The future of manufacturing with generative AI

Faster product innovation, improved shop floor efficiency, and reduced worker training time

This ebook is for business and technology decision makers in manufacturing organizations interested in leveraging generative AI to improve machine availability, maintenance, product quality, and design.

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INTRODUCTION

Harnessing the power of generative AI in manufacturing

Generative artificial intelligence (AI) is rapidly transforming modern businesses, as virtually all industries are discovering ways to leverage it. New research from Capgemini shows that 55 percent of manufacturers are currently exploring the potential of generative AI and another 45 percent are working on pilots.[1]

Generative AI represents a leap forward in AI technology, and adopting it can give manufacturers a competitive advantage. An IDC study showed that 83 percent of IT leaders believe that leveraging their business data to fine-tune generative AI models will give them a significant competitive advantage; however, only 30 percent of organizations are presently building out the modern industrial data architecture needed.[2] By bringing generative AI to the cloud where customers' data already resides, Amazon Web Services (AWS) enables manufacturers to unlock their transformative potential.

> From the office floor to the factory floor, generative AI has the potential to deliver transformative results for manufacturers.

With generative AI, manufacturers can:

Improve shop floor productivity
Leverage machine documentation, maintenance records, and OT data for faster problem diagnosis and issue resolution.

Reduce worker onboarding and training time
Capture experienced worker knowledge on complex machinery operations and create training content to onboard new workers.

Improve product engineering
Manufacturers can use generative AI to create, test, and refine product designs, implement personalization, develop prototypes, and accelerate proofs of concept to shorten their time to market.

[1] "Harnessing the Value of Generative AI," Capgemini, 2023
[2] Lang, Jonathan, "A Grounded Assessment of GenAI in Industrial Operations," IDC, November 2023

Examining the challenges of adopting generative AI

There are a few perceived challenges around adopting generative AI, including:

- **Moving from pilot to production**
- **Choosing the best high-performing foundation model (FM)**
- **Enhancing base FMs with proprietary data to build differentiated applications**
- **Protecting data and controlling how it is shared**
- **Training personnel on this new technology**

Read on to explore manufacturing use cases that illustrate how AWS can help your organization quickly realize the benefits of adopting generative AI technology to keep pace with or surpass the competition.

Terms to know

Artificial intelligence (AI):
The field of computer science dedicated to solving cognitive problems commonly associated with human intelligence, such as learning, creation, and image recognition.

Generative AI:
A type of AI that can create new content and ideas, including conversations, stories, images, videos, and music. It is powered by large models that are pretrained on vast amounts of data, commonly referred to as FMs.

Machine learning (ML):
The science of developing algorithms and statistical models that computer systems use to perform tasks based on patterns and inference rather than explicit instructions. ML is a subset of AI and the foundation of generative AI.

Foundation model (FM):
An ML model that is pretrained on large amounts of data—and may contain billions of variables that enable it to learn complex concepts—to power generative AI applications.

Large language model (LLM):
An ML model that is trained on trillions of words so it can recognize, translate, predict, and generate text, images, music, and other content. Some LLM examples are BERT, GPT, PaLM, BLOOM, LLaMA, and Chinchilla.

How to start your generative AI journey

Successfully adopting and unlocking the benefits of generative AI requires the right strategy. The following steps can help your organization get off to a good start:

1

Define your objectives

Do you need to speed apprentice onboarding, improve machine availability, or enhance product quality? Set a clear goal from the start to keep your efforts focused and track progress along the way.

2

Identify specific real-world use cases

Identify and use manufacturing best practices to decide the best place for generative AI within your organization before implementing the technology.

3

Select FMs that best fit your application

Should you build with existing models, customize from the ground up, or something in between? Keep your choices open, as different FMs have their own benefits.

4

Collaborate with experts

Working with an expert like AWS or AWS Generative AI Competency Partners can keep you focused on goals instead of managing technology. AWS continues to build on a 20-year track record of AI investment and innovation, employing thousands of ML engineers who help develop and implement generative AI strategies, including infrastructure considerations and ethical implications.

> AWS democratizes generative AI so that manufacturing organizations of any size can reinvent their products, processes, and experiences.

USE CASES

Putting generative AI to work for manufacturers

The following sections explore three use cases that illustrate how generative AI can improve product engineering, enhance production, and optimize worker training and productivity.

PRODUCT ENGINEERING

Explore optimized design options and generate synthetic data for simulations.

PRODUCTION

Accelerate production issue remediation and optimize operational efficiency.

