

Modernizing Mainframe Applications: *Strategies, Tools, and Insights for a Digital Future*

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Executive Summary

Mainframe modernization has become a critical priority for organizations navigating the challenges of digital transformation. This report, based on a comprehensive survey of 234 respondents across diverse industries and regions, explores the strategies, drivers, and technologies shaping modernization efforts. It highlights unexpected progress in modernization, key challenges organizations face, and the evolving role of mainframes in enterprise IT.

Key Findings

1. Mainframes Remain Essential, Yet Challenging

- **92% of respondents** rely on mainframes, with **72% citing critical or significant dependence** on these systems.
- **52% of respondents** reported that mainframes were a **major roadblock to digital transformation**, requiring them to halt progress until modernization was addressed.
- **39% cited mainframes** as one of several reasons driving their decision to modernize, underscoring the urgency of overcoming technical and operational barriers.

2. Unexpected Progress in Modernization

- Many organizations are farther along in their modernization journeys than anticipated:
 - **35-40% completion** for short-term extending strategies.
 - **25-30% completion** for more complex transitioning and in-place modernization efforts.
- Despite this progress, most organizations anticipate **3-7 years** to fully implement long-term modernization strategies.

3. Key Drivers and Risks

- Organizations are driven by the need to improve **performance, cost-efficiency, and innovation**.
- Delaying modernization poses significant risks, including **security vulnerabilities, operational inefficiencies, and rising costs**.

4. Strategic Choices Influenced by Leadership

- Leadership tenure and bonus-driven incentives significantly influence modernization choices, often favoring **short-term strategies** like replatforming and extending.
- **93% of respondents** acknowledged leadership tenure as a major factor in decision-making.

5. AI and Emerging Technologies as Game-Changers

- AI tools are playing a pivotal role in addressing modernization challenges, with **59% of respondents** planning to invest in AI to enhance scalability, automation, and decision-making.
- Platforms like Azure, AWS, Google Cloud, IBM Watson, and OpenAI are leading the charge, alongside open source frameworks, such as Kubernetes and OpenTelemetry.

6. Perceptions of Replatforming

- Replatforming is viewed as a **long-term and cost-effective solution** by **96% of respondents**, demonstrating confidence in its sustainability when paired with ongoing maintenance.

7. Future of Mainframes

- **47% of respondents** anticipate an increasing role for mainframes over the next 5-10 years, driven by integration with hybrid and cloud native environments.

Conclusions and Recommendations

Organizations are making significant strides in modernization, but the journey is far from over. To accelerate progress and maximize ROI:

1. Embrace **AI and automation tools** to streamline processes, enhance decision-making, and address technical complexities.
2. Adopt a **phased approach** to balance short-term wins with long-term sustainability.
3. Prioritize **hybrid and cloud native solutions** to enable scalability and flexibility.
4. Align **leadership incentives** with broader modernization goals to avoid overreliance on short-term strategies.
5. Leverage **vendor expertise and open source technologies** to reduce costs and mitigate risks.

By taking a strategic, technology-driven approach, organizations can modernize their mainframes to not only overcome existing challenges, but also unlock new opportunities for growth and innovation.



Introduction

Mainframe modernization remains a critical area of focus for organizations as they navigate the challenges of digital transformation and operational efficiency. Despite their longstanding reliability and scalability, mainframe systems are increasingly seen as barriers to innovation, with **52% of surveyed organizations identifying them as significant roadblocks**. At the same time, **75% of respondents emphasized the essential role of these systems**, underscoring the delicate balance between leveraging legacy investments and embracing modernization.

This report explores insights from a survey conducted in October 2024, encompassing 234 respondents from diverse industries and geographies, including North America, Europe, and Asia. The survey represents organizations with revenues ranging from \$10 million to over \$5 billion, all with at least 1,000 employees. The respondents include a mix of technical and business decision-makers, providing a comprehensive perspective on mainframe modernization strategies, challenges, and outcomes.

By examining modernization strategies—such as extending the life of mainframe applications, transitioning to cloud-based platforms, modernizing in place, and replacing legacy systems—this report uncovers key trends, drivers, and risks associated with these efforts. It also delves into the role of artificial intelligence (AI) and emerging technologies in facilitating modernization, while highlighting the evolving perceptions of mainframe relevance over the next decade.

As organizations strive to balance short-term operational needs with long-term strategic goals, this report provides actionable insights for decision-makers navigating the complexities of mainframe modernization.



The Role of Mainframes in Modern Organizations

Mainframes have long been the backbone of enterprise IT infrastructure, supporting mission-critical applications in industries such as finance, health care, manufacturing, and government. Despite the advent of modern technologies, mainframes remain indispensable for many organizations due to their unparalleled reliability, scalability, and performance. However, as organizations pursue digital transformation, mainframes have also become a focal point of modernization efforts, balancing their strengths with the need for agility and innovation.

Mainframe Dependency and Importance

Survey results underscore the centrality of mainframes in enterprise IT.

- **97% of respondents** reported their organizations rely on mainframes, with **76% indicating a critical or significant dependence** on these systems.
- Mainframe applications are considered **essential or very important by 75% of organizations**, reinforcing their foundational role in running business-critical operations.

Despite this reliance, **80% of respondents' organizations have at least 25% of workloads** still on mainframes, highlighting the scale of modernization efforts needed to transition workloads to modern platforms or improve existing mainframe capabilities.

Challenges in Leveraging Mainframes

While essential, mainframes are increasingly viewed as inhibitors to digital transformation.

- **52% of respondents** identified mainframes as a major roadblock to achieving their digital transformation goals.
- Organizations further along the digital transformation journey were more likely to view mainframes as obstacles, suggesting that the challenges of integrating legacy systems with modern architectures intensify with increased digitalization efforts.

The challenges are multifaceted, including:

- **Technical debt** – Outdated architectures that are expensive to maintain and difficult to adapt.
- **Time-to-market pressures** – Legacy systems often cannot support the rapid development cycles required in competitive markets.
- **Leadership-driven constraints** – Short-term strategic priorities that delay long-term modernization investments.



Future of Mainframes

Despite their challenges, mainframes are not going away. **Forty-seven percent of respondents** anticipate an increasing role for mainframes over the next 5-10 years. This perception reflects:

- The continued importance of scalability, reliability, and security for largescale operations.
- The growing integration of AI and cloud technologies to extend the capabilities of mainframes.
- Hybrid approaches that position mainframes as part of a broader, interconnected IT ecosystem.

Key Insights

Mainframes are both a cornerstone and a conundrum for modern enterprises. While their stability and power are unparalleled, their complexity and rigidity often hinder digital innovation. As organizations evolve, the challenge lies in finding ways to modernize and extend the value of mainframes while minimizing disruption and cost. This balancing act sets the stage for exploring strategies to overcome these challenges.

Supporting Figures

- **Figure 1:** Percentage of workloads on mainframes.
- **Figure 2:** Importance of mainframe applications.
- **Figure 3:** Mainframes as roadblocks to digital transformation.

What percentage of your organization’s total workload is processed on mainframes?

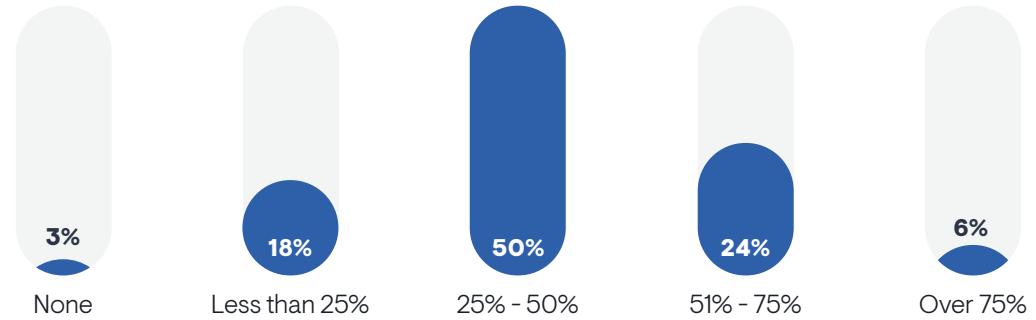


Figure 1

Sample Size = 234

To what extent are your mainframe applications critical to your organization’s core operations?

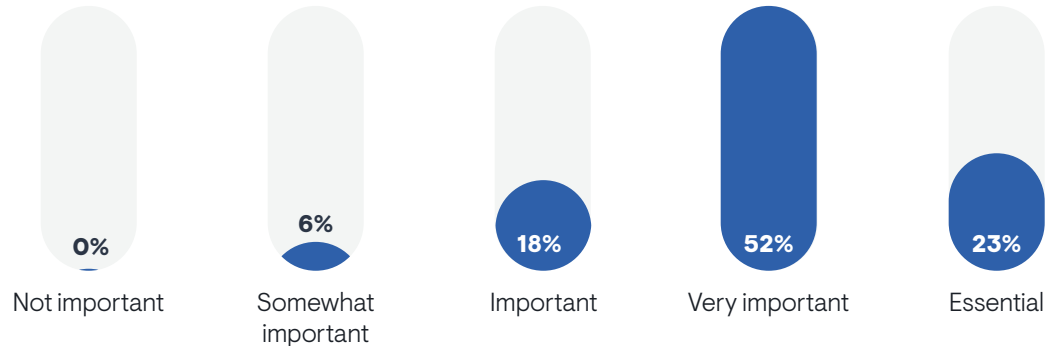


Figure 2

Sample Size = 234

Did your organization decide to modernize mainframe systems primarily to overcome obstacles in your digital transformation plans? VS Stage of Digitalization

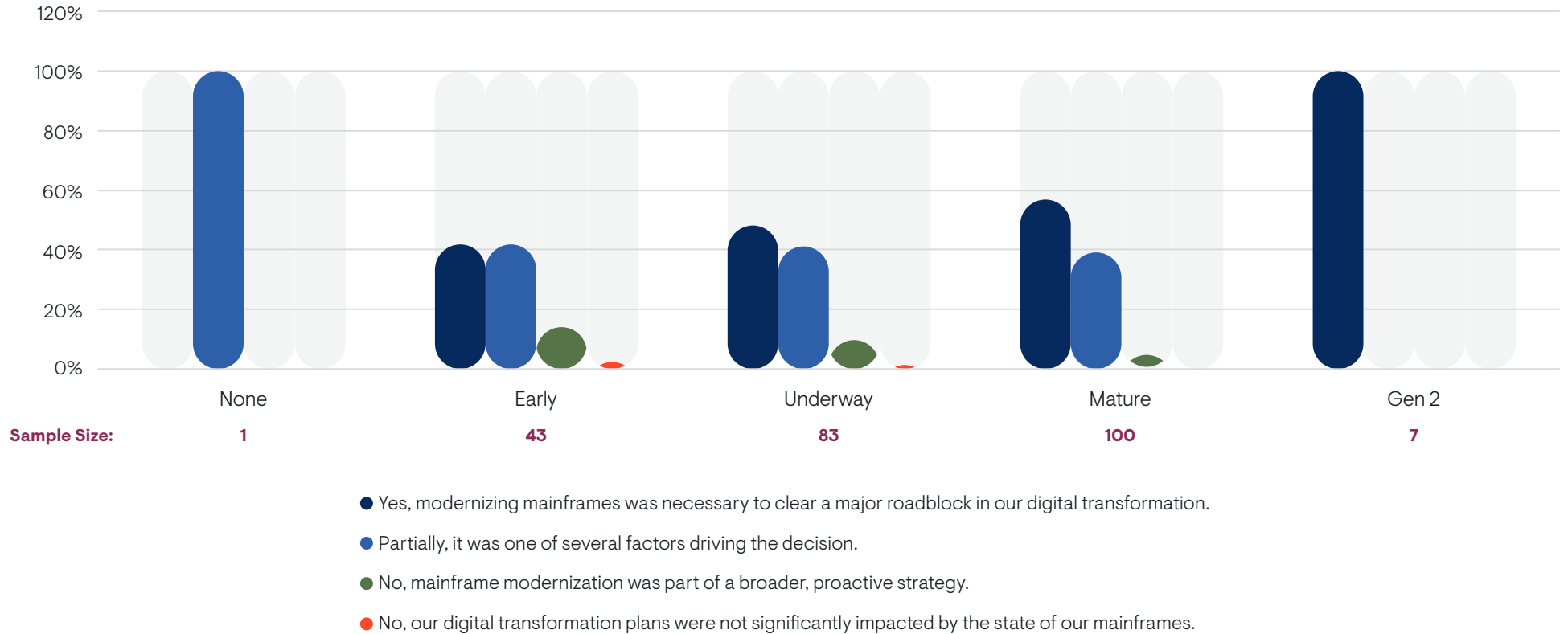


Figure 3

Sample Size = 234



Modernization Strategies

As enterprises confront the dual imperatives of preserving mainframe functionality and enabling digital transformation, they are adopting various strategies to modernize their mainframe environments. These approaches range from incremental improvements to full-scale system replacements, each tailored to address specific business priorities, technical constraints, and long-term goals.

