IDC FutureScape: Worldwide Healthcare Industry 2025 Predictions

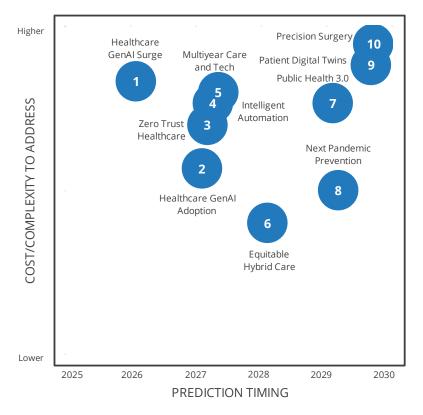Mutaz Shegewi   Lynne Dunbrack   Jennifer Eaton   Nino Giguashvili
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IDC FUTURESCAPE FIGURE

FIGURE 1

IDC FutureScape: Worldwide Healthcare Industry 2025 Top 10 Predictions

Note: Marker number refers only to the order the prediction appears in the document and does not indicate rank or importance, unless otherwise noted in the Executive Summary.

Source: IDC, 2024

EXECUTIVE SUMMARY

This IDC FutureScape provides executives across the globe with actionable insights and analysis for future healthcare industry scenarios. The intended readers include, but are not limited to, members of the business, clinical, and IT leadership of healthcare provider and payer organizations worldwide. The IDC FutureScape 2025 predictions indicate that healthcare organizations will shift from experimenting with generative artificial intelligence (GenAI) to implementing enterprisewide AI strategies. This shift will accelerate the adoption and infusion of AI and drive rapid transformation across the ecosystem. As care and reimbursement models continue to evolve, the healthcare industry will increasingly rely on AI to address its challenges. These challenges include dealing with workforce shortages, improving workflow efficiency, reducing costs, enhancing quality, and elevating experiences for all. With improved strategic alignment, new technological capabilities, and a shift from digital experimentation to value realization, healthcare organizations are preparing for an AI-infused future with substantial increases in IT scale and complexity. The focus will be on investments that modernize infrastructure and expand capabilities to enhance patient outcomes and operational efficiency, not only through new AI-powered solutions but also by upholding responsible, human-centric ethics as the foundation for best practice.

IDC's worldwide healthcare industry 2025 predictions are:

- **Prediction 1:** By 2026, healthcare GenAI investments will triple, driven by rapid use case deployment, more curated clinical data, and increased organizational buy-in.

- **Prediction 2:** By 2027, 75% of healthcare GenAI initiatives will fail to achieve expected benefits due to barriers to adoption like trustworthiness of the data, disconnected workflows, and end-user resistance.

- **Prediction 3:** By 2027, growing cybersecurity risks will push 40% of healthcare organizations to adopt AI-based threat intelligence solutions to ensure care continuity and safeguard patients.

- **Prediction 4:** By 2027, the healthcare industry will save up to $382 billion by significantly optimizing clinical, operational, and administrative workflows through intelligent automation.

- **Prediction 5:** By 2027, 40% of patients will enroll in multiyear reimbursement models that cause the need for long-term infrastructure investment to support linking payment to customized, longitudinal care models.

- **Prediction 6:** By 2028, driven by the demand for enhanced care collaboration, expanded clinician and consumer access, and enhanced digital literacy, 80% of patients will utilize hybrid care.
- **Prediction 7:** By 2029, AI-driven Public Health 3.0 initiatives will accelerate policy planning, execution, and resource mobilization, expanding local community engagement and program coverage by 50%.
- **Prediction 8:** By 2029, healthcare investments in AI-powered early detection programs will Triple to fight the "next pandemic" of noncommunicable diseases, focusing on cancer and neurological diseases.
- **Prediction 9:** By 2029, large healthcare providers will scale the adoption of patient digital twins by 60% to transform medical education, enhance clinical cost-effectiveness, and drive safer personalized care protocols.
- **Prediction 10:** By 2029, at least 50% of complex, high-volume surgeries at top global hospitals will use AI-driven, real-time guidance, haptic feedback, and advanced analytics, reducing surgical complications by 60%.

This IDC study provides executives across the globe with actionable insights and analysis for future healthcare industry scenarios.

"The healthcare industry is at the forefront of a technological era poised to redefine patient care for the long run, but this transformation is not without its challenges," says Mutaz Shegewi, senior research director at IDC Health Insights. "The future mandates that healthcare organizations not only embrace cutting-edge AI and GenAI but also navigate regulatory challenges, foster trust in the technology, secure their data at all times, and seamlessly integrate their vision for tomorrow into evolving care and reimbursement models. Those that thrive will proactively prioritize responsible, human-centric AI practices throughout the journey and continuously invest not just in technologies but also in their workforce's ability to adapt to and champion change."