WORKER TRAINING AND PRODUCTIVITY

Guide the use of manufacturing machinery with generative AI-powered chatbots.

USE CASE 1: PRODUCT ENGINEERING

Develop new and better designs faster

Today's manufacturing companies are challenged by on-premises equipment limitations, remote system access, and the need to keep innovating. Generative AI enables manufacturers to quickly and effectively explore design options that can minimize cost, mass, materials, design time, and production methods with a larger number of inputs and constraints than humans can rationalize.

Design potential

By combining AI with high performance computing (HPC), generative AI reimagines discrete product components, uncovering new and innovative designs.

Dataset analysis

Generative AI analyzes large datasets quickly, which can help your organization identify opportunities to improve products, manufacture or machine products faster, and accelerate time to market. It can also create synthetic datasets to run accurate simulations that inform product design and reduce the need for physical prototypes.

AUTODESK

"Although we've used AWS technologies for years in our Fusion product for generative design, we recently unveiled Project Bernini, a new generative AI model that can create functional 3D objects from 2D images, multiple views, or text descriptions. Trained on millions of diverse 3D shapes, Bernini can generate realistic objects that are applicable in architecture, and product design applications."

Steve Hooper, VP for Design & Manufacturing Software Tools, Autodesk

USE CASE 2: PRODUCTION

Minimize downtime and optimize production

An effective data strategy has long been the cornerstone of efforts to expand production in the manufacturing sector. By properly managing, analyzing, and acting on timely data, manufacturers can optimize productivity, improve quality, and maximize machine availability.

Industrial Data Fabric (IDF) solutions on AWS harness and unify disparate data types to create scalable, unified, and integrated mechanisms. This allows AWS customers to build the foundation for industrial digital transformation and generative AI adoption by offering economical, secure, and easy access to high-quality datasets. These datasets can help improve quality, maintenance, materials management, and process optimization.

Accelerate the time needed to remediate production issues and improve operational resilience by quickly providing workers with likely process and machine troubleshooting steps. Optimize machine productivity by analyzing decades of production data and providing operators with optimal parameter recommendations. Finally, enhance product quality and operational efficiency with synthetic image data to help train computer vision (CV) models quickly and accurately.

Georgia-Pacific

"This is a game changer...like just-in-time material movement and robotics have transformed manufacturing.... Generative AI, powered by AWS, is providing just-in-time best practices, institutional experience and real-time insights to empower GP personnel to make optimum decisions."

Steven Bakalar, VP – Digital Transformation, Georgia-Pacific

Georgia-Pacific (part of Koch Industries) is an American pulp and paper company based in Atlanta, Georgia. It uses an AWS-powered generative AI chatbot to guide machine operators with troubleshooting guidance to navigate complex machine operations and pinpoint the root cause of problems, reducing troubleshooting guidance retrieval time from hours to minutes and significantly reducing the number of escalations to senior personnel.

BMW GROUP

At BMW Group, generative AI helps its regional specialists focus on optimizing inventory throughout its supply chain to optimize manufacturing:

"[Amazon] Quicksight's new Q-powered authoring experience is a huge time saver to create calculations without stopping for reference, build visuals fast, and then refine the visual presentation for a precise experience, all with natural language."

Christoph Albrecht, Data Engineering & Analytics Expert, BMW Group

USE CASE 3: WORKER TRAINING AND PRODUCTIVITY

Enhance worker productivity

Onboard new workers faster

Generative AI-powered chatbots and virtual assistants can provide around-the-clock support to personnel, answering questions and offering guidance anytime on complex machine settings to optimize production and quality. Automatically generate and update a knowledge base with frequently asked questions, best practices, and troubleshooting tips, fostering a culture of continuous learning and improvement. When a machine problem does occur, leverage generative AI to offer likely repair procedures, spare parts, and maintenance actions to speed mean time to repair and reduce escalation calls to experienced technicians.

MERCK

Merck uses AWS services and generative AI to create synthetic image datasets that help train ML models to detect manufacturing defects, allowing them to reduce overall false rejects across various product lines by more than 50%.