Overview of Modernization Strategies

The survey identified four primary modernization strategies, often employed in combination.

1. **Extend**

- Focuses on integrating mainframes with distributed and cloud systems to maintain operational functionality with minimal changes.
- Common techniques include hybrid modernization and middleware integration, often serving as a short-term solution to buy time while planning more extensive modernization efforts.
- Adoption level: Frequently used as an initial step, with **35%-40% completion rates** among those adopting this strategy.

2. **Transition**

- Involves rehosting or replatforming mainframe applications to emulate functionality on modern platforms, such as cloud or virtualized environments.
- Seen as a middle ground that balances cost reduction with operational continuity.
- Completion rate: Reported progress is typically **25%-30% complete**, reflecting its more extensive scope.

3. **Modernize in Place**

- Focuses on optimizing applications while retaining them on the mainframe. Techniques include refactoring, re-architecting, and adopting modern programming languages.
- Long-term popularity: The most prevalent long-term strategy, with **79% of respondents** achieving or exceeding expectations through this approach.
- Benefits include improved scalability, performance, and maintainability.

4. **Replace**

- Entails retiring mainframe systems entirely in favor of cloud native applications or off-the-shelf solutions.
- Represents the most disruptive strategy, often requiring significant investment and a complete overhaul of legacy systems.
- Adoption: Less common, since only a subset of organizations can justify the cost and risk.

Adoption Trends and Strategy Combinations

- **85% of organizations** report using a mix of these strategies to address modernization challenges incrementally and flexibly.
- The survey reveals a progression from **extending applications as a short-term measure** to **modernizing in place for long-term sustainability**. Organizations seeking cost-efficiencies or to move entirely to cloud environments often pursue transitioning and replacing strategies.

Challenges in Strategy Execution

Modernization efforts, regardless of strategy, face several common obstacles.

- **Technical Complexity:** Difficulty integrating legacy systems with modern platforms and maintaining data consistency.
- **Resource Limitations:** High costs, staff shortages, and the need for specialized skills.
- **Change Management:** Resistance from employees and stakeholders accustomed to legacy workflows.

Satisfaction with Modernization Outcomes

- Organizations pursuing **modernization in place** report the highest satisfaction rates (79%), citing improved scalability, performance, and alignment with business needs.
- Tools from hyperscalers (e.g., Azure, AWS, Google Cloud) and open source technologies play a critical role in facilitating modernization, with high satisfaction ratings across all strategies.

Key Insights

The choice of a modernization strategy depends on an organization's immediate needs, long-term vision, and tolerance for risk. While extending and transitioning strategies provide quick wins, modernizing in place emerges as the most sustainable approach for retaining mainframe value while addressing modern requirements. Replacing mainframes entirely remains the most ambitious and least common path, reserved for organizations with specific needs or the resources to support such transformations.

Supporting Figures

- **Figure 4:** Breakdown of modernization strategies.
- **Figure 5:** Progress rates for each strategy.
- **Figure 6:** Satisfaction levels with modernization strategies and tools.

Extend Strategy – Buy Time

This involves fixing some issues in place to buy time. Strategies like integration, hybrid modernization, and maintaining with minimal changes are used to keep the mainframe operational with minimal investment, usually to extend its life while planning for future modernization.

Transition Strategy – Rehost/Replatform

This strategy involves moving mainframe applications to a new environment, such as cloud or virtualized platforms that emulate mainframe functionality. Rehosting and replatforming are used to extend the life of legacy systems by providing a more flexible or cost-effective platform, potentially serving as a long-term solution or a step toward further modernization efforts.

Modernize In-place Strategy – Re-Engineer

This involves modernizing and optimizing applications to remain on the mainframe indefinitely. Strategies include refactoring, re-architecting/re-engineering, and language migration, aimed at improving performance, maintainability, and alignment with modern practices while staying on the existing mainframe.

Replace Strategy – Buy Off The Shelf Cloud-Native Replacements

This strategy involves moving off the mainframe entirely by either retiring the legacy system in favor of commercial off-the-shelf (COTS) software or replacing it with cloud-native custom applications, thus fully transitioning away from the mainframe infrastructure.

Figure 4

What is the completion percentage for each application category under the chosen strategies?

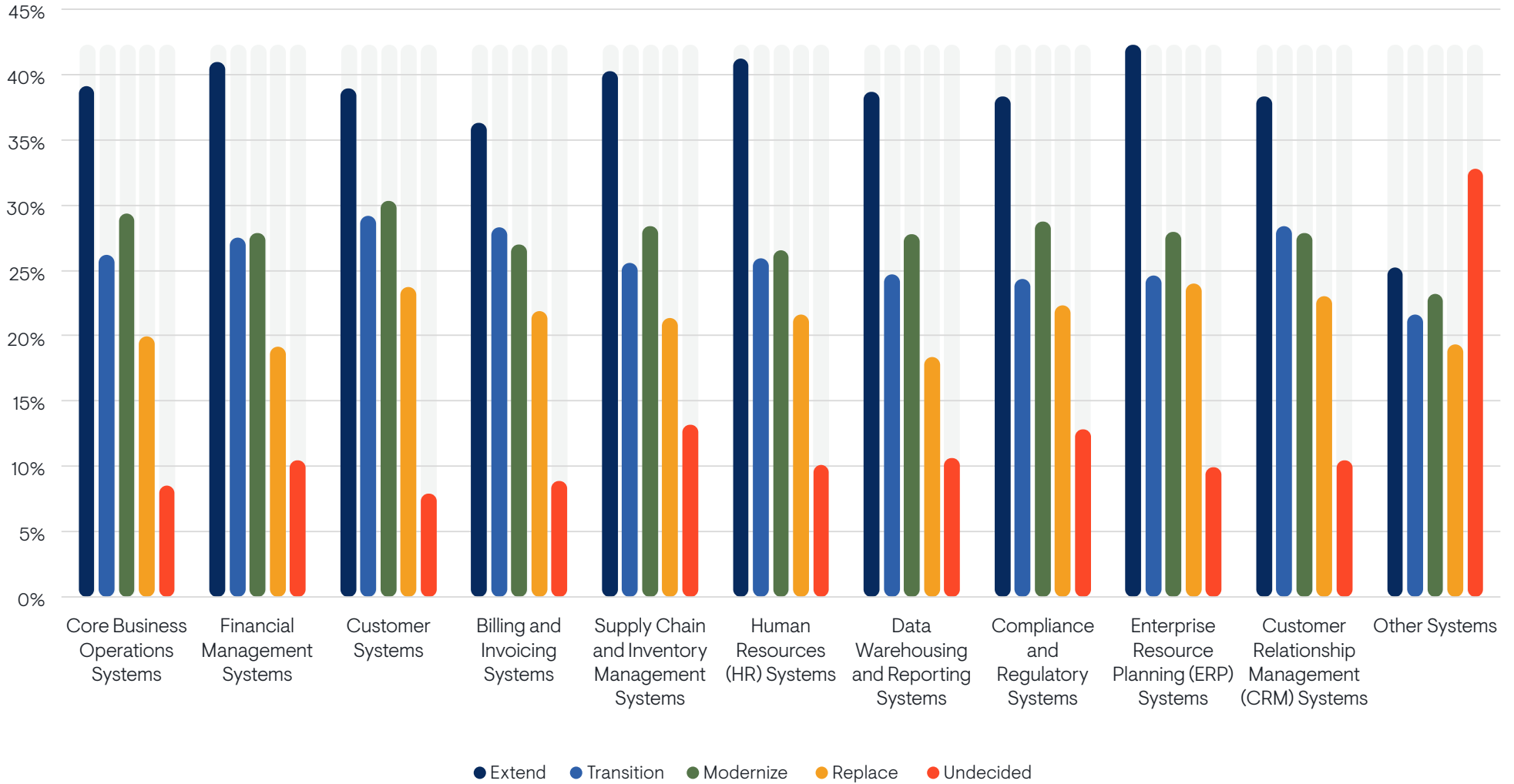


Figure 5

Sample Size = 234

How effective have the tools and environments you used for your modernization strategies been in meeting your expectations?

