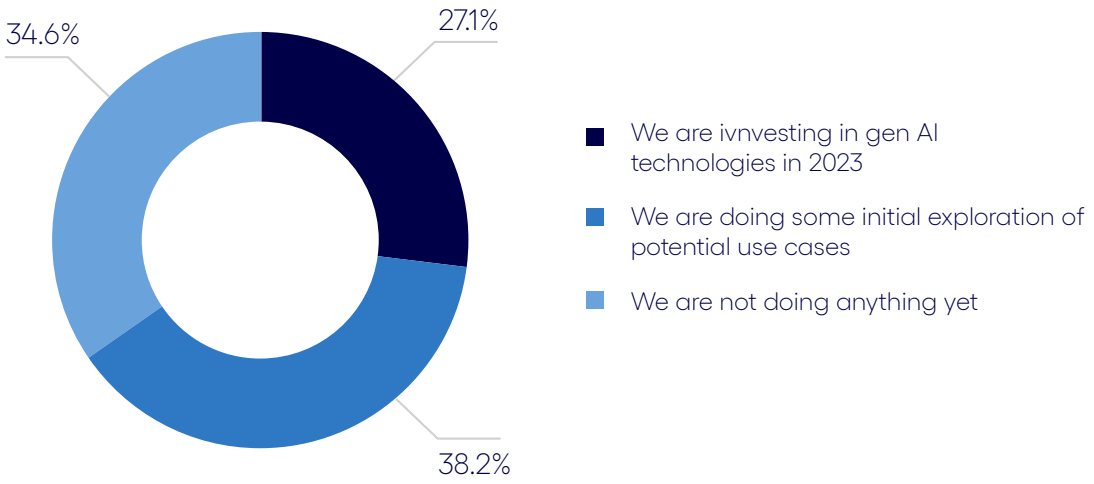
Gen AI offers immense potential to drive productivity, improve user experience, across key areas of the manufacturing industry such as after-sales operation, research and product development and marketing and sales. Multiple analysts—McKinsey, IDC and Gartner—are expecting similar areas to benefit from gen AI.

McKinsey has identified customer operations, marketing and sales, software engineering, and research and development as four key areas that could account for approximately 75% of the total annual value from gen AI use cases in a recent report on gen AI.



IDC published its findings from the manufacturing industry survey, which found out that 27% of the companies are actively investing in gen AI technology. The industry overall is expected to realize greater impact from gen AI, considering the excessive costs of operating and maintaining industrial/production equipment.

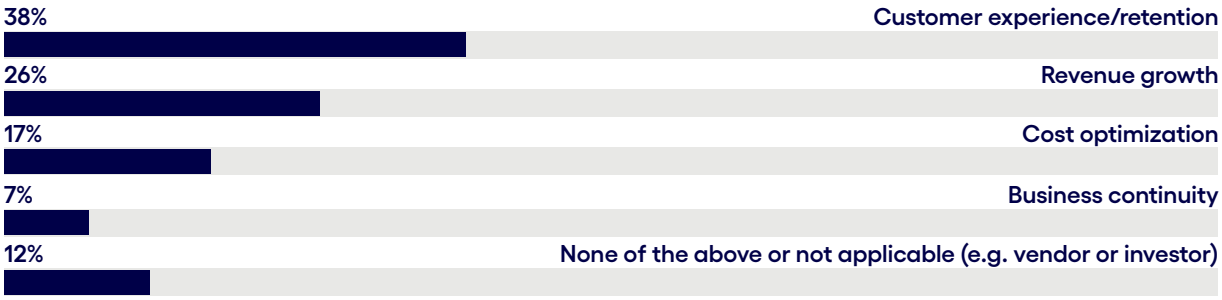
What is your organization's current approach to gen AI?



Gartner predicts gen AI's initiatives would be mostly focused on improving customer experience and retention, followed by revenue growth by building applications or processes to drive new revenue streams.

While there are differing views on the use of gen AI for manufacturing, there is overwhelming agreement that it will offer a disproportionate advantage to companies and will be extremely beneficial to their workforces, and to the organizations themselves.

Primary focus of gen AI initiatives



Gartner

gartner.com

We at Cognizant, through interactions with our customers, and prospective discussions, have identified a set of use cases where gen AI can drive competitive advantage for the manufacturing industry. While these use cases are not exhaustive, gen AI use cases are broadly classified into three categories:

Conversational

Human-like conversations with customers, suppliers, and more.