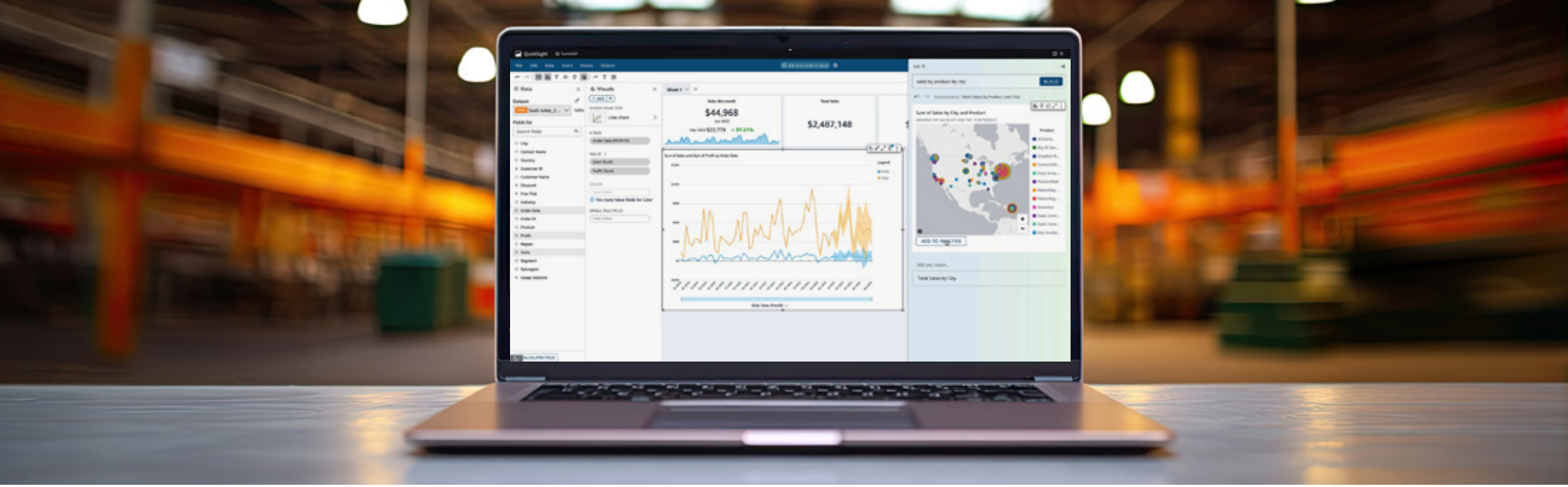
Learn more ›

KONE

"Amazon Bedrock enabled us to quickly innovate on industry use cases with generative AI. AWS's generative AI capabilities are the platform for our future Technician AI Assistant, which will leverage complex technical documentation and case libraries to speed customer service in the field."

Amy Chen, CIO, KONE

Learn how KONE is harnessing generative AI to make buildings smarter and more connected.
Watch the video ›



GENERATIVE AI ON AWS

Transform your future using generative AI on AWS

There are several ways AWS allows manufacturers to drive productivity and transformation with generative AI:

1. Easily build and scale generative AI applications

Amazon Bedrock is a scalable, reliable, and secure AWS managed service that lets you access a powerful range of FMs from Amazon and leading providers. With infrastructure built for generative AI and ML workloads, access to a choice of leading FMs for optimal cost performance, robust security, and an extensive global partner network with deep manufacturing expertise, AWS is the best place to build, train, and run generative AI-powered applications at scale.

2. Take full advantage of your valuable data

Amazon Q makes it easy for employees to get answers to questions across business data—such as company policies, product information, business results, code base, maintenance actions, and many other topics—by connecting to enterprise data repositories to summarize the data logically, analyze trends, and engage in dialogue about the data.

