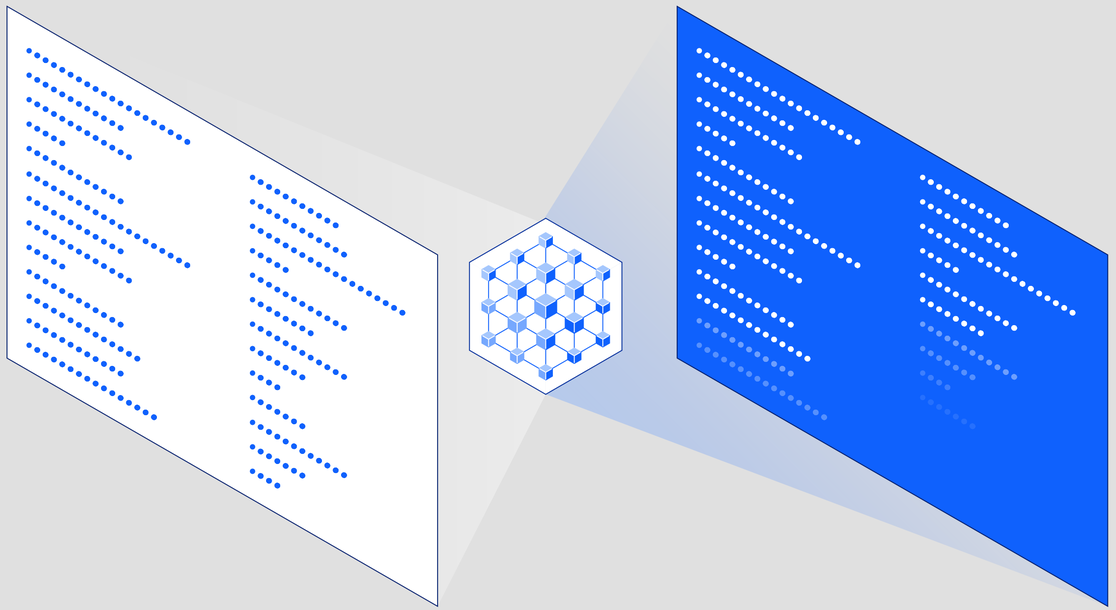
# Put AI to work for government application modernization

AI Academy



IBM

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01

# Application modernization in the age of AI

The human urge to modernize. It’s what has driven us for centuries to build new worlds—roads, bridges, cities and financial systems—and invent new technologies. It drives us today to update and optimize our digital infrastructure. Modernization offers the promise of achieving more through improved productivity.

For government organizations, that promise can mean more agility, more efficiency and a greater chance of mission success. Through application modernization, the potential to update the capabilities of existing applications to meet current technology standards, achieve faster resolution of issues, improve citizen services and build trust. These examples are some reasons why application modernization is a key imperative for many enterprises, including governments. According to a recent study [1] from the IBM Institute for Business Value, 95% of responding government leaders find many of the applications they use are slow and inflexible and need to be modernized.

But the promise of modernization isn't without its challenges. The process is often slow and seldom in lockstep with mission imperatives. Only a small number of government organizations have modernized their essential workflows, including the related applications, systems and data, across their organization. From technical debt accumulated over years of budget shortfalls to a need for diverse skills escalated by siloed computing platforms to cybersecurity and data privacy considerations, the barriers to application modernization can be many.

So, how can government leaders at all levels, CIOs in particular, address these challenges to succeed in their modernization efforts at a higher rate? Two words: generative AI. Generative AI—a generational leap forward in AI technology—draws from deep learning neural networks known as foundation models and uses powerful transformers to produce high-quality content, such as text, images or code, from existing proprietary data.

Let's explore why generative AI is key to application modernization and how government CIOs can capitalize on its potential to help simplify, de-risk and accelerate their modernization journeys.

# What’s hindering application modernization projects

Government CIOs are tasked with enabling their organizations’ missions, including reaching agency modernization goals and protecting their agencies from rising cyberthreats. If you’re one of these IT leaders, application modernization isn’t just an IT buzzword, but a business imperative that can help you achieve your goals. But there are several challenges—including an increasingly complex IT landscape, rising technical debt, aging applications, limited in-house skills and experience, high costs, security risks and more— that can slow down modernization efforts. Understanding these challenges is the first step toward overcoming them.