IDC FUTURESCAPE PREDICTIONS

Summary of External Drivers

- **AI-driven business models** — Moving from AI experimentation to monetization
- **The drive to automate** — Toward a data-driven future
- **Regulatory flux** — Navigating compliance challenges in a shifting policy landscape
- **Expanding digital security frontiers** — Fortification against multiplying threats
- **Responsible and human-centric technology** — Ethics in the enterprise
- **Battling against technical debt** — Overcoming hurdles to IT modernization

- **Customer experience squared** — Consumer and citizen expectations for digital services

Predictions: Impact on Technology Buyers

Prediction 1: By 2026, Healthcare GenAI Investments Will Triple, Driven by Rapid Use Case Deployment, More Curated Clinical Data, and Increased Organizational Buy-In

The healthcare industry is at a pivotal moment, with GenAI rapidly transitioning beyond experimental piloting. As healthcare organizations actively seek to enhance workflow productivity and workforce efficiency, the expected tripling of healthcare GenAI investments by 2026 is a testament to their strategic planning and proactive approach. Nearly two out of five (38.6%) healthcare organizations plan to allocate a dedicated budget for GenAI projects, recognizing the strategic importance of timely investments.[1] An almost equal number believe that GenAI foundation models, platforms, and application technologies will significantly disrupt their competitive position within the next 18 months. Globally, healthcare organizations are increasingly looking to external partnerships for advanced technologies like GenAI, analytics, and automation to enhance care delivery. In the United States, healthcare organizations like Mayo Clinic and Stanford Medicine have partnered with Google Cloud and Microsoft, respectively, to integrate GenAI for enhanced clinical decision-making and streamlined documentation, improving both physician efficiency and patient care. Similarly, in the European Union (EU), strategic partnerships and investments are driving the adoption of AI to enhance diagnostics and ensure equitable and safe access to it across the region. Meanwhile, in the Asia/Pacific region, nearly half (48.6%) of healthcare organizations are pursuing partnerships to optimize care processes and improve operational efficiency.[2] For example, Apollo Hospitals in India is consolidating its clinical data repository to create a new clinical intelligence engine using large language models, which will help enable doctors to quickly determine the next best action for patients during consultations.

Given this rapidly evolving landscape, it is crucial to clearly understand evolving regulatory requirements, including compliance challenges. Solutions should not only meet these standards but also align with responsible and human-centric technology principles as ethical AI is becoming a key purchasing criterion, with buyers tasked with ensuring that their investments align with broader societal values, such as transparency, equity, and patient-centered care. External factors, particularly the AI healthcare strategies of national governments, are also significant contributors to the increase in GenAI investments. For example, in the United States, the FDA's AI/ML-based Software as a Medical Device Action Plan is driving innovation and regulatory frameworks to ensure the safe and effective use of AI in healthcare. Similarly, the

United Kingdom's National AI Strategy aims to democratize the adoption of AI and GenAI across the country. Also, Singapore's National AI Strategy 2.0 is designed to amplify and manage the impact of AI across various industries, including healthcare. This strong support from national governments, combined with internal forces and robust digital infrastructure, is poised to drive outcome-based investment in healthcare GenAI.

Associated Drivers

- **AI-driven business models** — Moving from AI experimentation to monetization
- **Regulatory flux** — Navigating compliance challenges in a shifting policy landscape
- **Responsible and human-centric technology** — Ethics in the enterprise

IT Impact

- To ensure a scalable and secure platform capable of handling structured and unstructured data sets, it is essential to enhance collaboration with cloud partners and leverage the latest GenAI tools and features.
- Alignment of internal skill sets with specific investments in identified GenAI use cases will gain prioritization.

Patient Impact

- Faster and hyper-personalized query responses from automated systems supporting patients
- Enhanced patient confidence, as GenAI tools are equipped to ensure more accurate diagnosis, leveraging internal clinical data sets with a clinician-in-the-loop system.

Guidance

- Involve both IT and LOBs in evaluating use cases entering into POC and production to ensure clinicians' buy-in and alignment of GenAI use cases.
- Select a GenAI partner ecosystem based on clearly defined attributes and business objectives to anchor outcome-based engagement.

Prediction 2: By 2027, 75% of Healthcare GenAI Initiatives Will Fail to Achieve Expected Benefits Due to Barriers to Adoption Like Trustworthiness of the Data, Disconnected Workflows, and End-User Resistance

The healthcare industry is all in on the promise of AI, with about 40% of the industry increasing its overall IT budget and one-fifth relying on new funding from individual business units for AI initiatives.[1] However, several barriers hinder adoption, including

concerns about marginalization and the risk of AI-induced errors that could adversely impact patient care, raising questions about accountability. Bias and "hallucinations" frequently arise from training models on poor-quality or incomplete data, which can lead to inaccurate or misleading outputs, further complicating trust in AI systems. One-fourth of the healthcare industry does not believe it has systems and processes in place to ensure that the data used in GenAI initiatives will always be of high quality.[1] A fourth also believes inadequate infrastructure performance and availability will be the greatest factor limiting success in GenAI implementation initiatives.[1]

Ignorance breeds fear. To address this, a third of the healthcare industry believes mandatory GenAI awareness and acceptable use training programs should be introduced for specific workforce groups. In addition, 40% advocate for establishing corporatewide guidelines to ensure transparency and track the use of GenAI code, data, and trained models.[1] Furthermore, 29% of the industry emphasizes that the most important process or policy to put in place to ensure success in developing GenAI models and capabilities is creating or expanding a formal AI governance, ethics, and risks council to oversee these initiatives.[1]

Integrating GenAI into healthcare workflows can lead to better member, patient, and provider experiences, greater productivity, and reduced administrative burden, helping alleviate clinician burnout. The true value of GenAI in healthcare lies in its potential to transform patient experiences and improve clinical outcomes by offering providers real-time, critical insights on the end-to-end patient profile at the point of care. However, disconnected data and fragmented workflows can increase end-user resistance, jeopardizing the success of otherwise promising GenAI initiatives.