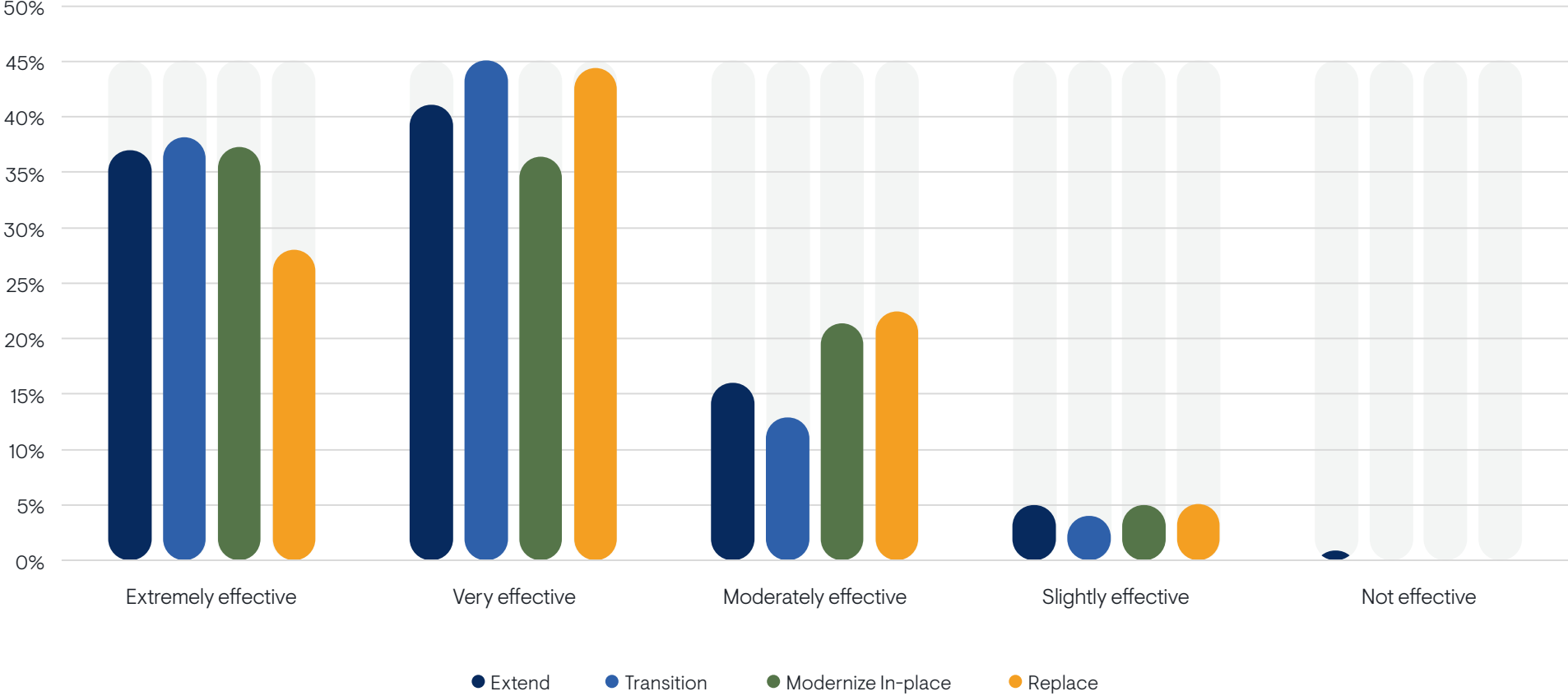


Figure 6

Sample Size = 234



Modernization Drivers and Challenges

A complex interplay of business objectives, technical demands, and market pressures drive mainframe modernization. While organizations aim to enhance performance, reduce costs, and foster innovation, they face significant challenges that can impede progress. Understanding these drivers and obstacles is critical to devising effective modernization strategies.

Key Drivers for Modernization

Survey respondents highlighted several primary motivators for embarking on modernization initiatives.

1. Performance Improvements

- Businesses demand faster, more reliable systems to meet evolving customer expectations.
- Nearly all respondents cited performance improvements, including reduced latency and higher throughput, as a priority.

2. Cost Reduction

- High operational costs, including hardware maintenance and software licensing, are pushing organizations to seek cost-effective alternatives through modernization.
- For **63% of respondents**, cost reduction was a critical factor.

3. Innovation Acceleration

- Organizations recognize the need for agility in developing and deploying new features and services.
- **52% of respondents** highlighted innovation as a key driver, particularly for improving time-to-market capabilities.

4. Regulatory Compliance and Security

- Evolving industry standards and increasing cybersecurity threats require modernization to ensure systems meet compliance and resilience needs.
- **76% of respondents** prioritized security and compliance as critical modernization drivers.

Challenges in Modernization

Despite the strong drivers, modernization initiatives are fraught with challenges that can delay or derail projects:

1. Technical Complexity

- **44% of respondents** reported difficulty integrating legacy systems with modern platforms.
- Data migration errors and maintaining operational continuity during transitions were frequently cited issues.

2. Resource Constraints

- Limited budgets, skilled personnel shortages, and staff turnover were reported as barriers to progress by **38% of respondents**.

3. Change Management

- Resistance from employees and misalignment among stakeholders often hinder modernization.
- Organizations reported challenges in fostering cross-departmental collaboration and securing buy-in for transformation initiatives.

4. Security and Compliance Risks

- **40% of respondents** expressed concerns about safeguarding data during modernization and meeting evolving regulatory standards.

Mitigation Strategies

Organizations that successfully navigated these challenges employed several mitigation strategies.

- **Phased Implementations:** Gradual rollouts allowed organizations to address challenges incrementally, reducing risk.
- **AI and Automation:** Leveraging AI tools for predictive analytics and automation streamlined modernization processes.
- **Vendor Collaboration:** Partnering with hyperscalers and consultants provided the expertise and tools needed for complex transitions.

Key Insights

The dual imperatives of improving performance and reducing costs while enabling innovation drive modernization. However, achieving these goals requires addressing technical, resource, and organizational challenges head-on. Organizations adopting phased approaches and leveraging advanced tools like AI are better positioned to overcome obstacles and achieve sustainable modernization outcomes.

Supporting Figures

- **Figure 7:** Top drivers for modernization (performance, cost reduction, innovation).
- **Figure 8:** Challenges encountered (technical complexity, resource constraints, change management).

What were the primary challenges or motivations that drove your organization to modernize mainframe applications?

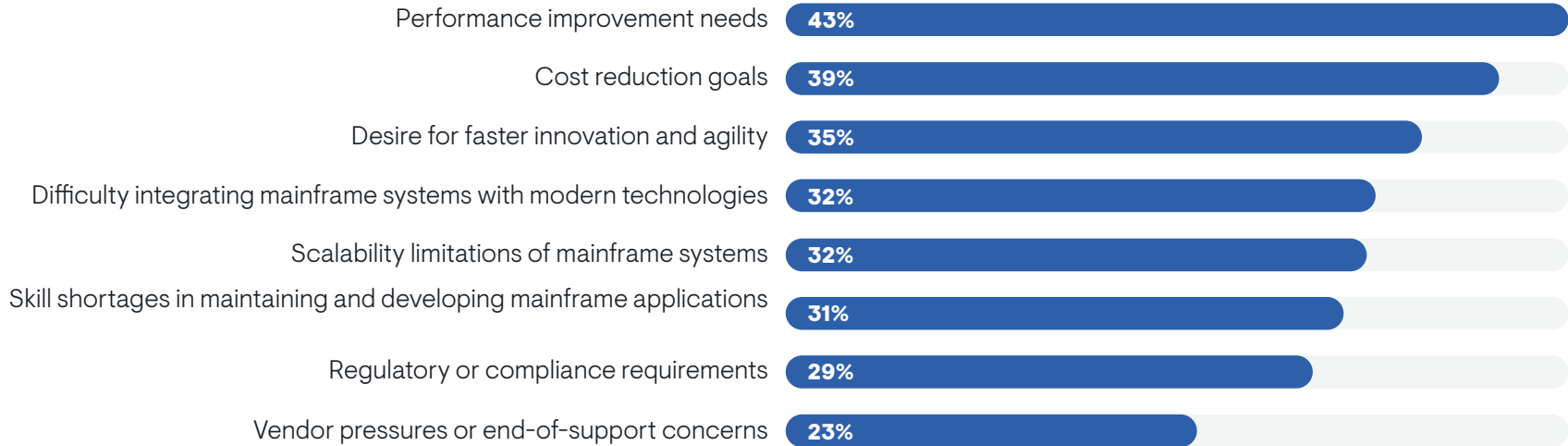


Figure 7

Sample Size = 234

What challenges has your organization encountered in integrating mainframe systems with newer cloud or distributed environments?

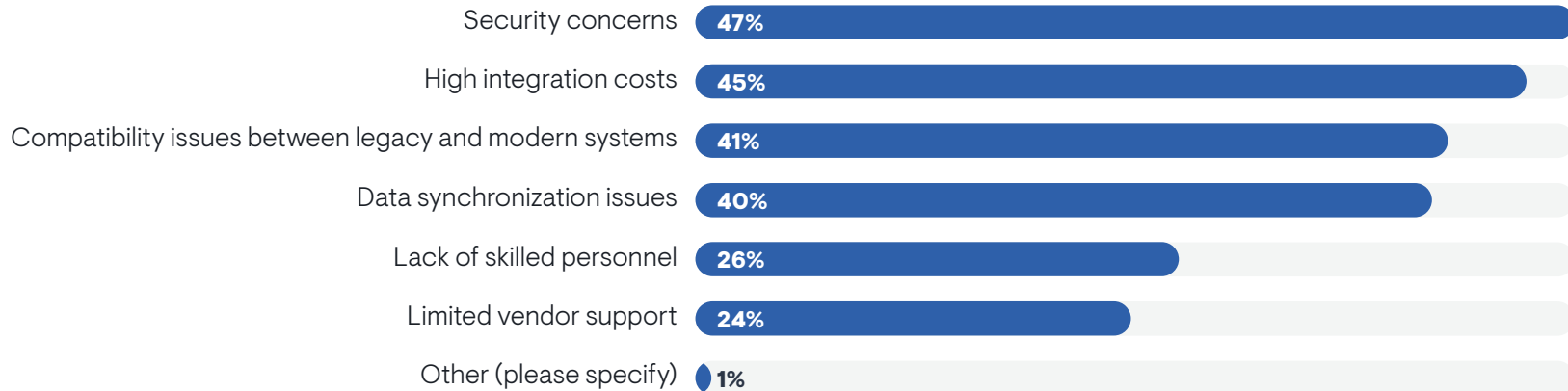


Figure 8

Sample Size = 234



Decision-Making Processes

Mainframe modernization requires careful decision-making that balances short-term priorities with long-term goals. The complexity and cost of modernization make these decisions highly strategic, involving multiple stakeholders and varying approaches depending on the chosen strategy. Leadership dynamics, including tenure and incentive structures, play a pivotal role in shaping these decisions.

Decision-Making by Strategy

The survey revealed distinct decision-making patterns across the four primary modernization strategies.

1. **Extend (Short-Term)**

- Typically a **top-down decision**, driven by leadership addressing immediate operational concerns with minimal disruption.
- Focused on maintaining business continuity while planning for future transformations.
- Key Decision-Makers: CIOs, CTOs, and VPs of IT.

2. **Transition (Rehost/Replatform)**

- Often influenced by **vendor-driven proposals** involving external service providers offering cloud or virtualized solutions that emulate mainframe functionality.
- Decision-making revolves around cost-benefit analyses and implementation feasibility.
- Key Decision-Makers: CIOs and vendor partners.

3. **Modernize In Place (Re-Engineer)**

- A **collaborative process** involving technical and operational teams, requiring a long-term vision for scalability and maintainability.
- Sustainability and alignment with strategic goals often influence decisions.
- Key Decision-Makers: COOs, enterprise architects, and VPs of IT.

4. **Replace (Cloud Native or Off-the-Shelf)**

- Initiated by senior leadership, but requires extensive technical input due to the complexity of retiring legacy systems.
- Decisions hinge on future business requirements and risk mitigation strategies.
- Key Decision-Makers: CIOs and external consultants.

Factors Influencing Modernization Decisions

Organizations consider a range of factors when choosing and implementing a modernization strategy.

1. Leadership Tenure

- **93% of respondents** indicated that leadership tenure influenced modernization decisions.
- Shorter tenures often favored **short-term strategies** like extending or transitioning, which yield quicker results.

2. Performance Incentives

- **90% of respondents** cited performance-based incentives as a factor, especially those tied to cost reductions and operational improvements.

3. Risk and Complexity

- **81% of respondents** reported that risk assessment and the complexity of integrating legacy systems heavily influenced decisions.

4. Strategic Alignment

- Balancing immediate operational needs with long-term modernization goals was reported as a major consideration by **61% of respondents**.

Stakeholder Involvement

The decision-making process for modernization often involves a diverse group of stakeholders.