## Why application modernization projects fail, according to respondents:

### High costs

**57%**

of leaders say they are challenged by financial factors

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### Technical debt

**51%**

say they’re challenged by technical factors

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### Skills gap

**45%**

say they’re challenged by expertise factors

Fortunately, AI provides new capabilities to help ease these challenges. From increasing developer productivity to accelerating application modernization and operational optimization, agencies can address many strategic outcomes

Source: Modernizing applications on hybrid cloud, IBM Institute for Business Value | Research Insights, 4 May 2023.

02

# Putting generative AI to work for application modernization

While the benefits of AI are too often mythologized, there's no denying that it's one of the most revolutionary technologies of our time. It's at once transformative and disruptive, holding the potential to both unlock immense economic value and bring about irrevocable changes in our lives and work.

The introduction of generative AI has driven up that potential—and exponentially so. Many government organizations are already working with or planning to adopt generative AI. With wide-ranging capabilities that span different business processes and operations, not to mention the breadth of government missions, it's not hard to see why many organizations are readily embracing generative AI.

But how can government organizations, with its unique missions, constraints, and operating parameters, successfully apply generative AI?

You do so by choosing the right foundation models: enterprise-grade, domain-specific foundation models over consumer-focused general-purpose models. These models—they could be large language models (LLMs), IT automation models, and many more—are typically trained on a wide variety of government-owned data and tuned to perform mission-specific tasks. With enterprise-grade AI, you can bring these models to life to implement new capabilities, such as semantic search, code generation and knowledge management, to not only enhance automation and increase efficiency in different processes, but also help augment your staff's skills and knowledge.

But, just as authors oftentimes need to edit content after using autocorrect, developers will still need to refine their work and the work of generative AI. As always, they will make the call on whether the code, for example, should be accepted as is, modified or completely rejected. However, generative AI can help them fast-track certain steps in the development process.

# Scaling AI across the organization, safely

Despite the widespread enthusiasm for using generative AI, many government leaders still have concerns about generative AI adoption.

At IBM, we see a few common concerns about AI adoption within government organizations[2]:

– Data lineage or provenance
– Data security
– Data privacy

How your organization succeeds with generative AI is influenced by the process used to select, govern, analyze and apply data across it. Huge volumes of data from different sources are used to train generative AI models, so, implementing governance, management and ethical frameworks that operate end to end is especially important. These frameworks are key to safely and responsibly adopting AI that is supportive of mission outcomes while remaining incredibly secure and in compliance with government regulations.

IBM has long followed core principles grounded in commitments to trust, transparency and fairness to guide how we handle any of our clients' data and insights—and how we develop and deploy new technologies.

To continue this practice in the age of AI, IBM has developed a multidisciplinary, multidimensional approach that embeds ethical principles into AI applications and processes. With IBM's Principles of Trust and Transparency and Pillars of Trust as the foundation for our AI ethics initiatives, we're helping people and organizations adopt AI responsibly, with clear purpose, and in alignment with the Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence.

# IBM's guiding principles for AI ethics

## Principles for Trust and Transparency

**The purpose of AI is to augment human intelligence**
We believe that AI should make all of us better at our jobs, and that the benefits of the AI era should touch the many, not just the elite few.

**Data and insights belong to their creator**
Clients' data is their data, and their insights are their insights. We believe that government data policies should be fair and equitable, prioritizing openness.

**Technology must be transparent and explainable**
Companies must be clear about who trains their AI systems, what data is used and what goes into their algorithms' recommendations.