Associated Drivers

- **AI-driven business models** — Moving from AI experimentation to monetization
- **The drive to automate** — Toward a data-driven future
- **Responsible and human-centric technology** — Ethics in the enterprise

IT Impact

- IT will partner with business and focus on building responsible AI frameworks and robust data governance models.
- Collaboration between IT and business will fuel the development of frameworks to prioritize use cases that transform provider and patient experiences.
- IT will create model scorecards to monitor for model drift and bias creep.

Patient Impact

- The lack of robust governance frameworks and policies that drive transparency will negatively impact patients, resulting in a lack of trust and reduced retention.

- Clinical outcomes will be impacted in cases where patients decline treatments or reject diagnoses owing to distrust in AI.

Guidance

- Establish ethics councils and responsible AI frameworks to define ethical boundaries for AI use while regularly reviewing risks and opportunities.
- Listen to the voice of the patient and the provider. Establish training programs to create awareness and build trust.
- Prioritize data integration strategies and drive interoperability to create seamless workflows, yielding valuable insights at the point of care.

Prediction 3: By 2027, Growing Cybersecurity Risks Will Push 40% of Healthcare Organizations to Adopt AI-Based Threat Intelligence Solutions to Ensure Care Continuity and Safeguard Patients

Healthcare organizations face escalating cyberattacks globally that jeopardize patient safety and care continuity. IDC's latest data highlights that 30% of European healthcare providers identify growing cybersecurity risks as a top challenge.[3] In 2023, European healthcare providers accounted for 53% of all cybersecurity incidents over the previous two years, with hospitals representing 42% of these cases.[4] Ransomware attacks can cause substantial operational disruptions, leading to a 20.7% increase in in-hospital death rates and severe complications, as demonstrated by the first U.S. lawsuit and settlement involving a death allegedly linked to a hospital ransomware attack.[5,6] A 2023 report by the American Hospital Association noted that outdated software systems in 96% of hospitals, coupled with fewer than 50% of hospitals assessing patient care risks when reviewing new products from technology suppliers, exacerbates vulnerabilities.[7] According to the same report, the Federal Bureau of Investigation and the Department of Justice classify hospital cyberattacks as "threat to life" offenses, highlighting their severe impact.

Governments and regulators across the globe are collaborating to enhance cyber-resilience in healthcare, encouraging healthcare organizations to prioritize investments in cybersecurity infrastructure and deploy advanced solutions. Zero trust architecture (ZTA) — incorporating endpoint security, security analytics, data security, and identity and access management — forms the backbone of modern cyber defense strategies, ensuring thorough verification of all access requests. IDC data confirms that 44% of healthcare organizations acknowledge the benefits of incorporating zero trust principles into their strategy.[8] Simultaneously, threat intelligence is the least likely to be affected by budget cuts in healthcare.[9] As these solutions evolve, AI-driven threat intelligence will play a crucial role in implementing and maintaining a robust ZTA by

analyzing extensive threat data in real time and supporting adaptive security measures for swift detection and response. This proactive approach significantly reduces the likelihood of successful cyberattacks and enhances the ability to predict and mitigate potential security breaches, protecting patient safety, preventing care disruptions, and maintaining trust in the healthcare ecosystem.

Associated Drivers

- **AI-driven business models** — Moving from AI experimentation to monetization
- **Regulatory flux** — Navigating compliance challenges in a shifting policy landscape
- **Expanding digital security frontiers** — Fortification against multiplying threats

IT Impact

- Higher short-term investments in IT infrastructure, including replacing legacy systems, are necessary to support advanced cybersecurity solutions.
- Increased costs will be incurred for upskilling staff to manage and operate new systems and technologies effectively.

Patient Impact

- Improved patient safety and continuity of care through resilient IT systems and advanced cybersecurity measures
- Increased trust in healthcare providers due to enhanced data protection and privacy measures, fostering a stronger relationship between patients and their care teams

Guidance

- Establish rigorous protocols to assess the cybersecurity practices of new suppliers, ensuring they comply with stringent security standards for data protection and patient safety.
- Strengthen your ZTA by integrating AI-driven technologies that enhance real-time threat detection, monitoring, and response capabilities, ensuring robust protection while maintaining operational continuity.

Prediction 4: By 2027, the Healthcare Industry Will Save up to $382 Billion by Significantly Optimizing Clinical, Operational, and Administrative Workflows Through Intelligent Automation

Healthcare organizations are strategically aligning with the burgeoning shift toward intelligent automation, poised to generate up to $382 billion in savings across the industry. This projection is rooted in a detailed analysis by IDC in July 2024 of global healthcare expenditures, expected to reach $10.92 trillion by the end of 2024.[10] With

payroll expenses comprising up to 50% of this total — approximately $5.46 trillion — intelligent automation offers a transformative opportunity to optimize efficiency. By increasingly and more sophisticatedly automating clinical, operational, and administrative workflows, the industry can expect to save around 7% of work hours across these payroll expenditures by 2027, equating to significant cost reductions. Research conducted by the McKinsey Global Institute aligns with this view by estimating that 15% of current work hours in healthcare could be automated by 2030.[11]

Several factors drive the financial impact. AI-driven business models are rapidly evolving, transitioning from experimentation to full deployment as organizations integrate AI. Technologies such as Nuance DAX Copilot, scaled by Microsoft Cloud for Healthcare and Oracle Health's Clinical Digital Assistant, have already shown promise, enabling more efficient clinical documentation and patient interaction. The drive to automate is increasingly pushing the industry toward a data-driven future where traditional AI and GenAI are harnessed to optimize clinical, operational, and administrative workflows. This shift is supported by major initiatives such as the U.S. Department of Health and Human Services' push for AI adoption and the EU's Digital Health Strategy emphasizing the role of intelligent automation in enhancing healthcare on a global scale.

