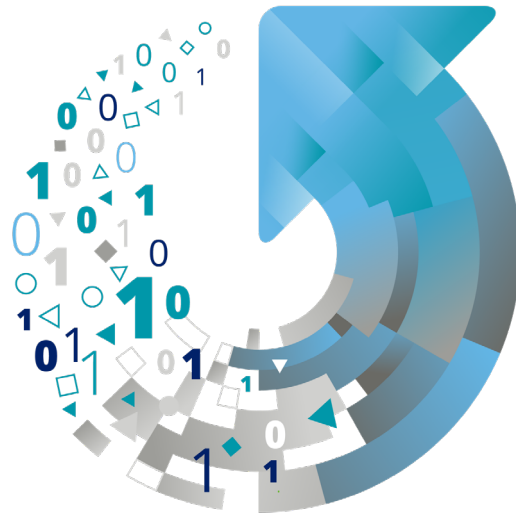


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Mainframe modernization: The AI-human synergy

**Leveraging the power of AI and human expertise to transform
legacy systems and accelerate innovation**



The artificial intelligence (AI) revolution has begun and it's transforming just about everything. In addition to its myriad applications to business issues, such as improving customer engagement, data analysis, and decision-making, AI can also help organizations transform their information technology environment. With AI, organizations can streamline the modernization of their legacy systems and applications to a more technologically advanced environment faster, with less effort, and with limited business disruption.

AI-powered automation and intelligent data integration can also help enhance efficiency, which can accelerate and optimize the modernization process. However, as powerful as AI is, it's only a tool—one that needs the capability of human knowledge, creativity, and control to realize its true power and potential.

In this paper, we'll explore how organizations can implement AI-powered modernization initiatives, as well as some of the primary challenges that they'll likely face along the way and strategies to overcome them—all through a lens that focuses on how humans can—and must—drive the AI-enhanced process.

The modernization imperative

Fierce competition and increasing customer expectations, along with more stringent regulatory requirements and growing cybersecurity threats, are compelling many organizations to innovate faster and leverage modern technologies like AI, Internet of Things, edge computing, and cloud to improve responsiveness and resiliency to power growth.

However, legacy mainframe architectures can hamper efforts to modernize, thus creating hurdles to innovation and resiliency. For example, hard-to-manage legacy systems can significantly increase time to market. As a result, it can put organizations' unique selling points at risk because more agile competitors can bring new products to market faster. An aging mainframe workforce only heightens the challenges as mainframe workers retire and take their invaluable systems knowledge with them. As a result, it becomes increasingly difficult to find new talent with mainframe experience.ⁱ Add increasing maintenance costs and decreasing vendor support to the mix and the challenges to modernization can seem almost insurmountable.

Leveraging AI to assist in the modernization process can help. When driven by humans with the organizational knowledge to get the most out of AI technologies, AI becomes a formidable tool to help organizations innovate faster and operate more efficiently and securely—which can lead to more satisfied customers and a healthier bottom line.

A recent Deloitte survey revealed that 42% of respondents listed increased efficiency, productivity, and reduced costs as their most important benefits achieved to date with their Generative AI (GenAI) investments, with 67% of organizations increasing their AI investments because of the early capture of value.ⁱⁱ



How AI helps in the modernization process

AI-enabled tools can serve as powerful assistants in mainframe modernization. They can accelerate the process and make it more secure, which can reduce business disruptions. AI can help via:

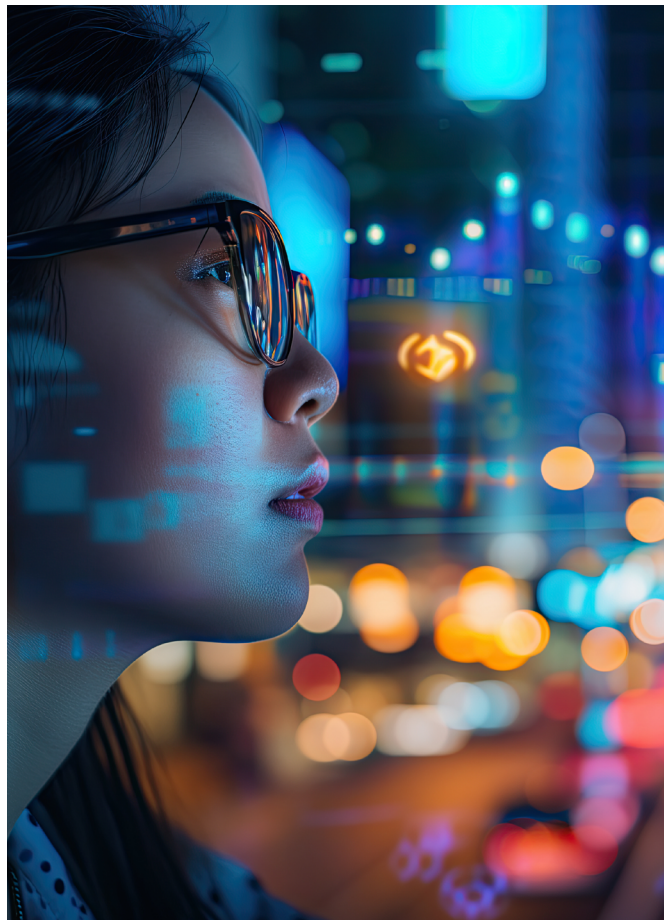
Automated code analysis, conversion, refactoring, and copiloting: Aided by human experience, AI can help developers analyze legacy code to assess functionality and identify anomalies. AI can also automate conversion and refactoring; however, the most impactful AI solutions will be augmented, domain-specific large language models that can ingest the specifics of the legacy system. GenAI can assist by generating code snippets, which can reduce time and effort and enhance code quality and system performance.