## Pillars of Trust

**Explainability**
Good design does not sacrifice transparency in creating a seamless experience.

**Fairness**
Properly calibrated, AI can assist humans in making fairer choices.

**Robustness**
As systems are employed to make crucial decisions, AI must be secure and robust.

**Transparency**
Transparency reinforces trust, and the best way to promote transparency is through disclosure.

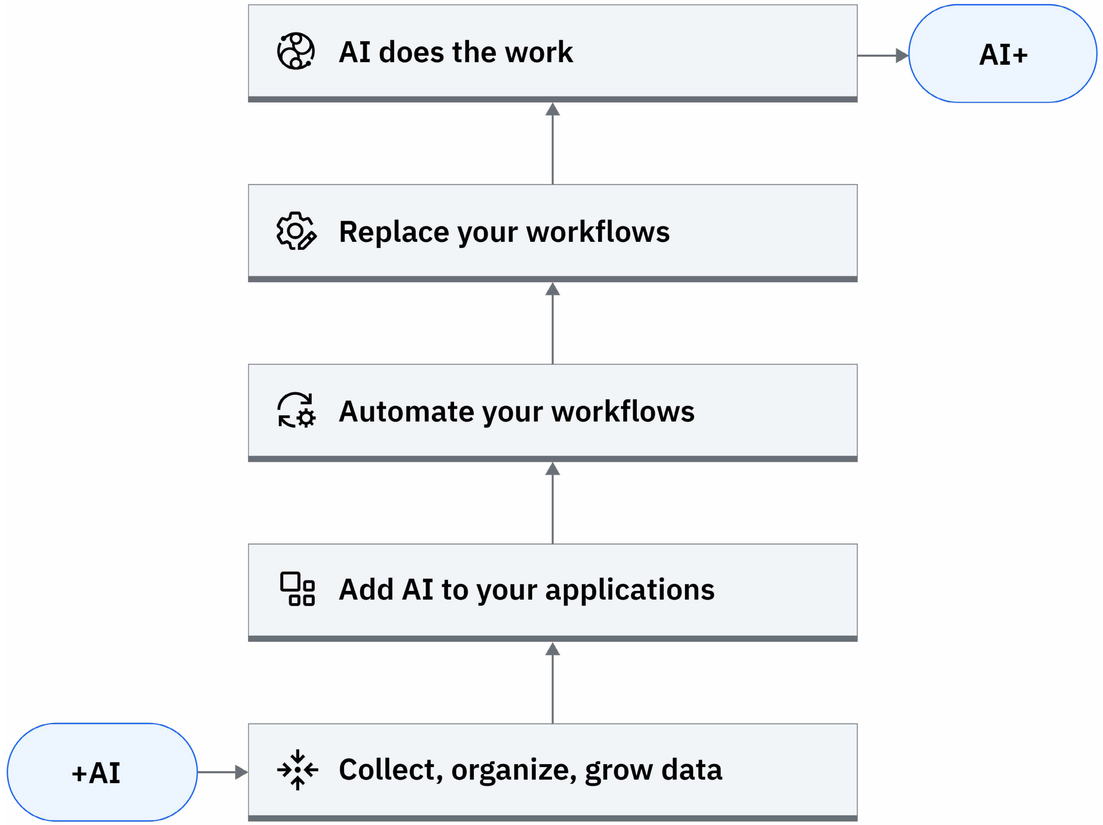
**Privacy**
AI systems must prioritize and safeguard consumers' privacy and data rights.

## What does generative AI mean for traditional AI?

In the past, enterprises have approached AI as an add-on, with the end goal being digital transformation and cloud modernization. Now, AI is becoming the centerpiece of business transformation. As a data point in the commercial space, 75% of business leaders surveyed believe competitive advantage will depend on who has the most advanced generative AI.[4] But harnessing the potential of AI to fundamentally transform application modernization requires a mix of vision and technology. In the case of government organizations, they too need to put AI to work at the strategic core of their strategy—not just add it on to existing systems—to solve enterprise challenges and help achieve their mission objectives. It's time to move from applications +AI to AI+ applications.

So, does this shift in technology mean there's a need to replace traditional AI solutions with the latest generative AI for application modernization? IBM AI leaders say no. Traditional AI models that use conventional machine learning (ML) and rules-based models have different capabilities and serve different functions: predictive analysis, security and compliance, automation, and more. Generative AI models, on the other hand, use foundation models to autonomously generate content based on the data they were trained on. Generative AI and traditional AI are, in fact, complementary technologies; use them together to help accelerate and achieve your agency's modernization goals.

**The AI Ladder® in the modern day**



**Traditional AI**
Applies predefined rules and algorithms to specific sets of data to solve problems, make predictions and automate tasks.

Potential application modernization tasks using traditional AI
- Capacity planning
- Resource utilization
- Cost optimization
- Performance monitoring

**Generative AI**
Generates new content based on patterns learned from the data it was trained on.

Potential application modernization tasks using generative AI
- Code generation
- Best practice recommendation
- Context-sensitive automation
- Code debugging

Many government CIOs may already recognize the obvious merit in adopting generative AI to progress their many mandates. If you're still on the fence, now is the time to embrace a new perspective and learn why generative AI could be the solution to  many modernization challenges.challenges.

As a data point from the commercial sector, 79% of responding executives say using generative AI in application modernization projects will increase business agility.

Source: The CEO's guide to generative AI: Application modernization, IBM Institute for Business Value, 15 August 2023.