More than half (55%) of healthcare organizations globally currently plan to prioritize their investments in AI-based intelligent workflow automation.[12] The successful implementation of intelligent automation, with a strong focus on ethical considerations, data privacy, and patient safety, can ensure that automation enhances, rather than replaces, human expertise. Automation is not intended to displace workers but to augment their capabilities, enabling them to focus on higher-value tasks such as patient interaction and complex decision-making. This approach reassures the workforce that their professional value is not diminished by automation, but rather enhanced, by reducing the burden of repetitive tasks and allowing human resources to be allocated more effectively. Moreover, automation can help address workforce shortages by acting as a force multiplier, ensuring that limited human resources are maximized while preserving the essential human elements of care. By strategically investing in these technologies and upskilling the workforce, healthcare organizations can position themselves for long-term success.

Associated Drivers

- **AI-driven business models** — Moving from AI experimentation to monetization
- **The drive to automate** — Toward a data-driven future
- **Responsible and human-centric technology** — Ethics in the enterprise

IT Impact

- Investing in AI-powered clinical documentation within cloud platforms optimizes workflows and scales automation. AI provides real-time insights, while the cloud ensures seamless integration and scalability, ensuring intelligent automation enhances efficiency and future proofs the IT environment.

- Comprehensive, targeted training programs are necessary to ensure the smooth and effective adoption of intelligent automation at the departmental level, enabling staff to fully utilize new technologies while minimizing disruptions to existing workflows and maximizing productivity gains.

Patient Impact

- Elevated care experiences by allowing clinicians to focus on more personalized and meaningful patient interactions, as intelligent automation reduces administrative burdens and routine tasks

- Improved access to care through the use of intelligent automation to address workforce shortages, enabling healthcare providers to manage higher patient volumes without compromising the quality of care

Guidance

- Align technology investments with a long-term strategic vision that prioritizes the ethical use of AI-driven intelligent automation, ensuring responsible implementation that benefits both patients and providers while mitigating risks.

- Prioritize upskilling and change management to help teams adapt to evolving roles and responsibilities, ensure smooth transitions, and maximize the value of intelligent automation across departments.

Prediction 5: By 2027, 40% of Patients Will Enroll in Multiyear Reimbursement Models That Cause the Need for Long-Term Infrastructure Investment to Support Linking Payment to Customized, Longitudinal Care Models

The impacts of the technological and clinical innovations powering individualized care are astonishing — and in many cases, so are their price tags. The high cost of innovative new treatments, such as GLP-1 receptor agonists (e.g., Ozempic for diabetes and weight management), digital therapeutics, and advanced technologies like predictive AI and data platforms, will be significant barriers preventing the health ecosystem from reaching a diverse range of eligible patients and members. Covering these costs requires payers to face financial, performance, and operational risks. These high costs also impact providers, as they must navigate the financial and operational complexities of adopting and integrating these innovative treatments and technologies into clinical practice. They also face challenges in ensuring equitable access and

managing patient expectations, especially when reimbursement is uncertain, all while balancing cost efficiency with personalized care delivery.

To mitigate these risks, payers and providers will need to look at investment, care metrics, and project budgets that go beyond single-year, basic, regulatory efficacy and safety requirements to articulate the long-term value of high-cost treatments and technologies. The typical 12- to 18-month window is insufficient to capture the longitudinal value of many health programs and treatments. Furthermore, the typical five to seven-year ROI is inadequate to rationalize transformative and modernized technical investment. Health plans, employers, device manufacturers, and providers will need to collaborate to roll out new technology, windows of analysis, payment models, products, and benefit packages.

Associated Drivers

- **AI-driven business models** — Moving from AI experimentation to monetization
- **The drive to automate** — Toward a data-driven future
- **Battling against technical debt** — Overcoming hurdles to IT modernization

IT Impact

- Project management software must handle multiyear PMO projects and budgets.
- IT architecture will address interoperability and API-based open access needs around a "platform" or "suite" mindset.
- When considering the ROI of a buy or build solution, take a multiyear approach.

Patient Impact

- Personalized, age-appropriate benefits and care plans will promote engagement, collaboration, and data-driven insights to support high-quality, proactive care.
- Patients will be coached to take a multiyear approach to care planning with emphasis on both short-term and long-term health.
- Patients will eventually learn to adopt a "bring your own data" approach to managing personal health data (using the patient access API technology to convene all health data) and present a comprehensive view.

Guidance

- Expand the definition of "value/ROI" to account for both short-term and long-term benefits of individualized products, devices, drugs, care plans, and bespoke technology that may significantly reduce the need for future medical interventions.

- Develop communication and education plans for patients and care team members to ensure long-term insights and strategies are optimized and well-coordinated.