Referential

Refer, summarize, and interpret information such as contractual documents and more.

Creative

Create new content such as documentation, product design enhancements, software code and more.

As gen AI technology evolves, some of the generative models have gained traction in the manufacturing space for their wide-ranging applicability across manufacturing value chain. Below are some of the models, and their relevance for the manufacturing industry.

Gen AI model	Description	Application in manufacturing
 Variational autoencoder (VAE)	• Often used in image and video processing • Works by taking in input image and encoding it into a lower-dimentional representation, which is then decoded to produce an output image	• Intelligent quality control • Product servicing • Smart operational technology systems management (OTSM)
 Generative adversarial networks (GANs)	• Used to generate new data samples that are similar to the training data (generator) • Accurately classify the data as real or fake (discriminator)	• Document generation, search and synthesis • Inbound/outbound marketing • Product R&D
 Recurrent neural networks (RNNs)	• Used for sequential data processing, such as natural language processing and time-series analysis • Output of each step is used as the input for next step	• Better CRM, CX and Customer seft-service • Product and process development
 Long short-term memory (LSTM) networks	• Type of RNN that is designed to handle long sequences of data which can be complex and difficult to analyze • LSTMs can learn to recognize patterns in data that occur over a period of time	• Informed procurement decisions • Smart supplier management contract negotiation and optimization • Digital twin powered by gen AI

Early interest use cases

While the gen AI technology is still evolving, the industry is investing in a few use cases in parallel, to leverage the technology's ability to process large volumes of data and offer contextual intelligence. Here are three of those areas and use cases where we see early investments. Through these experiments, organizations are testing the waters, with a commitment to expand the usage of gen AI to other parts of their manufacturing supply chain.

Maintenance/service advisory

Product servicing

- The manufacturing industry relies on a large workforce to support the after-sales service needs of their customers. This workforce needs extensive training, and years of experience to gain the expertise required for faster issue diagnosis and resolution. Gen AI offers an opportunity to simplify this with the ability to process large volumes of data from the user manuals, service manuals, and analysis of past diagnosis and resolution information to diagnose service issues quickly and suggest resolution for maintenance service personnel with greater accuracy. For manufacturing organizations and their customers, this reduces the overall equipment downtime, and helps build product trust with customers..
- Companies like Embassy of Things and Cognite have ventured into gen AI to train and validate their predictive maintenance models (with Twin Talk GPT) and enhance asset performance management (with Cognite Data Fusion), respectively.
- Cognizant is working with a top elevator manufacturer, leveraging the gen AI technology to develop a maintenance advisory solution that can ingest thousands of pages of product specs, log data and FAQs into an application that can respond with natural-language chat or a speech interface. This will enable technicians to diagnose and resolve problems much faster, without having to consult other systems or experts.

Smart operational technology support and services

- Gen AI enables IT support professionals to easily troubleshoot and resolve operational technology (OT) issues without extensive prior knowledge or training of specific technologies.
- OT support requires extremely specific skill sets and relies heavily on a limited number of workers. Smart OT Support is an effective way to reduce the mean time to repair, so that support workers can be more productive. Other benefits include less uncertainty surrounding issue resolution, better issue prioritization, query handling, and offline analysis..
- By capturing historical data and making it digestible, gen AI helpdesks can assist users in sifting through information. It can enable users to resolve issues with easy-to-follow instructions and clear process descriptions.

Intelligent quality control

- Manufacturers are constantly implementing and finding new avenues to minimize errors, and defects in products during the manufacturing process. Gen AI offers the potential to predict potential issues by analyzing vast sets of test cases and quickly spotting trends, recurring issues, and potential points of failure in new or modified products. This allows manufacturers to realize improved process accuracy and efficiency, scalability, broader coverage on risk assessment and improved product quality.
- Aerospace company Airbus is using gen AI to power AR (augmented reality) glasses for more efficient and accurate quality control. These glasses transmit data captured from drones to the AR glasses and tablets, enabling the user to easily digest the data.