3. Spend more time innovating and differentiating

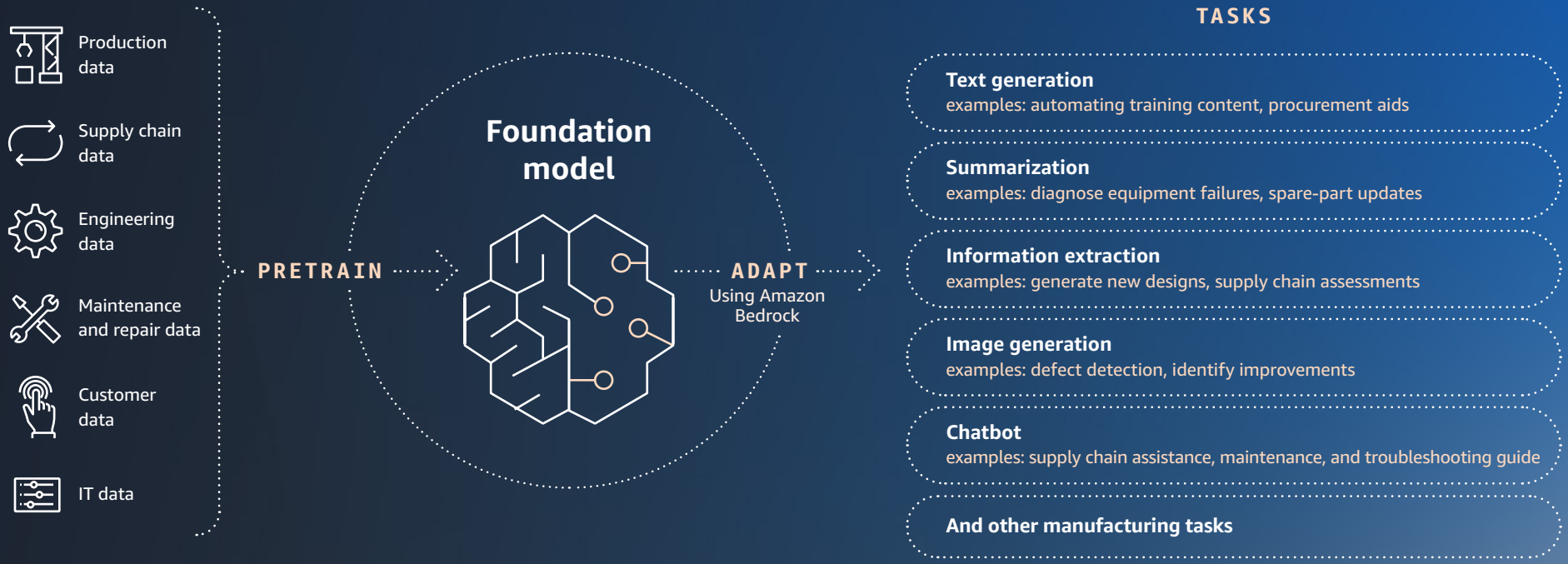
AWS services empower your developers with greater capabilities and more time to build. **Amazon Q Developer** generates code suggestions for developers in real time, helping them deliver value faster while reducing risks. And **Amazon QuickSight** and **Amazon Q in QuickSight** make it easier for your business users to understand data with executive summaries, a new context-aware data Q&A experience, and customizable, interactive data stories that help drive decisions from insights.

4. Enjoy flexibility and scalability

Take generative AI solutions even further with **Amazon SageMaker JumpStart**, an ML hub where your developers can discover, explore, and deploy FMs that aren't available on Amazon Bedrock. Plus, AWS is continuously adding more models at unprecedented scale and velocity—so your organization can continue enjoying a wide range of options for years to come.

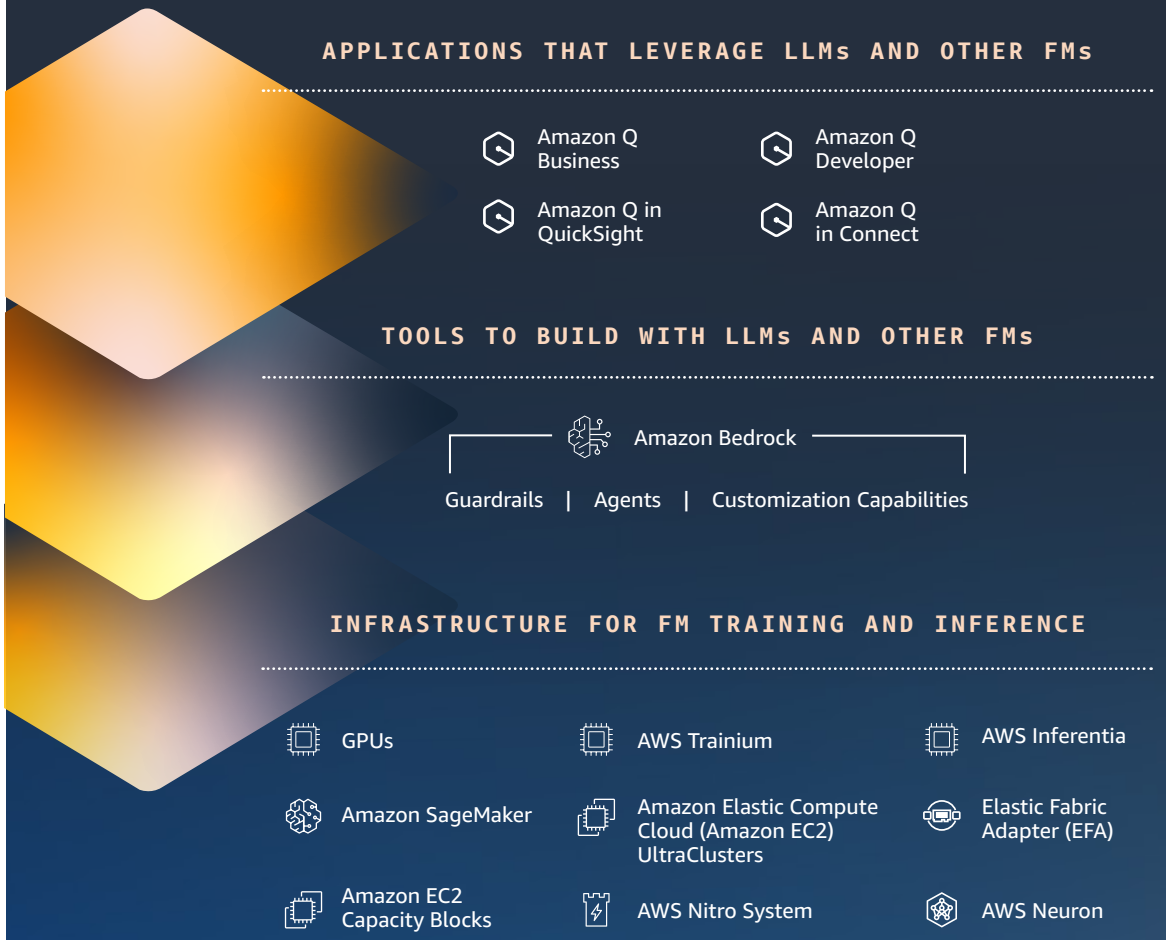
5. Build and deploy your own FMs at scale