Prediction 6: By 2028, Driven by the Demand for Enhanced Care Collaboration, Expanded Clinician and Consumer Access, and Enhanced Digital Literacy, 80% of Patients Will Utilize Hybrid Care

Hybrid healthcare marries traditional in-person medical consultations with the modern convenience of virtual care facilitated by digital technology. This blend aims to offer the best of both worlds: the personal touch and thoroughness of face-to-face interactions and the accessibility and efficiency of online consultations. According to the Centers for Disease Control (CDC), the COVID-19 pandemic served as a catalyst for this significant shift, with telehealth usage spiking to 70% in 2020.[13] Practically overnight, institutions transitioned to providing virtual care across all specialties, marking a pivotal moment in the evolution of patient care. This transition was not just about adapting to a crisis but also a leap toward a more patient-centric approach, where care is tailored to fit the individual's needs and lifestyle, not the other way around. While telehealth usage did decrease to around 20–25% in 2022, according to the CDC, organizations like the American Medical Association (AMA) continue to support the notion that hybrid healthcare is here to stay with rising patient demand for flexible care options, telemedicine advancements, and the integration of virtual care into value-based models. These trends are making healthcare more accessible and efficient, with the promise of higher patient satisfaction from hybrid care's convenience and continuity. Providers are also adopting digital tools for managing chronic conditions and improving care coordination, solidifying the hybrid model's role in the future of healthcare.

This shift is underpinned by the growing acceptance and integration of digital health tools, from in-home testing devices to health apps, increasingly featuring GenAI assistants, which enhance patient outcomes and convenience. According to IDC, almost half (48%) of global healthcare provider organizations will have increased spending on "Patient Engagement Apps" in 2024 compared with their actual spending in 2023 to enable this care shift.[14] The evolution toward hybrid healthcare is also expected to see healthcare organizations adopting hybrid cloud solutions, facilitating better data management and accessibility. IDC data also shows that nearly half (48.7%) of healthcare organizations globally plan to increase spending on customer data platforms over the next 12 months to gain a better understanding of customer context and personalized experiences.[12] This technological advancement, coupled with a more empowered patient role, supports a reality where healthcare is not only more responsive but also more attuned to the needs and preferences of individuals.

Associated Drivers

- **AI-driven business models** — Moving from AI experimentation to monetization
- **Responsible and human-centric technology** — Ethics in the enterprise
- **Customer experience squared** — Consumer and citizen expectations for digital services

IT Impact

- Hybrid care requires that robust cybersecurity measures are in place to safeguard patient information while maintaining trust and compliance.
- To optimize impact, IT should promote digital health integration that supports hybrid care goals with a focus on outcome-based ecosystem alignment.

Patient Impact

- Greater patient understanding of the benefits of hybrid services and available care options leads to improved adoption, resulting in more personalized, flexible, and accessible healthcare experiences.
- Diverse communication channels allow for personalized and convenient communication that supports engagement, satisfaction, and care coordination.

Guidance

- Establish patient education on hybrid model care options while ensuring various levels of digital literacy are supported to enable adoption, empowerment, and informed decision-making.
- Prioritize "techquity" to ensure hybrid services are accessible, inclusive, and user-friendly for all populations, particularly underserved communities.

Prediction 7: By 2029, AI-Driven Public Health 3.0 Initiatives Will Accelerate Policy Planning, Execution, and Resource Mobilization, Expanding Local Community Engagement and Program Coverage by 50%

Public health systems worldwide are at a critical juncture, needing transformation to address long-standing and emerging concerns, such as ensuring health equity and mitigating the health impacts of climate change. Structural issues, including resource shortages, workforce deficits, and coordination gaps hinder effective responses. Public Health 3.0 offers a framework to tackle these challenges by emphasizing community engagement, cross-sector collaboration (including payers, providers, and life sciences organizations) leveraging data-driven strategies and technologies to address clinical, social, economic, and environmental health determinants. Integrating AI into Public Health 3.0 promises transformative advancements.

The WHO underscores the importance of expanding public health interventions and community engagement.[15] While measurement standards for population engagement and coverage vary, the research highlights that active community participation and improved access to health services foster resilience and are critical for preventing disease spread, reducing health disparities, and enhancing overall well-being. AI's capability to analyze vast amounts of data — such as imaging, genomics, environmental, social media, weather, and geographic information — will provide new insights into complex health issues and enable real-time monitoring and prediction of population health needs. GenAI will help tailor evidence-based communication, adapting to diverse populations' health literacy and language needs. This will enhance public health services' accessibility and engagement while countering misinformation. By streamlining administrative tasks, AI will alleviate workforce pressures, allowing staff to focus on strategic initiatives. It will also bolster analytical capabilities for key functions like grant writing, comprehensive reporting, and data-driven policy innovation, ultimately improving public health outcomes and system efficiency.

Associated Drivers

- **AI-driven business models** — Moving from AI experimentation to monetization
- **The drive to automate** — Toward a data-driven future
- **Responsible and human-centric technology** — Ethics in the enterprise

IT Impact

- Scaling AI-driven Public Health 3.0 requires rethinking data strategies to handle different data types, ensure integration and security, and build trusted data exchange infrastructures to prevent bias and misinformation.
- Modernizing public health IT infrastructure, including connectivity, is essential to support AI-driven health monitoring, forecasting, cross-sector collaboration, and community engagement.
- Partnerships with AI vendors and sandbox environments for pilot projects and training are crucial for advancing AI initiatives.

Patient Impact

- The synergy of AI and digital tools will enable targeted and integrated interventions across social and health services, resource optimization, and outreach enhancement, improving population health and reducing health disparities.
- A strong focus on ethical practices, data quality assurance, and privacy compliance is crucial for ensuring trust and accountability.

Guidance

- Identify high-impact AI use cases that improve strategic priorities and demonstrate measurable efficiencies, helping build a business case for large-scale AI implementation.