Gen AI-powered digital twins

- The synergy of gen AI and digital twins offers an opportunity to create virtual worlds, using real-time information, that can mirror reality with detailed simulations to support predictive maintenance, minimize costly repairs and identify potential bottlenecks ahead of time.
- As gen AI technology progresses, we will see organizations progress from an early stage of modeling to a more connected digital twin and then a digital twin that uses real data (predictive twin/live data twin), updating in real time and then eventually helping businesses forecast the future (of your shop floor, for example).

Contract advisory

Smart supplier contract management

- Gen AI has the potential to revolutionize contract management by tracking, analyzing and automating compliance processes, generating standardized and customized templates that can reduce the overall costs and time involved. It allows manufacturers to get ahead of compliance issues and expedite remediation.
- Such systems can set alerts for contractual commitments, clause deviations, data privacy commitments, contractual obligations regarding data breaches and much more, thus improving overall compliance.
- Companies like Ironclad, Evisort and Spotdraft have already integrated gen AI with contract management systems to speed up negotiation and contract generation, and review process. gen AI can identify and categorize types of contracts from your database into groups based on type and function, using pattern-matching algorithms.

Data insights

Informed procurement decisions with market data

- Through its ability to process large volumes of external data to identify comparable products and competing suppliers, gen AI offers a unique opportunity to benchmark product, quality and cost information, and drive recommendations for minimizing the overall cost of purchase
- Sourcing and procurement functions can benefit using gen AI across areas from spend capitalization to guided buying/purchasing processes, thus enabling companies to make well-informed decisions with high value realization.
- An autonomous sourcing start-up Globality Inc. has launched a gen AI based conversational chatbot called “Glo” in its procurement platform to gain insights on the supplier and product data that is already implemented by many of its clients to make informed decisions around purchasing products and identifying suppliers.
- Gen AI-powered methodologies can uncover potential opportunities, provide benchmarks, and indicate supplier risk positions by utilizing immense amounts of external data such as market indexes, company credit ratings and publicly available information about suppliers.

Potential use cases

Gen AI is in the initial stages of maturity, and as society is starting to realize its benefits, Cognizant has identified additional use cases where gen AI would be relevant across the manufacturing value chain.

Research and design

Transformation of product R&D

- Research and design are the backbone of any successful product development effort in the manufacturing sector. Gen AI will enable manufacturers to iterate very quickly through a broad variety of design ideas, choosing which model best fits their needs. What was once a time/cost-consuming process will now be streamlined with gen AI.
- **Early research analysis:** Researchers use gen AI to enhance market reporting, ideation, and product or solution drafting.
- **Virtual design and simulations:** Researchers use gen AI to generate prompt-based drafts and virtual designs, allowing them to iterate quickly with more design options.

Toyota research institute researchers have developed a process that uses gen AI to implement constraints to the design process, producing specific, innovative design solutions.

Sales and marketing: Revolutionize content generation

Inbound and outbound marketing communication workflows

- Gen AI has tremendous potential to improvise customer targeting by leveraging machine learning algorithms to identify patterns and trends in customer buying behavior and hence tailor sales and marketing strategies to specific customer segments. This can also optimize product recommendations to customers.
- Lead generation, follow-ups and conversion become more effective using gen AI, as the sales team can tailor its pitch to specific customers based on the latest market information.

After sales services: Transforming customer operations

- Customer service is another area that can benefit from gen AI, to offer real-time responses, multilingual support, better service availability, and autonomous, impactful insights to customers.
- Customer self-service interactions: Customers can interact with a human-like chatbot that delivers immediate, accurate and personalized responses sourced from voluminous documents such as user manuals, product installation guides, etc., to answer complex queries and ensuring brand voice regardless of customer language and location.

A new tool called Air can do 5 to 40-minute customer service calls and it sounds like a human responding. It can work autonomously and can perform actions across different apps.

Document creation, search, and synthesis

Interacting with and auto-generating logistics documents

- The time-consuming and meticulous process of generating and searching through and drafting logistics documentation (such as BOL, POD, rate confirmations, Invoices, etc.) can be streamlined and standardized with gen AI. This can reduce errors, decrease resolution cycle time.
- Enabling chat with the documents can help gain insights and information even from different document types which contain images, scanned PDFs, digitized PDFs, etc., making reading of documents faster.
- Microsoft's Document Generative AI, that combines technologies like Azure AI, document intelligence and Azure OpenAI Service with cognitive search as its knowledge base can improve workflows like invoice processing (to automatically extract important information and generate payments), report generation (to automatically generate a variety of graphs, tables and summaries for stakeholders) and document classification (to automatically classify documents for easy retrieval and management).