Propping up existing systems with modern applications can compound the complexities in the IT environment. Using generative AI instead to tackle modernization issues can help simplify and accelerate the entire application modernization journey. Generative-AI-powered code conversion, code generation, code reverse engineering and transformation planning can help address common modernization challenges, improve employee productivity and reduce costs.

**Tackling technical debt with generative AI**

When technical debt accumulates across various aspects of an organization's IT infrastructure, such as code, architecture and documentation, identifying, prioritizing and resolving the complexities can become a Herculean task. Generative AI offers a solution. When you use it to take on technical debt, you can accomplish tasks and achieve outcomes that were otherwise impossible. Enterprise-grade AI provides capabilities that improve issue classification, generate code for issue resolution and set up context-sensitive automation—helping to significantly cut down the time developers spend fixing code. With AI-enabled automation, they can also reduce the time they spend provisioning cloud infrastructure, applying patches and performing maintenance. From implementing faster code debugging and enabling better document generation to driving automation efforts, generative AI is designed to help reduce technical debt and accelerate modernization efforts one prompt at a time.

**Bridging the skills gap with generative AI**

The shortage of in-house traditional technical skills is a real challenge many government CIOs must address today. But with technology evolving faster than ever, it's equally important that IT staff acquire modern skills—including ones related to generative AI and the new disciplines it's creating, such as prompt engineering. The solution to this problem may seem simple enough: reskill, automate and adapt. But is it still simple if it costs you time? Make use of the code generation capabilities of generative AI and provide your teams a new, faster way to work with a variety of new skills and languages. With these capabilities, teams are positioned to translate code from one language to another or create code, even when they don't know the specifics or syntax of a language. They also can easily summarize code—typically existing code, which may have been poorly documented—and provide the necessary context without any assistance from the original developers who may no longer be around. They can also write automation playbooks with AI-generated recommendations all with the security and data privacy government organizations need.

## Generative AI in action

The IBM CIO Organization, as “client zero,” used IBM watsonx™ Code Assistant for Red Hat® Ansible® Lightspeed in a tech preview and experienced firsthand the benefits of putting AI to work for application modernization including:

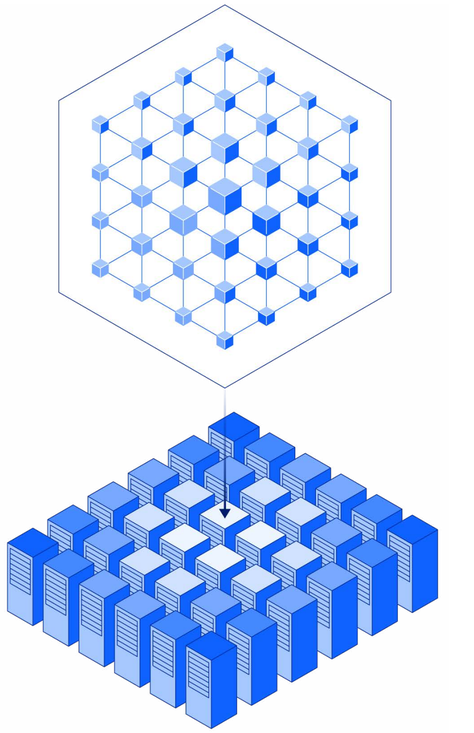
**50%**
reduction in playbook development effort

**60%**
of Ansible Playbook content automatically generated

**10X**
expected increase in the number of people who can help produce Ansible Playbooks going forward

IBM Consulting®, too, used the technical preview of IBM watsonx Code Assistant for Red Hat Ansible Lightspeed and improved developer productivity with generative AI.

**30%**
reduction in Ansible Playbook development effort while maintaining quality, compliance and resiliency



Transformation planning with AI

# How to use AI for application modernization

As with any complex IT transformation project, application modernization also happens in phases, broadly categorized as advisory, planning, transformation and testing. These phases include critical workflows that present fitting opportunities for applying generative AI.

**Application modernization phases and workflows in brief**

| What happens in these phases? | Which key workflows align with these phases? |
|---|---|
| **Advisory**<br>You assess your application landscape and create the modernization roadmap. | Transformation planning |
| **Planning**<br>You develop the project plan and set the modernization milestones. | Transformation planning and code reverse engineering |
| **Transformation**<br>You modernize the applications and migrate them to newer platforms and architectures. | Code generation and code conversion |
| **Testing**<br>You validate the modernized applications to ensure they are fully functional and meet the performance and security requirements of your organization. | Code generation and code conversion |

**What are workflows?**
Workflows are processes and tasks that occur in a sequential order, from start to finish, through which people and enterprises accomplish their work. The workflows discussed in this section are instances where generative AI can be infused into an application modernization process to standardize and optimize outputs, enriching what teams can achieve.