- Assess technology, data, and talent readiness for AI projects and plan capability building, risk mitigation, and staff training to ensure effective governance and management.

- Address AI risks such as bias, privacy, and misinformation. Ensure human oversight, regulatory adherence, and prioritize equity, security, and cultural sensitivity in implementation.

Prediction 8: By 2029, Healthcare Investments in AI-Powered Early Detection Programs Will Triple to Fight the "Next Pandemic" of Noncommunicable Diseases, Focusing on Cancer and Neurological Diseases

The acceleration of AI adoption has ushered in a new era of diagnostics in healthcare. As the healthcare industry strongly relies on clinical data sets, AI has already emerged as a powerful tool for the early detection of various diseases. Major hospitals are not only prioritizing investments in AI for early detection of noncommunicable diseases (NCDs) but they are also engaged in patient outreach programs to "close the care gap." For instance, the NHS is proactively implementing AI-powered programs for care home residents across the United Kingdom to support the identification of people with dementia, with the country having one of the highest dementia rates in the world. The Mayo Clinic and Cleveland Clinic are leading AI adoption by leveraging algorithms to detect early-stage cancers and heart conditions with the aim of improving patient outcomes. All India Institute of Medical Sciences (AIIMS), the largest public hospital in India, has launched an AI platform — iOncology.ai — designed for the early detection of breast and ovarian cancer and plans to deploy this solution to district hospitals for broader patient coverage.

The need for such early detection and outreach programs has been emphasized by the WHO. According to the WHO, NCDs are responsible for 74% of all deaths globally, with 77% occurring in low- and middle-income countries.[16] The WHO further estimates that over one in three people are affected by neurological conditions, the leading cause of illness and disability worldwide.[17] The Intersectoral Global Action Plan 2022–2031, adopted by WHO member states, sets a road map for countries to improve the prevention, early identification, treatment, and rehabilitation of neurological disorders while promoting equity and access to quality care.[18] These reports underscore the importance of preventing and controlling such conditions globally, focusing on equitable healthcare delivery and outcomes. Multiple factors are expected to drive a

tripling of investments in AI for early detection programs over the next five years, including advancements in AI, government AI strategies for managing chronic diseases, the growing availability of curated clinical data to support algorithmic accuracy, and increasing consumer health literacy and awareness of the need for early detection and diagnostics.

Associated Drivers

- **AI-driven business models** — Moving from AI experimentation to monetization
- **Responsible and human-centric technology** — Ethics in the enterprise
- **Customer experience squared** — Consumer and citizen expectations for digital services

IT Impact

- Budget allocation for AI-driven early detection programs must be precisely aligned with the specific use cases and skill levels required to implement and maintain them effectively, ensuring optimal ROI and operational success.
- A strong partner ecosystem must be developed to strengthen more comprehensive screening of NCDs.

Patient Impact

- Early detection of NCDs allows for more effective interventions, leading to improvements in disease outcomes, quality of life, and reduced care costs.
- Patients will benefit from enhanced societal and economic impact, including lower out-of-pocket expenses, thanks to early disease detection.

Guidance

- Plan your AI-powered intervention programs based on the NCDs identified as a priority for your target communities (i.e., neurological and oncological conditions) as well as the cost-effectiveness profiles of available digital solutions.
- Ensure a "human-in-the-loop" approach, even short-listing patients for treatment as part of mass screenings, as AI-based solutions are to augment clinicians' efficiency and not replace them.

Prediction 9: By 2029, Large Healthcare Providers Will Scale the Adoption of Patient Digital Twins by 60% to Transform Medical Education, Enhance Clinical Cost-Effectiveness, and Drive Safer Personalized Care Protocols

Patient digital twins are emerging as a transformative force in medicine, moving from research to clinical use, thanks to recent AI-driven simulation advancements and regulatory approvals. While global adoption rates are currently low and limited to

specific use cases, as the digital twins technology value proposition becomes clearer, significant growth is expected, with large healthcare providers projected to increase deployments by 60% by 2029. These virtual models of patients can revolutionize personalized care by enabling predictive simulations for treatments, improving outcomes, and reducing trial-and-error approaches in clinical settings. As integration with AI and real-time data sources continues to evolve, digital twins are expected to play a key role in medical education, preventative care, and disease management.

Despite data complexity, regulatory and technological challenges, patient digital twins offer significant benefits to both patients and clinicians. As demonstrated by various examples such as the deployments at Johns Hopkins School of Medicine[19] or Niño Jesús University Children's Hospital in Spain[20], digital twins provide a secure platform for medical professionals to practice procedures, study rare conditions, and explore new treatments, accelerating learning and enhancing clinical skills. By simulating treatment scenarios and predicting outcomes, digital twins optimize care plans, reduce unnecessary procedures, and minimize adverse events. As a result, they also contribute to lowering healthcare costs. Furthermore, digital twins enable highly personalized treatment plans tailored to each patient's unique characteristics, ensuring safer and more precise care throughout the treatment process.

Associated Drivers

- **Regulatory flux** — Navigating compliance challenges in a shifting policy landscape
- **Responsible and human-centric technology** — Ethics in the enterprise
- **Customer experience squared** — Consumer and citizen expectations for digital services

IT Impact

- Digital twins will prompt the adoption of unified, standard-based platforms for integrating diverse data, ensuring interoperability, governance, and robust cybersecurity.
- Digital twins' adoption will further intensify the need for IT staff upskilling in advanced analytics, AR/VR, IoMT, IT/OT convergence, and machine learning.
- High processing power for AI/ML, real-time simulations, and advanced visualization requires advanced IT infrastructure to balance workloads across on premises, edge, and cloud while ensuring data governance compliance.