- **Technical Teams:** Evaluate feasibility, scalability, and integration challenges.
- **Business Leaders:** Ensure alignment with broader business objectives and ROI expectations.
- **Vendors and Consultants:** Provide critical expertise, tools, and frameworks for execution.

Key Insights

Leadership tenure and incentive structures significantly influence modernization choices, often prioritizing short-term strategies over more sustainable approaches. Collaborative decision-making, involving both technical and business stakeholders, is essential for aligning modernization efforts with organizational goals and mitigating risks.

Supporting Figures

- **Figure 9:** Decision-making patterns by strategy type.
- **Figure 10:** Factors influencing modernization decisions (e.g., leadership tenure, risk assessment, and incentives).

How was the decision to pursue each modernization strategy made within your organization?

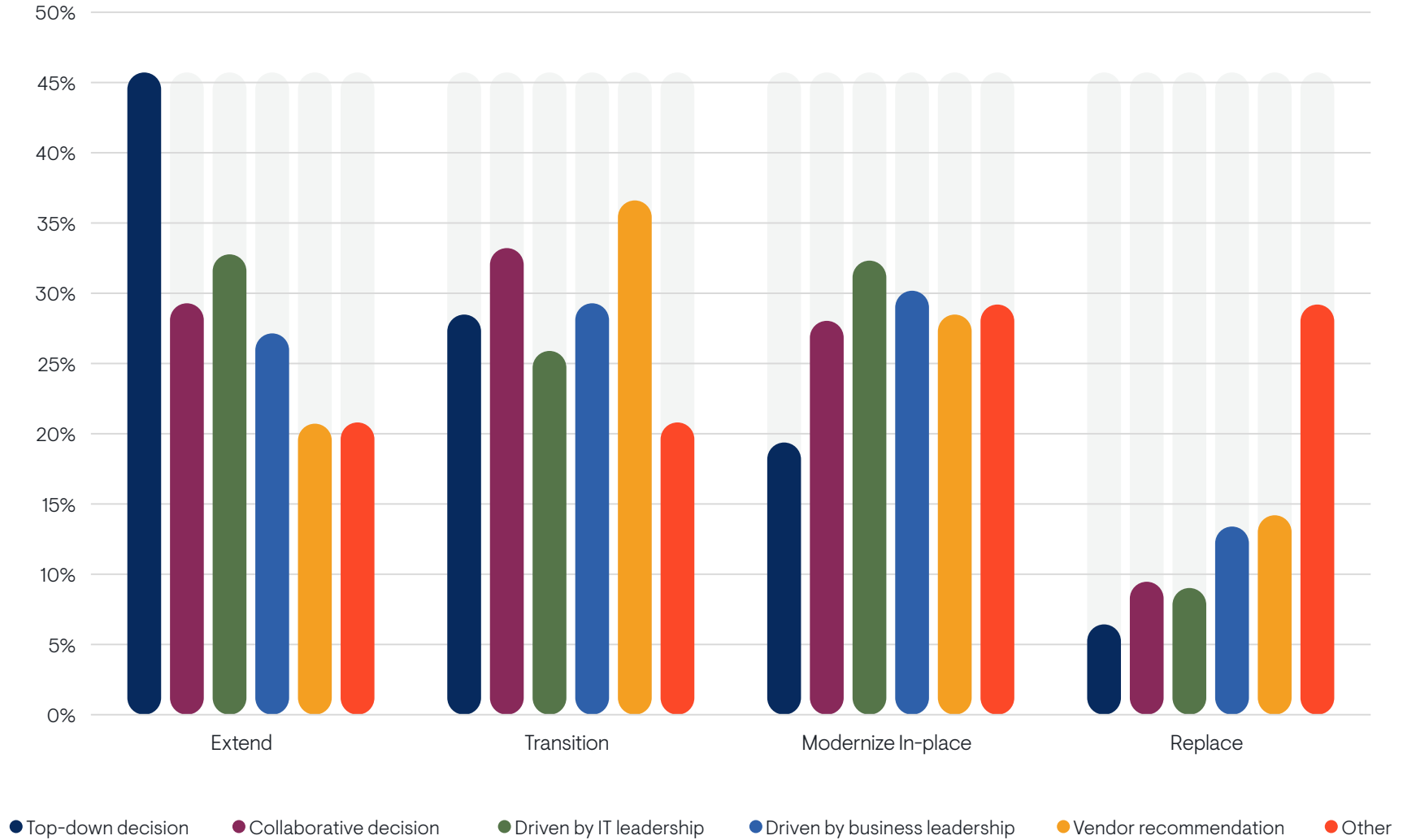


Figure 9

Sample Size = 234

How significant were the following cost factors in your decision to replatform or reengineer your mainframe applications?

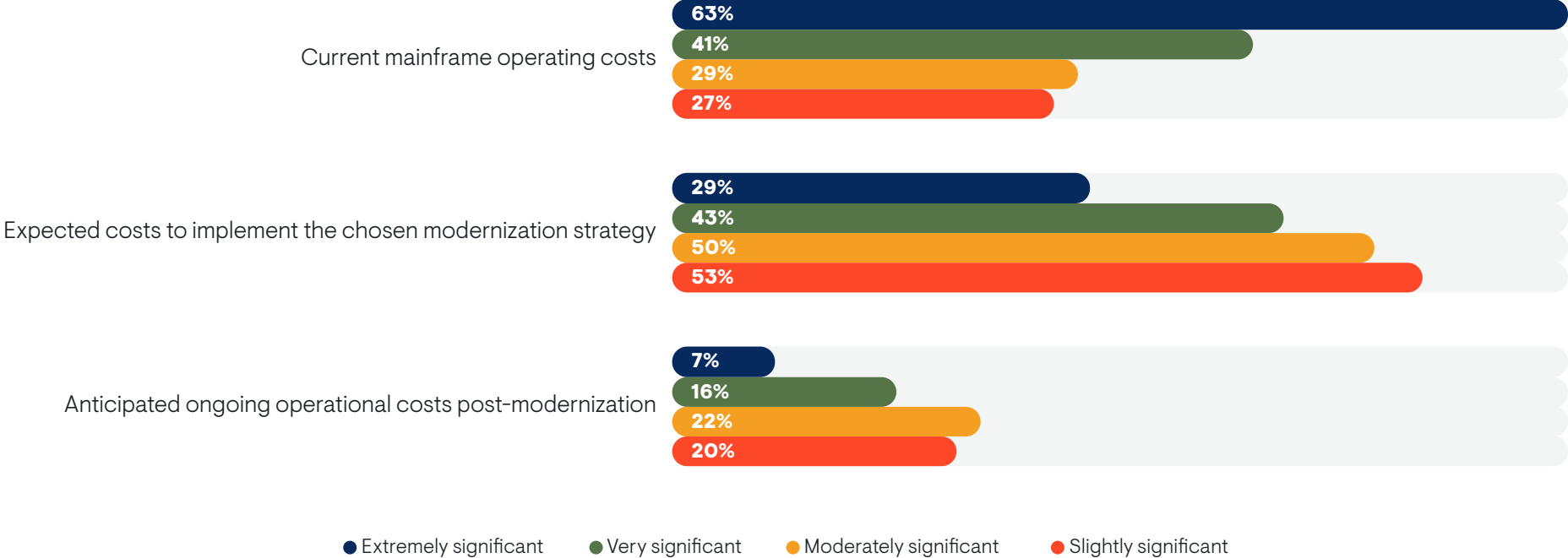


Figure 10

Sample Size = 234



The Role of AI and Emerging Technologies

Integration of AI in Modernization

AI tools are increasingly recognized as a cornerstone of mainframe modernization efforts, offering capabilities that address both immediate and long-term challenges. Organizations are leveraging AI to:

1. Streamline Processes

- Automated data migration and testing reduce time-to-market and improve reliability.
- Intelligent workload orchestration optimizes resource utilization across hybrid environments.

2. Enhance Decision-Making

- AI-driven insights help organizations prioritize modernization strategies by identifying high-impact areas.
- Predictive analytics provide real-time visibility into system performance and potential bottlenecks.

3. Support Long-Term Sustainability

- Machine learning models ensure continuous optimization of workloads as systems evolve.
- AI-based anomaly detection enhances system reliability and security post-modernization.

Key AI Tools Used in Modernization

Survey respondents identified several prominent AI platforms and frameworks as critical enablers of modernization.

• Hyperscaler Tools

- Cloud providers like Azure, AWS, and Google Cloud offer integrated AI services, including predictive analytics, anomaly detection, and natural language processing.

• Enterprise AI Frameworks

- Platforms such as IBM Watson and OpenAI are widely used for advanced data analysis, automation, and integration capabilities.

• Open Source AI Technologies

- Open source solutions provide flexibility for organizations to tailor AI capabilities to their unique modernization needs, particularly in hybrid environments.

AI's Role in Addressing Modernization Challenges

AI tools are particularly effective in mitigating some of the most significant obstacles to modernization.

1. Technical Complexity

- Automated code analysis and refactoring tools simplify the transition from legacy to modern systems.
- Middleware powered by AI ensures seamless integration across disparate platforms.

2. Resource Constraints

- AI reduces dependency on specialized technical skills by automating repetitive tasks.
- Intelligent monitoring tools optimize resource allocation, enabling IT teams to focus on strategic initiatives.

3. Security and Compliance

- AI-driven threat detection enhances security during and after modernization.
- Natural language processing aids in regulatory compliance by analyzing and aligning documentation.

Success Stories with AI Tools

Survey results underscore the value of AI in achieving modernization goals.

- **59% of respondents** plan to invest in AI as part of their modernization strategies.
- Organizations using AI for predictive maintenance and automation report higher satisfaction with modernization outcomes, particularly in scalability and cost-efficiency.

Key Insights

AI tools are a critical enabler of modernization, driving automation, predictive insights, and long-term system optimization. By leveraging AI, organizations can reduce complexity, enhance efficiency, and achieve scalable, sustainable modernization outcomes.

Supporting Figures

- **Figure 11:** Adoption of AI tools by hyperscalers and AI frameworks.
- **Figure 12:** Challenges in integrating AI into modernization efforts.

Which AI tools or automation technologies has your organization considered or used in your mainframe modernization efforts?

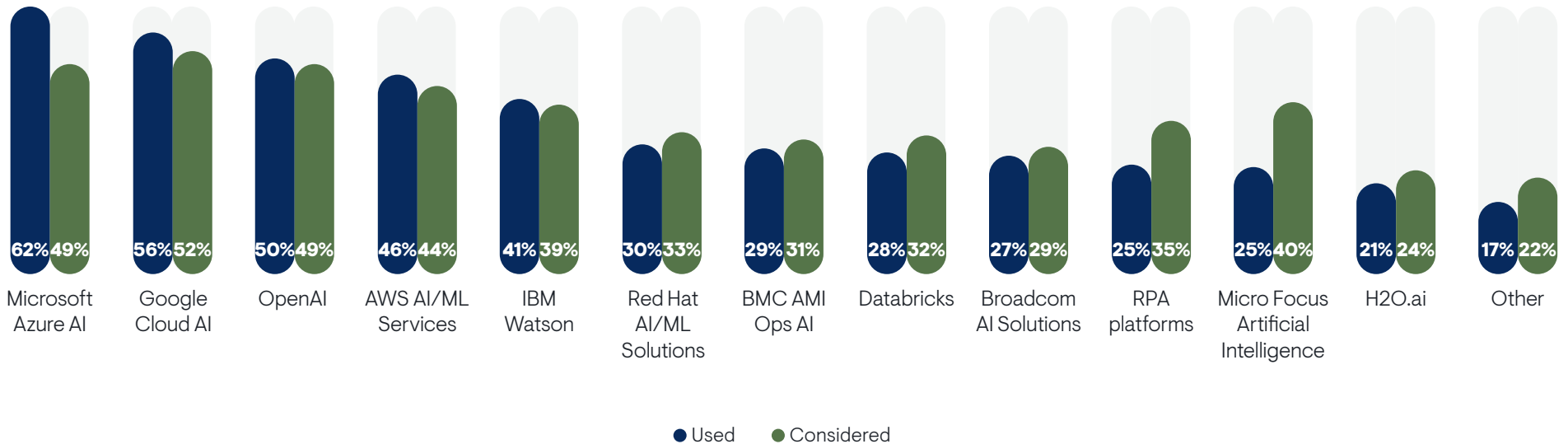


Figure 11

Sample Size = 234

What challenges has your organization encountered when integrating AI tools into your mainframe modernization process?