Teaming with IBM Consulting gives you access to services that help your organization prepare for its transformation journey, meeting you where you are—whether it's creating a custom strategy, modernizing business-critical applications, or developing and managing new applications.

## Let’s look at the 4 main generative AI workflows for application modernization.

**Transformation planning**
You perform transformation planning in the advisory and planning phases to define your modernization strategy based on the business and technical properties of the applications and to calculate expected ROI. Today, you likely rely on extensive rules encoded in spreadsheets and other tools to do the planning. But when there are hundreds of servers and applications to modernize, how do you manage the complexity?

Throughout the industry, technical leaders are considering how generative AI can be adopted to radically streamline transformation planning. It might:

- Help accelerate discovery and disposition by processing hundreds of documents and summarizing the documents if required.
- Help create modernization roadmaps with detailed transformation plans and target architecture designs.
- Help generate reference architecture, including diagrams and documentations that can be converted into Terraform code to create a landing zone for the transformed applications.

Generate new code

**Code reverse engineering**
In the planning phase, you perform reverse code engineering to analyze the business logic that's embedded in the existing code. It helps you understand the codebase, its architecture and any dependencies.

With generative AI, technology experts are exploring ways to summarize the code and analyze existing applications to generate phased modernization plans based on code dependencies and historical project sequencing.

- Help extract business rules by analyzing and summarizing code.
- Help uncover domain models by analyzing code and identifying domain-specific entities.
- Support monolith-to-microservices transformation by analyzing monolithic applications and generating microservice recommendations.
- Help optimize application refactoring and containerization by identifying refactoring opportunities, generating refactored code and suggesting containerization configurations.

**Code generation**
You focus on code generation in the transformation and testing phases. But what if you are plagued by developer team fatigue, too many repetitive manual tasks, poor code quality and constant customization challenges?

Generative AI lets you create code very quickly, enabling you to accelerate code development with just natural language prompts.

- Write cloud-native code in Java, Quarkus, Spring Boot and more.
- Build UI code, including backend for frontend (BFF) patterns, by analyzing images to generate code compatible with the UI design.
- Generate infrastructure code, including Terraform infrastructure code.
- Create code for configuring container platforms, such as the Red Hat® OpenShift® Platform.
- Develop serverless code for serverless functions using Knative.

IBM offers you enterprise-grade code generation capabilities through IBM watsonx Code Assistant—a generative-AI-assisted solution purpose-built to help you accelerate development with multiple highly relevant uses cases. Your developers will still play the valuable role of refining their code when using both IBM watsonx Code Assistant for Z and IBM watsonx Code Assistant for Red Hat Ansible. While generative AI will help accelerate the development process, final approval of the code rests in the hands of human experts.

IBM watsonx Code Assistant for Z helps equip your developers, regardless of their skill levels, with the ability to write code through AI-generated recommendations. With IBM watsonx Code Assistant for Z can help you reduce not only the burden of cognitive switching, but also the complexity of coding.

For overall IT automation, start with IBM watsonx Code Assistant for Red Hat Ansible Lightspeed and create Ansible Playbooks with automation content recommendations.

**Code conversion**
In the transformation and testing phases, you also engage in code conversion to translate or migrate code from one format to another. Maybe you have existing applications that aren't compatible with new platforms, but you still need to retain them. But what if your developers don't have the bandwidth or the expertise required for code conversion from existing applications?

Generative AI can help you automate this conversion process and enable it for many languages. For example, convert code from COBOL to Java by generating optimized Java code that matches the functionality of the original COBOL code.

For code conversion, start with IBM watsonx Code Assistant for Z—an AI-assisted mainframe application modernization solution—and enable your developers to incrementally modernize COBOL business services and selectively convert them to high-quality Java code. It is enabled by a 20-billion-parameter LLM for code, which is one of the largest generative AI foundation models for code automation.[5]

03

# Taking the next steps

Applying generative AI to application modernization can accelerate your organization’s transformation journey and set in motion a new era of efficiency that enhances mission execution.

But scaling generative AI across the enterprise is still a challenge for many government CIOs. And doing it with a focus on trust, compliance and security is an even bigger challenge.

Here are 7 recommendations for government CIOs to successfully adopt generative AI for application modernization.