Patient Impact

- Digital twins provide detailed patient data and simulation capabilities. This allows for early diagnosis, predictive analysis, and practice of medical procedures. These capabilities lead to more personalized, safer, and effective treatments.

- Patient digital twins pose risks, including data breaches, inaccurate predictions, and ethical issues surrounding consent, data ownership, and the use of personal health information.

Guidance

- Develop patient digital twins through partnerships, managing technological, biological, clinical, and socioeconomic complexities with trusted expertise and stakeholder collaboration.

- Define ontologies for data aggregation from multiple sources. Rigorous data governance ensures interoperability, maintains data quality, and upholds ethical and compliant use.

- Establish digital twin architectures for data pipelining, aggregation, real-time analytics, AI, and visualization. Prioritize modular, distributed infrastructures for reusability and optimized computing to accommodate changing strategic needs.

Prediction 10: By 2029, at Least 50% of Complex, High-Volume Surgeries at Top Global Hospitals Will Use AI-Driven, Real-Time Guidance, Haptic Feedback, and Advanced Analytics, Reducing Surgical Complications by 60%

Intraoperative complications currently account for 48% of all preventable adverse events in hospitalized patients, with significant clinical and financial impacts.[21] AI-powered platforms offering real-time guidance, haptic feedback, and data-driven insights can better support minimally invasive surgeries and enhance surgical precision and dexterity, reducing surgical complications. These innovations not only improve patient safety but also offer significant financial benefits to hospitals. By integrating preoperative and intraoperative data and providing real-time AI recommendations during surgery, AI-driven surgical platforms can support surgeons' decision-making processes, anticipating next steps, and providing oversight to minimize risks and postoperative complications. Integrating haptic feedback in robotic-assisted surgical (RAS) systems and advanced surgical instruments enhances surgical accuracy and success rates, reducing applied force and shortening completion times.[22] This feedback helps surgeons perceive tissue characteristics more accurately, leading to precise manipulations and better patient outcomes. Other AI technologies, such as computer vision and deep learning, can identify surgical instruments and patient anatomy, predict surgical steps, and evaluate technical performance. These capabilities offer invaluable intraoperative decision support, preventing errors and enhancing precision. AI's role in image guidance extends beyond visualization by analyzing images to detect anomalies and guiding surgeons to target areas more precisely, enhancing diagnostic and therapeutic accuracy.

However, challenges remain. While AI shows promise, achieving the necessary sophistication for real-time surgical guidance is ongoing. In addition, the effectiveness of surgical AI models and platforms depends on high-quality and extensive data sets, necessitating data-sharing initiatives and standardization. Regulatory standards are nonnegotiable, and addressing ethical concerns like bias, liability, and privacy is critical. Fostering surgeon trust through training and emphasizing human-AI collaboration is key to long-term success. In addition to efforts to improve affordability and accessibility, AI-driven surgical platforms are becoming more efficient and effective, driving broader adoption. These platforms are increasingly demonstrating improved patient outcomes, enhancing safety, reducing surgical errors, and shortening recovery times in complex surgeries, which could further justify their cost and improve their long-term value. As advancements continue, economies of scale and technological innovations will likely make these tools more affordable for healthcare providers.

Associated Drivers

- **AI-driven business models** — Moving from AI experimentation to monetization
- **The drive to automate** — Toward a data-driven future
- **Customer experience squared** — Consumer and citizen expectations for digital services

IT Impact

- The integration of AI-driven surgical platforms will increase the complexity of operating room IT systems, requiring advanced data management capabilities.
- IT infrastructure must support both advanced data management and surgical technologies. This includes integrating data from EHRs, monitors, and imaging systems for AI use while also accommodating technologies like RAS and haptic feedback instruments to enhance precision and outcomes.

Patient Impact

- Reduced intraoperative and postoperative complications, leading to improved outcomes and experiences
- Greater precision in surgical procedures, enabling more personalized diagnostics and treatments

Guidance

- Support robust training programs to empower surgeons with the necessary skills to use and leverage AI technologies in surgical theaters.
- Embed stringent cybersecurity measures to ensure real-time exchange of patient data at the time of surgery is risk free and patient safety is assured.

ADVICE FOR TECHNOLOGY BUYERS

Healthcare organizations face an era marked by rapid technological advancements and high-speed transformation. It is an era fraught with challenges, including regulatory complexities, heightened patient expectations, cybersecurity threats, and a strained workforce. As AI becomes more infused into processes, healthcare organizations must carefully consider the long-term implications of their technology investments. Over the next five years, bold and forward-thinking approaches will be required to ensure healthcare organizations keep up not only with transformation but also with sustainability goals, an increasingly risky digital frontier, and the evolving demands of more personalized care and reimbursement models. To do this, healthcare organizations must prioritize not only immediate technological needs but also investments that can ensure adaptability, security, and ethical responsibility in preparation for healthcare in the latter half of the decade.