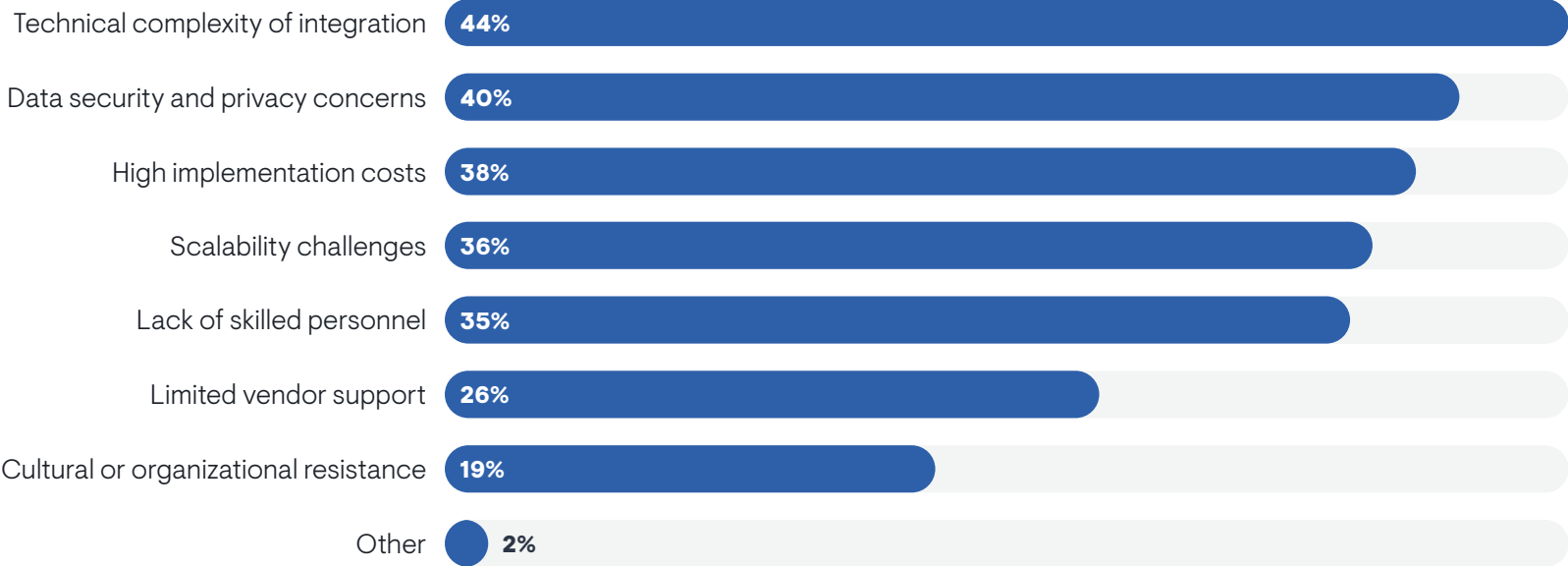


Figure 12

Sample Size = 234



ROI and Success Metrics

Mainframe modernization represents a significant investment, both financially and operationally. Measuring its success is critical for demonstrating value to stakeholders and guiding future modernization efforts. This section examines how organizations assess ROI, the lessons learned from their experiences, and the unforeseen challenges encountered along the way.

Measuring ROI

Organizations evaluate ROI using a combination of financial, operational, and strategic metrics. The survey highlights the following key areas:

1. Scalability and Performance

- **79% of respondents** reported meeting or exceeding expectations for scalability and performance improvements, particularly in modernization-in-place initiatives.
- Improved system reliability and the ability to handle larger workloads were cited as direct outcomes of successful modernization.
- Transitioning and replatforming strategies showed moderate success due to technical challenges in integration and data migration.

2. Cost Optimization

- Reducing operational and maintenance costs is a critical metric for **63% of respondents**.
- Organizations reported that transitioning to cloud native platforms or leveraging hybrid IT models significantly reduced infrastructure costs.
- In-place modernization, while less disruptive, demonstrated sustained cost-efficiency over time.

3. Enhanced Customer Experience

- Modernization efforts have led to faster application performance, improved service delivery, and better end-user satisfaction.
- Cloud native and AI-enabled systems were particularly successful in meeting customer expectations for speed and reliability.

4. Business Agility

- Respondents noted that modernization efforts improved their ability to adapt to changing business requirements, launch new services, and scale operations more effectively.

Lessons Learned

Respondents provided valuable insights into what they would do differently if they started modernization over again.

1. Thorough Planning and Phased Implementation

- A phased approach with clearly defined milestones and timelines reduces risk and allows for iterative improvements.
- Organizations emphasized the importance of detailed resource analyses and alignment of technical capabilities with business goals.

2. Early and Continuous Stakeholder Engagement

- Collaboration between technical teams, business leaders, and external partners ensures alignment and smoother adoption.
- Engaging stakeholders early helped organizations avoid misaligned priorities and unexpected resistance.

3. Leveraging AI and Automation Early

- Respondents highlighted the critical role of AI in streamlining modernization processes, particularly in areas like system testing, data migration, and predictive analytics.
- Early adoption of AI tools enhanced scalability and improved decision-making throughout the modernization lifecycle.

4. Vendor and Technology Selection

- Prioritizing scalable, flexible technologies and avoiding vendor lock-in were cited as key strategies for long-term success.
- Respondents advised thoroughly vetting vendor capabilities and aligning them with organizational objectives.

5. Addressing Change Management

- Developing robust change management strategies minimized resistance and fostered a culture of adoption across departments.

Unforeseen Challenges

Despite meticulous planning, organizations encountered several unanticipated hurdles.

1. Technical Complexities

- Data migration errors, integration bottlenecks, and unexpected system incompatibilities were common issues.
- Organizations underestimated the effort required to maintain operational continuity during transitions.

2. Resource Constraints

- Staffing shortages and skill gaps were significant barriers for **38% of respondents**.
- Budget overruns, particularly in transitioning and replacing strategies, caused delays and scope reductions.

3. Change Resistance

- Organizational inertia and employee reluctance to adopt new workflows delayed implementations.

4. Security and Compliance Risks

- Delays in meeting regulatory requirements and ensuring data integrity added complexity to many projects.

5. Timeline Adjustments

- Many projects experienced delays due to scope changes, unforeseen technical roadblocks, and insufficient testing.

ROI Benchmarks

The survey provided valuable benchmarks for organizations evaluating their own modernization efforts.

- **79% satisfaction rate** for scalability and performance improvements, particularly for in-place modernization.
- **63% reported significant cost savings**, particularly in hybrid and cloud native models.
- **59% planning AI investments** to further enhance ROI through automation and predictive insights.

Key Insights

Modernization success depends on balancing immediate needs with long-term objectives. Organizations that prioritize careful planning, proactive stakeholder engagement, and the strategic use of advanced technologies, such as AI, report the highest satisfaction and ROI. However, unforeseen challenges highlight the importance of flexibility, risk management, and continuous improvement throughout the modernization journey.

Supporting Figures

- **Figure 13:** Key ROI metrics for modernization efforts.
- **Figure 14:** Lessons learned and unforeseen challenges in modernization.

Have you achieved the expected ROI from your chosen modernization path to date?

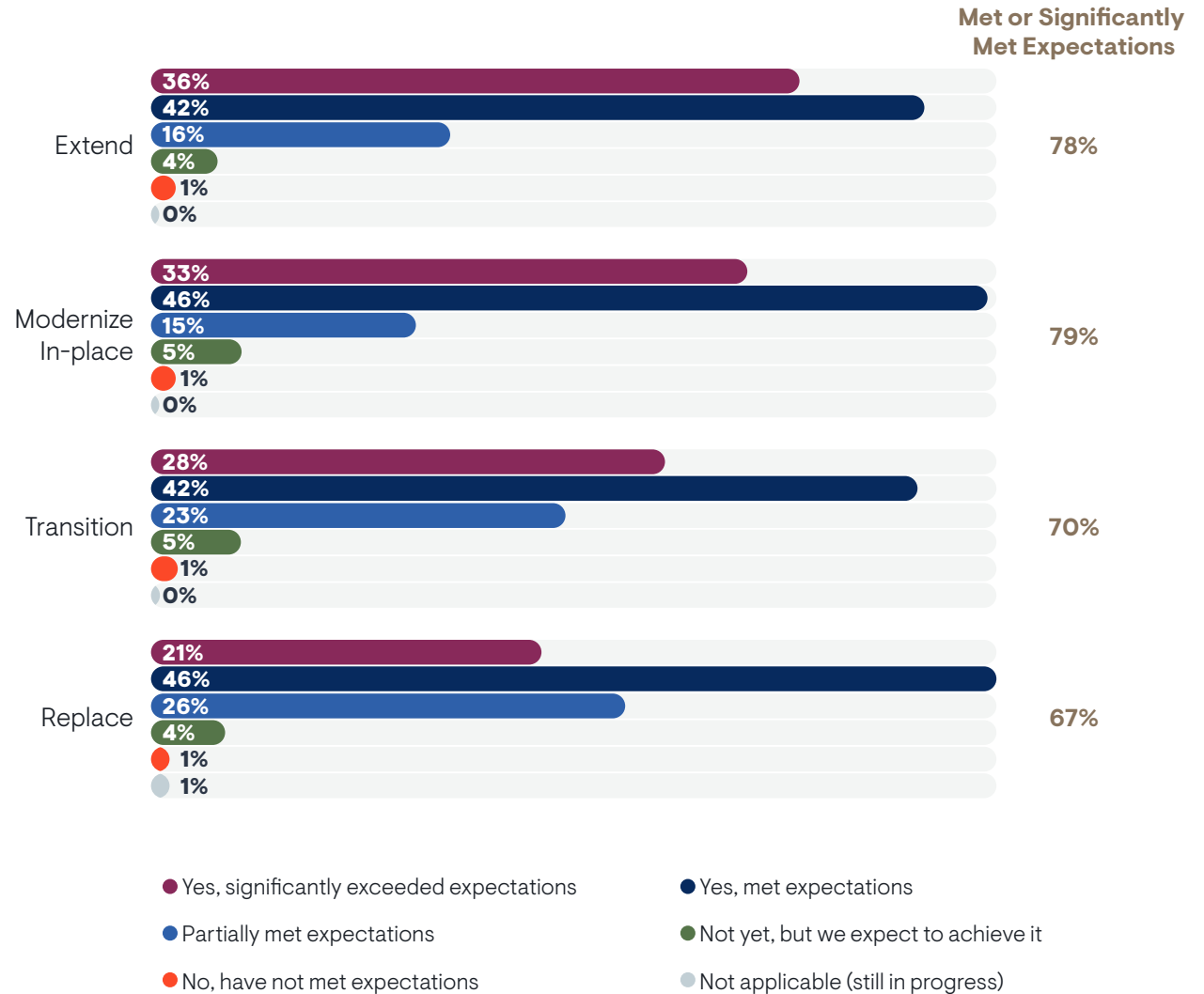


Figure 13

Sample Size = 234

If you were to start the modernization process again, what would you do differently?