01

**Ensure the right infrastructure is set up with the necessary security, privacy and resiliency controls to support the right AI use case for your organization.**

Choose an open, hybrid cloud platform empowered by Red Hat OpenShift that enables deployment across different locations and offers a consumption-based model for both on-premises infrastructure and cloud-delivered services.

Do not over invest or over provision infrastructure for AI; instead, align the right infrastructure to the right AI task at hand.

Make sure the infrastructure meets government standards for security, privacy and resiliency.

*IBM's IT infrastructure solutions—from servers and mainframes to storage systems and software—have been designed to help support the next generation of AI technology and follow* a clear set of build guidelines.

02

**Start with a clear roadmap and develop a well-articulated plan before you implement the modernization and migration journeys.**

Understand how the applications are aligned to your organization and discover any dependencies to ensure your transformation strategy doesn't disrupt normal government operations.

*IBM Consulting can help you discover your entire landscape—from the platform, operating systems and middleware you use to the different applications you run—to define your AI roadmap and tailor it to your transformation journey.*

03

**Grab low-hanging fruit by applying generative AI to applications that have already been modernized.**

Seize the low-risk, high-visibility opportunities. Applying generative AI to already-modernized applications can help you more readily highlight its benefits.

04

**Go after opportunities that were previously off limits, such as applications and processes in core systems.**

Direct your efforts toward core systems where generative AI can deliver bigger, more strategic results. Focus on past initiatives that represented the most mission value but were abandoned due to cost or complexity.

*IBM Consulting can help you rethink your strategy and modernize with purpose. With a focus on AI and hybrid cloud, we can implement and scale advancements to reinvent your agency's workflows.*

## 05

**Track and measure the impacts of generative AI on developer productivity.**

Measure and reward fast cycles of modernization made possible by generative AI. Use this data todemonstrate the value of generative AI to other division leaders and drive consistent and accurate automation adoption across your agency.

*IBM watsonx Code Assistant for Red Hat Ansible Lightspeed can help novice developers to write Ansible Playbooks and automate tasks while removing the burden of low-level task creation from more experienced automators.*

## 06

**Seed new teams with experienced talent to serve as cross-functional guides and advocates.**

Extend generative AI modernization to opportunities across the enterprise. Close the gap between IT and operations and form new partnerships that drive technology modernization and mission performance, irrespective of roles.

## 07

**Take a strategic approach to AI ethics, ensuring that platform policies are based on the principles of transparency, trust and fairness.**

Establish, publish and enforce organization-wide policies, practices and guidelines for government employees using the technology.

Instill a culture of ethics and AI governance to enable holistic, end-to-end management of AI solutions.

IBM can help you deploy the right AI technology in the right business area, designed for maximum impact, with governance and security guardrails built

04

# Ready to begin?

IBM has both the technology and the expertise to help you get started with generative AI for application modernization.

Register for a discovery session with IBM AI experts →

**AI platform**
IBM watsonx is our data and AI platform, native to hybrid cloud, designed to enable you to train, tune and deploy generative AI across your agency, using your critical, trusted data wherever it resides.

**AI assistant**
IBM watsonx Code Assistant is powered by state-of-the-art models designed for code, which help your developers generate high-quality code and content using natural language prompts or existing source code, enabling your developers to expand their skills and optimize their bandwidth. The result can be an acceleration in code development and increased drive in developer productivity throughout the application modernization lifecycle.

**AI expertise**
IBM Consulting can help you strategize, modernize, build and manage applications with the power of AI and hybrid cloud. IBM has formed a Center of Excellence (CoE) for generative AI, specializing in applying the watsonx platform and IBM ecosystem partner technologies to rapidly create coherent strategies and accelerate how we solve business problems. The CoE complements more than 21,000 IBM data and AI consultants with a strong track record in AI who are already collaborating with thousands of global clients and partners to shape the future of AI.

1. The CEO's guide to generative AI: Platforms, data and governance, Benchmark Wizard, IBM Institute for Business Value, 2022.

2. The CEO's guide to generative AI: Industry insights – Government, IBM Institute for Business Value,

3. The CEO's guide to generative AI: Platforms, data and governance, IBM Institute for Business Value, 12 September 2023.

4. Based on proprietary internal data. Every company will have different use cases and will, therefore, experience different results. Client examples, such as IBM's, are illustrative, but actual results will vary based on client configurations and conditions. Generally expected results cannot be provided as client results will depend on the data, systems and services used.

5. IBM Unveils watsonx Generative AI Capabilities to Accelerate Mainframe Application Modernization, IBM Newsroom, 22 August 2023



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