Intelligent data migration and integration: Legacy systems migration can be complex and error prone. AI can help with “intelligent” data migration that enhances data integrity and limits disruptions. In combination with human systems knowledge, AI algorithms can help map and transform data to fit new architectures, enabling a smoother transition.

Predictive maintenance and optimization: AI can help predict potential system failures and optimize maintenance schedules, reducing downtime and improving reliability. Also, AI-enabled predictive maintenance processes can help organizations become more proactive, increasing operational efficiency and reducing costs.

Enhanced security and compliance: AI can help improve systems security by using sophisticated algorithms to identify vulnerabilities, monitor for threats, and automate compliance checks. Enhanced security can also help organizations better align to regulatory requirements and protect sensitive data from cyberthreats.

Resource optimization: Organizations can “merge” AI with people to help them optimize resource allocation. By leveraging the deep organizational knowledge of their workers, organizations can identify tasks for automation, better predict demand, and streamline processes. This enables workers to concentrate on more strategic activities, which can help improve efficiency and performance and increase return on investment (ROI).



Challenges to modernization

Though the benefits of modernization are substantial, resistance to change can be a significant hurdle. Leadership often fears business disruption, operational inefficiency, or worse—privacy issues and security breaches. Securing C-suite buy-in and ongoing funding can also present challenges, potentially stalling the project. In fact, Deloitte's most recent survey found that 68% of responding organizations are still in the pilot stage with GenAI due to concerns with scaling and strategy.ⁱⁱⁱ

Ensuring ongoing alignment of the modernization efforts with business goals that are constantly evolving is another persistent challenge that can result in an outcome that doesn't meet strategic objectives. Further, due to the complexity and frequent issues with access to and availability of legacy systems data, integration poses both technical and logistical hurdles. For example, in Deloitte's most recent survey, 55% of responding organizations reported avoiding certain GenAI use cases because of data-related and other technical issues.^{iv}

Just getting started can also be tough. Choosing the right applications to show the promise of modernization involves complex consideration with many variables, and poor choices can hamper project success and reduce stakeholder confidence. Compounding these challenges is a growing skills gap in many organizations. As workers who are experienced with legacy systems and the languages they're written in retire, they take invaluable knowledge with them, exacerbating the challenge of attracting workers with modern technology skills in a highly competitive environment.

Strategies to overcome the challenges

The right combination of strategies to deal with these issues, coupled with a focus on letting the business inform and drive the modernization process, can help mitigate challenges. To overcome modernization challenges, organizations can:

Think strategically and develop a comprehensive roadmap: Start with business objectives in mind and let them guide the modernization process. Build a robust business case that clearly communicates goals, benefits, funding needs, risk reduction strategies, and expected ROI to secure stakeholder buy-in and ongoing support. Think "product," not "project," and create a detailed roadmap that clearly defines the final product; aligns with business objectives; and outlines the approach, milestones, and risk mitigation strategies. Leveraging deep organizational knowledge from the outset is critical to ensure that the effort meets its business goals.

Collaborate with trusted AI/software engineering vendors: Work with the right AI and software engineering vendors to select the appropriate technology and migration approach. A good collaborator will have experience in both modern software development and mainframes, as well as data analytics and AI. Those competencies allow them to provide the experience, tools, and methodologies that align the organization's business goals with its technical requirements. The deep knowledge of mainframe experts, coupled with the business insights gleaned from the C-suite, is essential to ensure that the end solution meets business needs.

Develop training programs and bridge skills gaps: Invest in training programs for internal resources to build modern tech skills within the organization, develop strategies to recruit workers who are proficient in modern technologies to bridge skills gaps, and build a tech-savvy workforce that is steeped in both modern technology and institutional knowledge. Finally, foster a culture of continuous learning and growth to build the workforce of the future.