1. Improved Planning and Preparation

- **Thorough Analysis:** Respondents emphasized the importance of conducting detailed resource and process analyses, as well as gathering requirements before starting the modernization process.
- **Clear Objectives:** Establishing clear goals and milestones for modernization efforts was widely recommended.
- **Incremental Approaches:** Many suggested adopting phased or step-by-step modernization plans to reduce risks and manage complexity.

2. Enhanced Stakeholder Engagement

- **Early Involvement:** Engaging stakeholders earlier in the process to align expectations and gather input was a recurring theme.
- **Cross-Functional Collaboration:** Several responses highlighted the importance of including diverse teams and viewpoints to address all requirements comprehensively.

3. Technology and Vendor Selection

- **Scalability and Flexibility:** Many respondents suggested prioritizing scalable, flexible, and interoperable technologies to future-proof systems.
- **Vendor Management:** Improved vendor selection processes and management were highlighted to avoid compatibility issues and ensure clear accountability.
- **Avoiding Lock-In:** Some participants emphasized the use of open standards to reduce vendor dependence.

4. Resource Allocation

- **Staff Training:** Properly training staff to manage new systems and ensuring robust training programs were common suggestions.
- **Adequate Budgeting:** Participants recommended allocating realistic budgets, including buffers for unforeseen costs.

5. Change Management

- **Employee Training and Buy-In:** Enhanced change management strategies, including employee training and communication, were emphasized to reduce resistance and ensure smooth adoption.
- **Continuous Feedback Loops:** Establishing mechanisms for ongoing feedback from users and stakeholders was highlighted as a way to refine modernization efforts.

6. Risk Mitigation

- **Testing and Validation:** Emphasizing pre-implementation testing, including compatibility and compliance checks, was widely recommended.
- **Backup Plans:** Several responses pointed to the importance of having contingency plans to address unexpected issues during modernization.

7. Leveraging AI and New Technologies

- **AI Integration:** Some respondents mentioned incorporating AI earlier in the process to improve decision-making and automate processes.
- **Advanced Tools:** Recommendations included adopting cutting-edge tools for iterative development and performance monitoring.

8. Sustainability and Long-Term Focus

- **Environmental Considerations:** A few respondents suggested prioritizing sustainability and aligning modernization efforts with broader environmental and social goals.
- **Future-Proofing:** Ensuring that modernization strategies accommodate evolving technologies and business needs was frequently mentioned.



Future Directions in Mainframe Modernization

Mainframe modernization is not a one-time event, but a continuous process shaped by emerging technologies, evolving business demands, and the pressures of digital transformation. This section outlines the key trends driving the future of modernization, the challenges organizations are likely to face, and actionable recommendations for achieving long-term success.

Key Trends Shaping the Future

1. **AI and Machine Learning as Strategic Drivers:**

- AI is no longer just a supplementary tool; it has become a foundational component of modernization strategies.
- Respondents noted that AI's applications in **predictive analytics, workload orchestration, anomaly detection, and resource optimization** are redefining how organizations approach operational efficiency and scalability.
- **59% of respondents** indicated that expanding AI investments is a top priority within the next two years, reflecting the growing reliance on intelligent systems to drive modernization efforts.

2. **The Rise of Hybrid IT Ecosystems:**

- Hybrid environments, where mainframes coexist with cloud native systems, are becoming the dominant model for modernization.
- **71% of respondents** view hybrid models as critical to bridging the gap between legacy systems and modern IT needs.
- Benefits of hybrid strategies include leveraging the reliability of mainframes for mission-critical workloads while gaining the agility and flexibility of cloud services for innovation and scaling.

3. **Open Source Tools and Technologies:**

- Open source frameworks, such as Kubernetes, OpenTelemetry, and OpenAPI, are increasingly favored for their flexibility, cost-effectiveness, and compatibility with hybrid IT environments.
- These tools allow organizations to avoid vendor lock-in while providing robust support for containerization, monitoring, and orchestration.

4. **Expanding Role of Mainframes in Digital Transformation:**

- While mainframes are often seen as legacy systems, **47% of respondents** anticipate their importance growing over the next 5-10 years, particularly as they integrate into hybrid IT ecosystems.
- Organizations are exploring ways to modernize mainframes to support **real-time analytics, API-driven applications, and AI workflows**.

5. **Sustainability and ESG Alignment:**

- Environmental, social, and governance (ESG) considerations are increasingly shaping IT decisions, with a focus on reducing carbon footprints and optimizing energy consumption.
- Respondents emphasized the role of modernization in achieving energy efficiency through hardware upgrades, workload consolidation, and intelligent scheduling.

Challenges on the Horizon

While the trends highlight opportunities, they also introduce new challenges.

1. Integration Complexity

- Combining modern tools, like AI and open source technologies, with existing mainframe environments requires careful planning and technical expertise.

2. Talent Shortages

- Finding skilled professionals who understand both mainframes and modern IT technologies is a growing concern.
- Many respondents indicated that **upskilling existing teams** is a priority to address this gap.

3. Balancing Costs and Benefits

- The high upfront costs of modernization can deter organizations, particularly when ROI is perceived as long-term.

4. Change Resistance

- Resistance from stakeholders and employees accustomed to legacy systems remains a significant barrier to adoption.

Strategic Recommendations

Organizations can position themselves for future success by adopting the following strategies:

1. Invest Heavily in AI and Automation

- AI tools should be integrated across all phases of modernization, from initial assessments and decision-making to execution and monitoring.
- Leveraging predictive analytics for system health and automated anomaly detection ensures smoother transitions and minimizes risks.

2. Adopt Hybrid Models

- Start with incremental migrations that focus on non-critical workloads to build confidence and mitigate risks.
- Hybrid models allow organizations to leverage mainframe reliability while gaining the flexibility of cloud platforms for innovation.

3. Leverage Open Source Solutions

- Open source frameworks provide cost-effective ways to enhance integration, monitoring, and orchestration in hybrid environments.
- Kubernetes, for example, allows for containerized workloads that can run seamlessly across mainframes and cloud environments.

4. Upskill Workforce and Build Collaborative Teams

- Invest in training programs that focus on bridging mainframe knowledge with expertise in cloud native and AI technologies.
- Cross-functional teams, including business and IT stakeholders, ensure alignment with strategic goals.

5. Prioritize Sustainability

- Modernization efforts should align with ESG goals by focusing on energy-efficient solutions, reducing redundancy, and consolidating workloads where possible.

Key Insights

Mainframe modernization is entering a transformative phase in which hybrid models, AI, and open source technologies play leading roles. Organizations that prioritize these trends, while addressing challenges like talent gaps and integration complexity, will gain a competitive advantage in the digital age.

Supporting Figures

- **Figure 15:** Adoption rates of AI and automation tools in modernization.
- **Figure 16:** Projected growth of hybrid IT ecosystems.

What unforeseen challenges did you encounter during the modernization process, and how did your organization address them?

1. Technical Challenges

- **Integration Issues:** Difficulty integrating legacy systems with modern platforms and cloud services.
- **Data Migration:** Errors, data loss, and challenges in maintaining integrity during migration.
- **Compatibility Problems:** Challenges in ensuring new systems work with existing technology stacks.
- **Scalability Issues:** New technologies not scaling as expected, leading to performance bottlenecks.

2. Resource Constraints

- **Staffing:** Shortages of skilled personnel and high turnover during key phases of modernization.
- **Budget Overruns:** Underestimation of costs, including vendor fees, hardware, software, and unanticipated expenses.
- **Training Needs:** Need for intensive training programs to upskill staff on new systems.

3. Change Management

- **Resistance to Change:** Hesitation or pushback from employees in adopting new technologies and workflows.
- **Stakeholder Engagement:** Difficulty in aligning departments and securing buy-in from stakeholders.

4. Security and Compliance

- **Regulatory Compliance:** Delays and issues in meeting industry standards and security protocols.
- **Data Security:** Concerns around maintaining data confidentiality and integrity.

5. Timeline and Execution

- **Delays:** Extended timelines due to unforeseen complexities and mid-project scope changes.
- **Project Management:** Challenges in maintaining the predicted pace and scope of implementation.

6. Strategies for Addressing Challenges

- **Phased Approaches:** Gradual implementations and data migrations to manage risk.
- **Middleware Solutions:** Use of middleware for seamless integration.
- **Budget Reallocation:** Adjusting financial plans to cover unexpected costs.
- **Enhanced Communication:** Workshops, targeted training, and regular updates to improve collaboration and change management.
- **Use of Consultants:** Engaging external experts for specialized support and solutions.

Figure 15

Sample Size = 234

As your organization looks ahead to the next 2-3 years, which of the following strategic actions do you plan to prioritize?

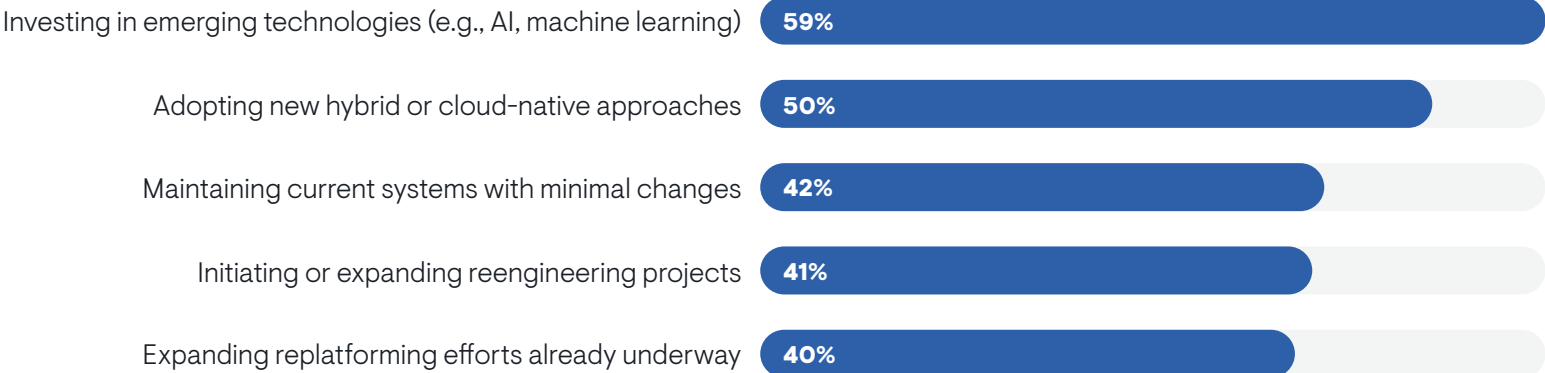


Figure 16

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Vendor and Tool Analysis

Vendors and tools are the backbone of successful mainframe modernization initiatives. They provide the frameworks, platforms, and expertise that enable organizations to overcome integration challenges, achieve scalability, and optimize costs. This section delves into the tools most commonly used, satisfaction levels with vendor-provided solutions, and best practices for selecting and working with vendors.