Key considerations

Generative AI is an evolving technology that promises greater benefits to businesses. However, organizations including manufacturers will need to evaluate data privacy, bias, ethics and more in their approach towards gen AI. Here are some of the early considerations for manufacturers seeking to handle the power of this technology:

- Include only depersonalized and non-sensitive data.
- Stay current with gen AI news and trends.
- Develop a gen AI usage and ethics policy.
- Consider workforce implications. gen AI adoption will create new jobs that require skilled workers.
- Offer career training to all employees; this will help them use gen AI appropriately in their work, while also building their skills.
- It remains vitally important for humans to use their best judgement when deciding how involved Gen AI will be in their company. Ensure that contextual knowledge and domain expertise are utilized before allowing anything to be permanently altered by gen AI.
- Be wary of overreliance on gen AI. Complete reliance on the technology may lead to critical errors or missed opportunities—which can be avoided by mandating human reviews where applicable.

Getting started with gen AI

Getting started with Gen AI solutions require a deep understanding of the technology's capabilities, and involves several key activities such as problem definition, gen AI applicability assessment, data preprocessing, algorithm selection, building a prototype model, fine tuning the model and then scaling to business functions.

Cognizant recommends a five-step approach for organizations to undertake gen AI adoption strategically, as depicted in the figure below.

Foundational systems and data assessment, and readiness

Assess organizational data, architecture, infra requirements and build a strong foundation (including operating model and governance)

Organization readiness and change management

Help employees understand and adopt gen AI to drive company's business, value and strategy

Cross-disciplinary governance approach

Engage cross-disciplinary teams to define AI strategy as well as track and report progress over time to provide openness on adoption and success

Security and compliance

Evaluate potential risks, regulatory requirements & compliance and proactively manage these through policy, control, enablers & training

Organizations need to invest in gaining an understanding of the technology's capabilities and evaluate the benefits it can offer to their businesses. This may require identifying specific functions and use cases that could benefit from gen AI. When use cases are identified, organizations may want to prioritize the use cases to pilot before considering expansion of gen AI to multiple use cases across business functions. Based on the key success metrics, if the results enhance the current customer or user experience or reduce costs and efforts, a decision can be made to scale and expand the use of gen AI. As with other technologies, the use of gen AI should also be continuously expanded and iterated through an ongoing innovation process.

While the technology offers benefits, organizations would need to make multiple decisions depending on their use case, starting with the hyperscaler(s) to use (Microsoft Open AI, Google, etc.), perform data readiness assessment, skills and expertise required to implement, and many more. In addition, organizations also need to consider the impact of the technology on humans, and plan for upskilling and cross-skilling its workforce, while also focusing on governance, security, and compliance.

Selecting the right partner

As organizations embark on their gen AI journey, it is critical and worthwhile to invest and collaborate with the right IT partner who could bring in and integrate all the required stakeholders (for cloud services, gen AI model , APIs etc.) and prepare a roadmap for Gen AI adoption. It is important for partners to be able to bring knowledge of your business, be it about suppliers, dealers, operations, manufacturing providers or customer point of sales.

Keeping in mind how critical gen AI will be in the manufacturing industry, Cognizant has invested in Neuro, an AI platform that brings together multiple features spanning areas such as IT services, automation, and gen AI. Cognizant has also forged best-in-class partnerships with the major hyper-scalers, such as Google, Microsoft, and Amazon Web Services. Each of our hyper-scale partners have invested and developed their own gen AI solutions, and capabilities. Cognizant also has a deep knowledge of open-source language models that can be deployed for specific use cases. We are currently working with several manufacturing clients to plan their gen AI journey in collaboration with our hyper-scaler partners and can bring in the support and guidance for organizations to begin or expand their gen AI journey.

Conclusion

Gen AI has the potential to revolutionize the manufacturing industry—enhancing CX, improving productivity, reducing cost, and re-imagining every process. Gen AI can add value to company operations, fuel economic growth, and dramatically transform how companies work and their overall purpose in society. While technology is still evolving, the potential value it offers is a compelling proposition for organizations to explore and get started with their respective gen AI initiatives. The time to act is now!

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