Implement pilot and proof-of-concept projects: Based on organizational needs and the deep internal knowledge of systems specialists, implement pilots and proof-of-concept projects to test functionality and refine the strategy. Build on initial successes and learn from failures to develop the ability to scale to the enterprise.

Adopt end-to-end thinking: Blend business knowledge, subject matter expertise, development skills, cutting-edge accelerators, and a state-of-the-art operations team to ensure that all aspects of the modernization process are integrated and aligned with business goals and can drive overall success.

Benefits of AI-enabled modernization

The benefits that can result from using AI to power mainframe modernization can be substantial and can put organizations in a prime position to accelerate innovation and growth. Recent Deloitte research found that 76% of responding organizations that have implemented GenAI in some form have realized one or more of the following benefits:^v

Improved performance and reliability: AI-driven solutions optimize and streamline the modernization of legacy systems, allowing organizations to focus on the areas of the application that have high business value. The result is faster, more reliable application modernization and less downtime.

Enhanced flexibility and scalability: AI and GenAI enable systems to adapt quickly to changing business needs and scale efficiently to handle increased workloads.

Increased regulatory compliance and heightened cybersecurity: AI helps automate compliance processes, ensuring systems adhere to stringent regulatory standards and reducing the risk of noncompliance. AI-powered security measures can provide advanced threat detection and response, enhancing the cybersecurity posture of modernized systems.

Augmented efficiency: AI-enabled automation and optimization enables knowledge workers to focus on more value-added processes, which can help improve overall efficiency.

Accelerated innovation and time to market: AI can help accelerate the development and deployment of new products and services, which has potential benefits such as accelerating innovation, reducing time to market for new products and services to attract new customers, and improving the overall customer experience.

Transition to open, cutting-edge technologies: AI enables the transition from proprietary systems to more open and flexible technology environments that can integrate with the latest cutting-edge technologies that offer powerful capabilities to drive innovation and growth.

Insights at your fingertips: AI helps to re-document legacy applications where documentation or knowledge may be missing.



AI-powered modernization in action

This section explores some real-world examples of organizations that have successfully navigated the challenges of mainframe modernization. Their success stories highlight the strategic use of AI and human expertise to transform legacy systems, driving innovation and achieving significant business outcomes.



Large global automotive manufacturer

A global car manufacturer struggled with a specialized stock-tracking application, originally developed using PL/1 and JCL and containing more than 250,000 lines of code. Only 10% of this code was relevant, but the outdated system's complexity made it difficult to maintain, innovate, or integrate with modern technologies. The monolithic and spaghetti-like code structure created challenges in identifying and isolating business functionalities, and the company needed to document the source code, enhance context through dependency mining, and eliminate dead code.

Deloitte proposed a proof of concept to help modernize the application by extracting its functionality and transitioning it to a Java-based system. The approach involved iterative code generation, using GenAI, to automate source code documentation and dependency mining, isolate business functionality, and adapt the generated code to incorporate new features. The project resulted in a modernized Java application with significant efficiency and quality gains, though full automation was not feasible. The modernization improved the application's maintainability, efficiency, and adaptability, positioning the client to better leverage modern technologies and innovate more effectively.



Large North American insurer

A large North American insurer faced a significant challenge as it lacked documentation linking more than 60 million lines of COBOL code to specific business capabilities. This gap created obstacles for its outsourced mainframe application development team, making it difficult to understand system intricacies, navigate complexities, and support a planned business-driven modernization initiative. Without detailed insights into what code components were responsible for which business functions, the organization risked delays and inefficiencies.

Deloitte helped them address this challenge by leveraging dependency mining, GenAI, and a proprietary industry framework during the discovery phase. This approach enabled the creation of a detailed system map, identifying logical clusters within application domains, and removing technical noise. Deloitte successfully mapped 90% of the codebase to corresponding business capabilities in under four weeks, avoiding months of manual effort and costs. This accelerated approach facilitated improved decision-making, resource allocation, and set the foundation for efficient system integration and a successful modernization journey.

A powerful synergy: AI and humans combine to accelerate modernization

Though AI is a critical tool that can significantly accelerate mainframe modernization, it is human expertise, knowledge, and creativity that ultimately drive the effort's success. Coupling the power of AI with human knowledge and experience accelerates the modernization process and aligns those efforts with organizational strategy and goals. The AI-human synergy helps organizations address complex modernization challenges and supports the integration of AI technologies to improve ROI. Together, AI and human expertise form an exceptional combination that makes it possible for organizations to build a resilient, future-ready IT infrastructure that powers innovation and growth well into the future.

To learn more about how your organization can unlock the potential of legacy systems to fuel innovation, read our [full report](#).

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