Key Vendors and Their Offerings

Survey respondents highlighted three major categories of vendors and tools that are instrumental in their modernization efforts:

1. Hyperscaler Platforms

- **Microsoft Azure, Amazon Web Services (AWS), and Google Cloud** dominate the landscape with robust solutions for cloud integration, scalability, and AI-driven automation.
- Hyperscalers are particularly valued for:
 - Seamless integration with hybrid IT environments.
 - AI and machine learning capabilities to support predictive maintenance and intelligent workload orchestration.
 - Scalable infrastructure that adapts to varying workload demands.

2. Enterprise AI Platforms

- **IBM Watson, OpenAI, and Google Vertex AI** provide advanced analytics and automation capabilities that streamline modernization processes.
- Common use cases include:
 - Leveraging predictive analytics to identify system inefficiencies.
 - Automating repetitive tasks like testing, migration, and system health monitoring.
 - Supporting decision-making with real-time insights into system performance.

3. Open Source Frameworks

- Tools like **Kubernetes, OpenTelemetry, and OpenAPI** are gaining traction for their adaptability and cost-efficiency.
- Open source frameworks are particularly useful for:
 - Containerized workloads that operate seamlessly across mainframe and cloud environments.
 - Reducing reliance on proprietary ecosystems, giving organizations greater flexibility in their modernization roadmaps.

Tool Adoption and Satisfaction Trends

Respondents expressed varying levels of satisfaction across different vendor types, with notable trends.

1. Hyperscalers

- Hyperscaler platforms received high satisfaction ratings for their scalability, integration capabilities, and robust AI toolsets.
- Organizations praised the ability to integrate mainframes into broader IT ecosystems using prebuilt APIs and connectors.

2. Enterprise AI Platforms

- Satisfaction was highest for AI-driven capabilities, particularly in anomaly detection, predictive analytics, and decision automation.
- However, some organizations noted challenges with the learning curve and implementation complexity of advanced AI tools.

3. Open Source Frameworks

- Open source solutions were favored for their flexibility and cost-efficiency.
- Respondents noted the need for skilled personnel to implement and manage open source tools effectively.

Challenges with Vendors and Tools

Despite high satisfaction levels, respondents cited several challenges when working with vendors and tools.

1. Integration Complexity

- Ensuring seamless compatibility between mainframes, cloud platforms, and open source tools required significant technical expertise.
- **42% of respondents** reported issues with interoperability between different vendor solutions.

2. Vendor Lock-In

- Proprietary tools from some vendors limited flexibility, making it difficult for organizations to switch providers or integrate with other solutions.

3. Cost Overruns

- The high cost of some proprietary tools, particularly from hyperscalers, was a concern for **37% of respondents**.

4. Limited Customization

- Respondents noted that some vendor-provided solutions lacked the customization needed to address unique organizational requirements.

Best Practices for Vendor Selection and Collaboration

Organizations shared several strategies for selecting vendors and ensuring successful collaboration.

1. Alignment with Modernization Goals

- Vendors should demonstrate how their solutions align with the organization's specific modernization strategy, whether extending, transitioning, or modernizing in place.

2. Focus on Scalability and Flexibility

- Prioritize vendors that offer scalable solutions and avoid locking organizations into rigid ecosystems.

3. Leverage Open Source and Hybrid Solutions

- Combining proprietary and open source tools often yields the best results, offering both reliability and adaptability.

4. Engage in Collaborative Partnerships

- Organizations that worked closely with vendors during the planning and implementation phases reported higher satisfaction levels.

5. Invest in Training and Support

- Comprehensive training on vendor tools and access to responsive support teams were critical for successful adoption and integration.

Key Insights

Vendor and tool selection is one of the most critical decisions in modernization efforts. Organizations that align vendor capabilities with their strategic goals and focus on scalability, flexibility, and interoperability report the highest satisfaction levels. The growing adoption of hybrid models and open source tools underscores the importance of adaptable, cost-effective solutions that complement proprietary platforms.

Supporting Figures

- **Figure 17:** Satisfaction levels by vendor and tool type (e.g., hyperscalers, enterprise AI, and open source frameworks).
- **Figure 18:** Adoption rates for hyperscaler platforms, enterprise AI tools, and open source solutions.

How satisfied are you with the support and tools provided by your selected vendor(s)?

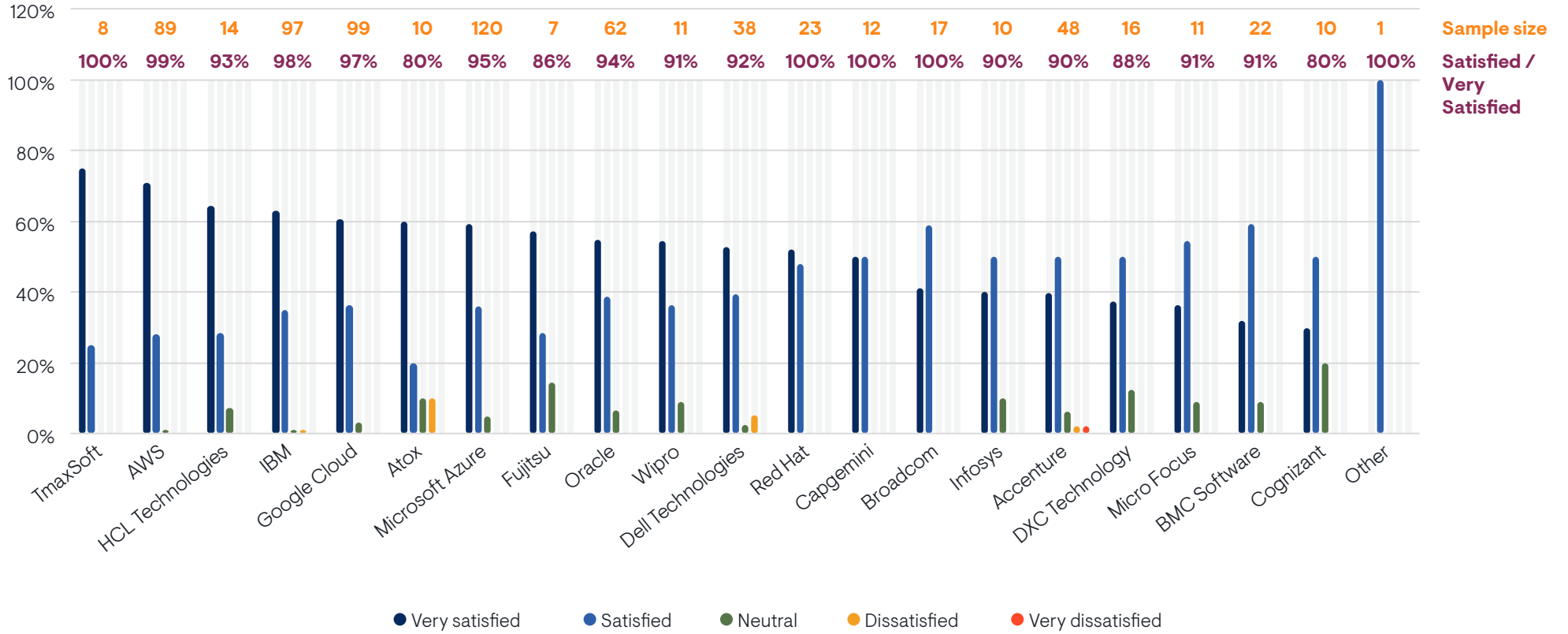


Figure 17

Sample Size = 234

Which vendors are you currently working with for your mainframe modernization efforts?

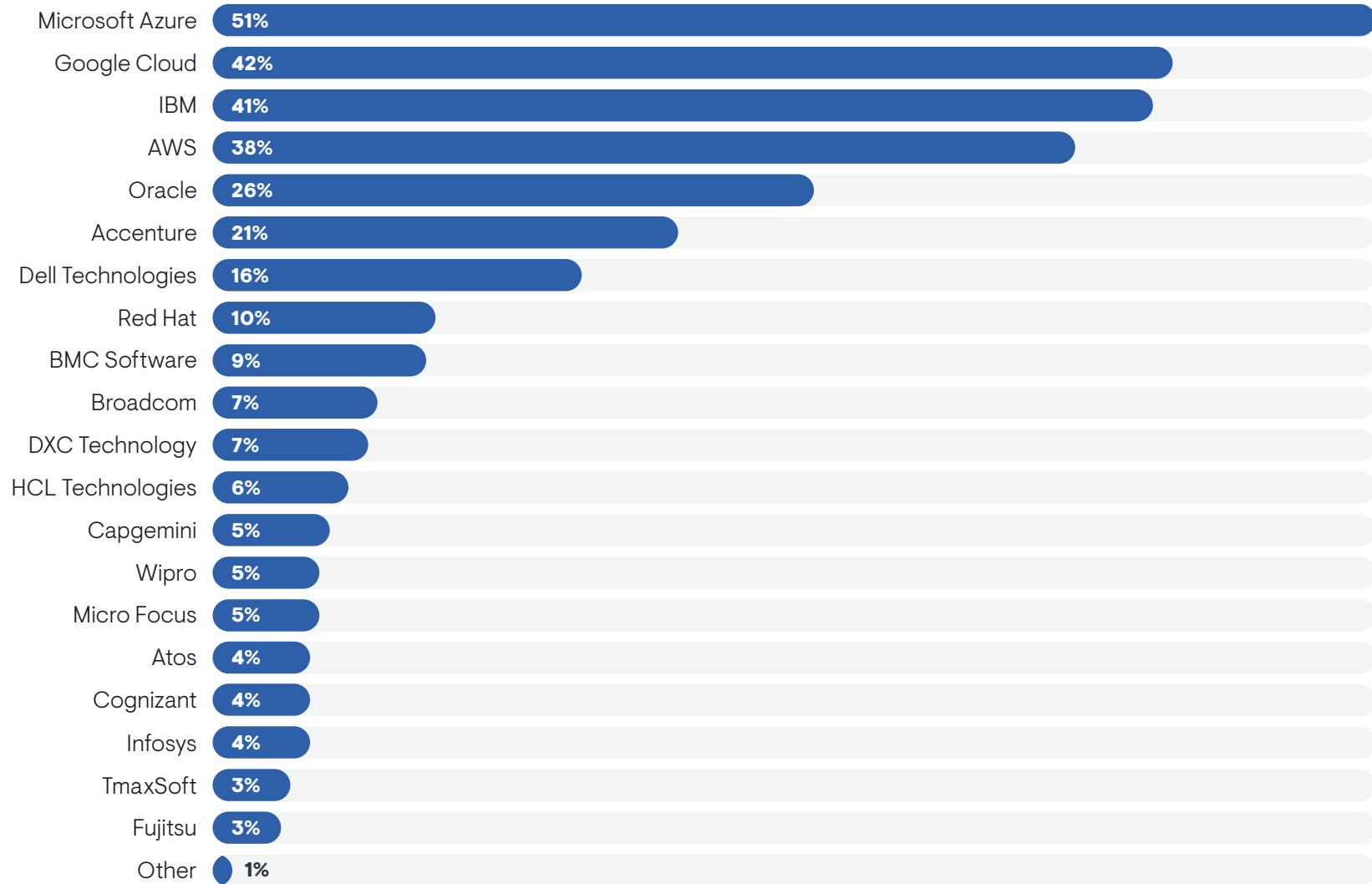


Figure 18

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Risks of Not Modernizing

Organizations that delay or avoid modernization efforts face significant risks, ranging from operational inefficiencies to missed opportunities for innovation. As digital transformation accelerates across industries, the inability to modernize mainframes poses both short-term challenges and long-term strategic disadvantages. This section explores the primary risks, their potential impact, and strategies to mitigate them.