AWS even provides solutions for building your own FMs. **SageMaker** provides managed infrastructure and tools to accelerate scalable, reliable, and secure building, training, and deployment of ML models. On SageMaker, you can train your own FMs, quickly correct performance issues with debugging tools, automate and standardize processes across the ML lifecycle, and create high-quality datasets while aligning model outputs with human preferences.



AWS is continuously investing and rapidly innovating to provide the most comprehensive set of capabilities across the three layers of the generative AI stack. At the top layer, we've been investing in game-changing applications in key areas like generative AI-based coding. The middle layer provides easy access to all of the models and tools customers need to build and scale generative AI applications with the same security, access control, and other features customers expect from an AWS service. And at the bottom layer is the infrastructure to train LLMs and other FMs and produce inferences or predictions.

With enterprise-grade security and privacy, a choice of leading FMs, a data-first approach, and the most performant, low-cost infrastructure, manufacturers trust AWS to accelerate generative AI technologies that reduce the cost and time to bring new products and services to market, boost employee productivity, streamline operations, optimize supply chains, and transform customer experiences.



CONCLUSION

Next steps

From aiding machine maintenance to improving new product designs and more, generative AI is delivering transformative results.

AWS helps manufacturers leverage the power of this technology, improving production, optimizing supply chain management, and creating better products faster. For manufacturing organizations looking to innovate beyond the competition, the time to adopt generative AI is now.

Start your generative AI journey today:

Explore AWS services for generative AI ›

Learn more about AWS for Industrial ›

Contact AWS to get started ›

Follow the *AWS for Industrial LinkedIn page* to learn more about AWS customer stories, industry use cases, events, and more.

Tools to accelerate your generative AI journey:

- **Amazon SageMaker**: Build your own FMs with managed infrastructure and tools to accelerate scalable, reliable, and secure model building, training, and deployment
- **Amazon SageMaker JumpStart**: ML hub that provides access to algorithms, models, and ML solutions so you can quickly get started with ML. With SageMaker JumpStart, ML practitioners can choose from a broad selection of publicly available FMs
- **AWS Trainium**: Train models faster with up to 50 percent cost savings using this ML model accelerator[3]
- **AWS Inferentia2**: Run high-performance FM inference with up to 40 percent lower cost per inference using this accelerator[4]
- **Amazon Bedrock**: Build and scale generative AI applications with this fully managed service that makes FMs available from leading AI startups and Amazon through an API
- **Amazon Titan**: Leverage this collection of powerful general-purpose FMs for text summarization, generation, classification, open-ended Q&A, information extraction, embeddings, and search
- **Amazon QuickSight**: Transform traditional multistep business intelligence (BI) tasks into intuitive and powerful natural language experiences with generative BI capabilities
- **Amazon Q**: The most capable generative AI-powered assistant for leveraging companies' internal data and accelerating software development

[3] AWS Trainium delivers up to 50 percent cost-to-train savings over comparable Amazon EC2 instances
[4] AWS Inferentia delivers up to 40 percent cost per inference over comparable Amazon EC2 instances