Key Risks Identified

1. Security Vulnerabilities:

- Legacy mainframe systems often lack modern security frameworks, making them more susceptible to cyberattacks, breaches, and ransomware threats.
- Outdated encryption standards and insufficient patching processes further compound these risks.
- **42% of respondents** cited security concerns as a primary motivator for modernization, highlighting the need for improved defenses.

2. Operational Inefficiencies:

- Legacy systems are costly and resource-intensive to maintain, leading to higher operational overhead and inefficiencies in critical processes.
- **47% of respondents** noted that outdated infrastructure slows time-to-market for new applications and services, hampering competitiveness.

3. Missed Innovation Opportunities:

- Delayed adoption of AI, cloud native solutions, and hybrid IT models limits the organization's ability to innovate.
- Respondents emphasized that modernization enables faster product development, real-time analytics, and improved customer experiences, which are crucial for staying competitive.

4. Compliance Challenges:

- Regulatory requirements are evolving rapidly, and legacy systems often struggle to meet these new standards.
- Compliance issues can result in financial penalties, reputational damage, and operational disruptions.

5. Rising Costs:

- The longer an organization relies on legacy systems, the higher the maintenance and upgrade costs become.
- Hardware replacement cycles, escalating licensing fees, and skilled personnel shortages increase the cost burden over time.

6. Talent Drain:

- As mainframe experts retire, organizations relying on legacy systems face a shrinking pool of skilled professionals to maintain and optimize these environments.
- **31% of respondents** reported concerns about the availability of experienced staff to manage mainframes effectively.

The Cost of Inaction

Delaying modernization compounds these risks and often leads to escalating costs.

- Organizations that wait too long may face critical system failures, requiring emergency upgrades or unplanned migrations under significant time and budget constraints.
- Competitors that adopt modern IT solutions gain a significant advantage, outpacing organizations stuck with outdated systems.

Mitigation Strategies

Organizations can proactively address these risks by adopting targeted strategies to balance modernization efforts with immediate operational needs.

1. Phased Modernization

- Gradual implementation of modernization strategies allows organizations to reduce risks and maintain operational continuity.
- Starting with non-critical workloads or pilot projects ensures smoother transitions and quicker ROI.

2. Invest in AI and Automation

- Leveraging AI tools for predictive maintenance, security monitoring, and workload optimization helps bridge gaps in legacy systems while modernization progresses.
- AI-driven insights enable better planning and execution of modernization initiatives.

3. Hybrid IT Approaches

- Combining the reliability of mainframes with the flexibility of cloud native platforms ensures that organizations can innovate without abandoning their core systems.
- Hybrid models also mitigate risks by providing redundancy and scalability.

4. Upskilling and Talent Development

- Investing in training programs to upskill existing staff ensures that organizations maintain the expertise needed to manage both legacy and modern environments.
- Collaborations with external vendors and consultants can provide additional support during transitions.

5. Focus on Security and Compliance

- Modernization efforts should prioritize updating security frameworks, enhancing data encryption, and ensuring compliance with industry standards.
- Real-time monitoring and threat detection tools help mitigate vulnerabilities during and after modernization.

6. Leverage Vendor Expertise

- Partnering with experienced vendors ensures access to proven methodologies, scalable solutions, and ongoing support for modernization efforts.
- Vendors can provide tailored roadmaps to address specific organizational challenges.

Case Examples

Survey respondents highlighted specific instances in which delayed modernization led to significant issues.

- **System Downtime:** One organization experienced a major outage due to the inability of its legacy system to handle peak workloads, resulting in revenue loss and reputational damage.
- **Security Breach:** A health care company faced a data breach linked to outdated encryption protocols, incurring regulatory fines and customer attrition.
- **Compliance Penalties:** An insurance provider struggled to meet evolving GDPR requirements, leading to legal challenges and operational disruptions.

Key Insights

Organizations that proactively address these risks through phased modernization, AI integration, and hybrid IT strategies are better positioned to remain competitive and resilient in the face of industry changes. Importantly, these strategies also shape the future role of mainframes. As Figure 20 illustrates, 47% of organizations expect mainframes to become increasingly central to operations, while 38% foresee stability with no significant change. Only a small minority anticipate decline or elimination. This indicates that modernization strategies are reinforcing, rather than replacing, mainframes as part of enterprise IT.

Supporting Figures

- **Figure 19:** Risks associated with delaying modernization.
- **Figure 20:** Future role of mainframes post-modernization.

What risks do you associate with not modernizing your mainframe systems?

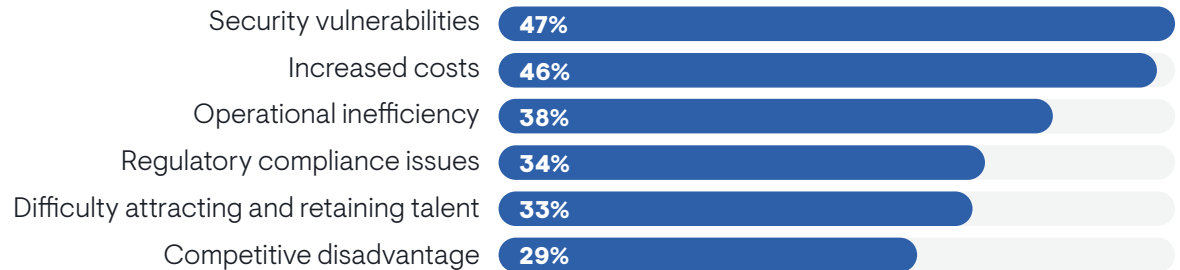


Figure 20

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Once your current modernization efforts are complete, how do you foresee the role of mainframes evolving in your organization over the next 5-10 years?

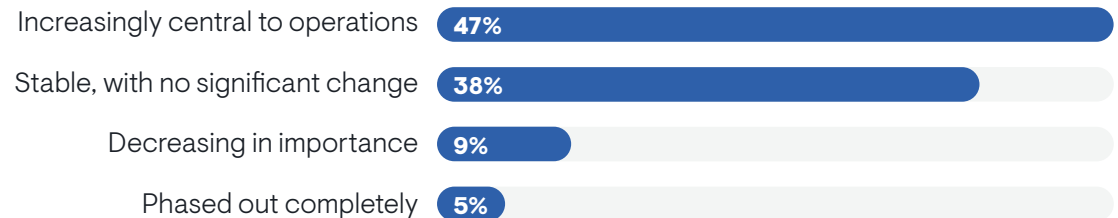


Figure 20

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EMA Perspective

Mainframe modernization is not just about updating legacy systems: it is the key enabler for unlocking the next phase of digital transformation. For many organizations, modernization is no longer a strategic option; it is a prerequisite for progress. The findings of this research highlight a stark reality: for a significant number of enterprises, digital transformation initiatives are at an impasse until the mainframe is addressed.

EMA's perspective provides context for these findings, offering a strategic lens through which to view modernization and its critical role in enterprise IT.

The Strategic Imperative of Modernization

Digital transformation initiatives often emphasize agility, speed, and customer-centric innovation. However, the survey results underscore a critical dependency: **52% of organizations cite the mainframe as a major roadblock to advancing their digital transformation efforts**. Another **39% acknowledge the mainframe as one of several factors necessitating modernization**. These findings reveal that digital transformation cannot fully move forward without modernizing the core systems that underpin critical business operations.

Modernization is the foundation upon which innovation rests. Until mainframe systems are re-engineered, extended, or transitioned, organizations will struggle to:

- Integrate with modern IT ecosystems.
- Deliver the rapid, real-time capabilities today's markets demand.
- Support advanced technologies like AI, predictive analytics, and cloud native applications.

EMA's view is that organizations must recognize modernization as a strategic priority, not merely a technical upgrade. The failure to modernize is a failure to compete in the digital economy.

Balancing Innovation and Risk

Modernization, while critical, comes with inherent risks. Organizations must carefully balance the need to innovate with the complexities of maintaining operational stability.

- **Innovation:** Leveraging AI, hybrid IT models, and open source tools allows enterprises to transform mainframes into hubs of agility and scalability.
- **Risk Mitigation:** Phased approaches, pilot programs, and collaboration with experienced vendors minimize the impact of unforeseen challenges.

The most successful organizations are those that adopt a “fail fast, learn fast” mindset. Incremental modernization efforts that deliver measurable value provide a pathway to transform systems with reduced risk and greater confidence.

Leadership and Cultural Transformation

Modernization is as much a cultural initiative as it is a technological one. Leaders must champion the effort and align it with the organization's broader goals. The research shows that leadership tenure and incentive structures influence the choice of modernization strategies, with shorter-tenured leaders often prioritizing quick wins. While such decisions can address immediate concerns, they risk delaying long-term progress.

EMA believes leadership should:

- Focus on long-term modernization objectives that support sustained innovation.
- Cultivate a culture of collaboration across IT and business teams to align technical capabilities with strategic needs.
- Prioritize upskilling employees to bridge talent gaps and foster a forward-looking mindset.

AI as a Cornerstone of Modernization

Artificial intelligence is no longer a differentiator—it is a necessity for modernizing mainframes. From predictive analytics to anomaly detection, AI tools enable mainframes to become proactive and adaptive systems capable of supporting the demands of the digital age. EMA's research finds that **59% of organizations plan to expand their use of AI**, recognizing its role in automating processes, enhancing decision-making, and optimizing workloads.

Organizations that fail to integrate AI into their modernization strategies risk missing opportunities to:

- Improve operational efficiency.
- Automate repetitive tasks.
- Deliver advanced customer experiences.

EMA's perspective is clear: AI should be embedded in modernization initiatives from the outset, providing a foundation for future growth and innovation.

Sustainability and Modernization

As sustainability becomes a top priority for enterprises, mainframe modernization offers unexpected alignment with ESG goals. Modern mainframe technologies enable energy-efficient operations, workload consolidation, and reduced hardware footprints, contributing to lower environmental impacts.

EMA sees sustainability as a key driver of modernization, particularly for organizations aiming to:

- Reduce energy consumption and operational costs.
- Align IT strategies with broader ESG initiatives.
- Demonstrate corporate responsibility to stakeholders and regulators.

Final Thoughts

For many organizations, the mainframe is not just a technical challenge: it is the lynchpin holding back broader transformation efforts. Mainframe modernization is the critical first step in enabling agility, scalability, and innovation across the enterprise. Until modernization is prioritized, digital transformation initiatives will remain incomplete and organizations will struggle to keep pace with market demands.

EMA's perspective is that modernization should be framed as an enabler of business outcomes, not merely a cost or a technical upgrade. Organizations that approach modernization with a strategic, long-term vision—embracing AI, hybrid IT models, and cultural alignment—will position themselves to thrive in an increasingly digital and competitive world.





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