In addition:

- **Invest in scalable industry cloud solutions and platforms.** As data-intensive technologies like GenAI become more prevalent, healthcare organizations need to ensure that their infrastructures are modernized and capable of handling increasing data volumes, including both structured and unstructured data. Cloud solutions and platforms offer more than just expanded technology capacity, scalability, and access to managed services. They also act as a catalyst for data exchange and interoperability, enabling seamless integration of third-party applications and other platforms, creating a more open, dynamic, and innovative ecosystem. In addition, by reducing the complexities associated with maintaining and integrating on-premise and disparate systems, cloud-based architectures can streamline operations, improve efficiency, enhance overall agility, and bolster security posture when implemented correctly. This allows organizations to not only meet current demands but also be better prepared for future needs.

- **Understand that cybersecurity is not optional.** To safeguard patient safety and ensure uninterrupted healthcare services, it is imperative to make investments in cybersecurity a top priority. With increasingly stringent regulations, implementing comprehensive strategies and adopting zero trust architecture frameworks, incident response plans, and strong cyber hygiene practices, such as regular software updates, vulnerability management, and penetration testing, are vital. In the face of evolving cyber threats, constant threat monitoring and cloud-based security solutions are becoming crucial for real-time protection. In addition, data backup strategies are fundamental for mitigating the impact of ransomware attacks. However, true cybersecurity success transcends technology and hinges on reinforcing the "weakest link" —

people. To achieve this, it is essential to foster a strong culture of security awareness within the healthcare workforce, as they serve as the first line of defense in safeguarding both patients and their data**.**

- **Embrace a data-driven model.** This is a key strategy for healthcare organizations aiming to unlock personalized patient care, curb medical costs, reduce administrative burdens, and move the industry toward the ultimate goal: proactive, whole-person care. Data-driven strategies empower providers and payers to utilize predictive analytics to anticipate patient needs and intervene proactively. This approach fosters better health outcomes and lowers healthcare costs. Moreover, crafting personalized care plans based on insightful data analysis boosts patient satisfaction and health results. Predictive analytics stand out as a transformative tool in this journey, enabling healthcare organizations to anticipate patient needs accurately and facilitate early interventions. This proactive approach is key to enhancing patient outcomes while curtailing healthcare costs, and the insights from data analytics allow for the creation of personalized care plans. Similarly, data paves the way to operational excellence and patient-centric care for healthcare providers. By leveraging data analytics for predictive insights and personalized care plans, providers can achieve the desired balance between operational efficiency and superior patient care. This dual focus positions them as leaders in the healthcare industry as well as champions of patient well-being.

- **Align GenAI use cases.** Healthcare provider organizations are increasingly prioritizing GenAI use cases, allocating dedicated budgets to GenAI initiatives. In this context, it is imperative to ensure that the GenAI use cases proposed by tech vendors align perfectly with healthcare organizations' specific needs and care gaps for optimum resource allocation and improved patient outcomes. This alignment should be ensured within the organization by assessing the potential of GenAI in addressing specific issues, deploying pilot studies, and involving clinicians in the evaluation process.

- **Ensure the right mix of private and public foundation models.** With the growing need to ensure data privacy and security, and to comply with evolving global and local regulations, the healthcare industry has a renewed interest in implementing private AI solutions, including developing its own private foundation models and using on-prem infrastructure. Protecting data privacy takes priority in this industry.

- **Recognize technology's role as a complement, not a replacement.** In healthcare, the allure of technology as a panacea is undeniable. Its potential to revolutionize care delivery, improve patient outcomes, and streamline operations is immense. However, it is crucial to recognize that technology, for all its advancements, has its limitations. The success of healthcare innovation lies in

its ability to integrate technology with the human element and navigate the systemic complexities of the industry. At the heart of healthcare lies the human element — the profound connections between patients and providers, the empathy, and the nuanced understanding that can only be conveyed through human interaction. These aspects are irreplaceable and underscore the importance of maintaining a balance. While technology can augment and enhance the healthcare experience, it cannot supplant the critical human touch that forms the essence of care. This synergy between technology and human interaction is not just beneficial but necessary for a holistic healthcare approach that truly meets the needs of patients by bridging the gap between the potential of technology and reality of improved patient outcomes and healthcare delivery.

- **Experiment through careful proof of concepts and pilot projects.** The stakes are high in healthcare and failure is not an option, especially when it comes to adopting new, cutting-edge technologies for clinical use cases. Leverage applicable best practices and lessons learned from other healthcare and life science organizations, as well as other industries. Iterate and validate to minimize risks associated with AI in general and GenAI in particular. In other words, fail fast and fall small. Stay focused on patient safety and the ethical and equitable use of AI technologies in delivering high-quality healthcare services to achieve optimal efficiencies, productivity, and, most importantly, improved patient outcomes.

- **Address the psychological barriers to the adoption of AI.** The AI identity threat is proving to be the biggest psychological barrier to the adoption of AI. People remain concerned about their jobs, status, and relevance as we progress along the AI/GenAI journey to artificial general intelligence (AGI). There is a lack of trust in AI owing to hallucinations and bias. Hence, concerns exist about the ability of AI to ensure diversity and equity in healthcare. In addition, cynicism prevails in the ability of AI to embed empathy when dealing with patients.

EXTERNAL DRIVERS: DETAIL

AI-Driven Business Models — Moving from AI Experimentation to Monetization

- **Description:** As the generative artificial intelligence (GenAI) hype settles into a new digital business reality, it's critical for both tech buyers and vendors to prove that "AI is real," can be monetized, and is leading to concrete business impact and revenue streams. While tech buyers' GenAI attention in the initial AI everywhere stages primarily focused on efficiency and automation-oriented use cases, the longer-term ambition is to leverage AI (including GenAI) to enable new

business models and open new revenue streams. At the same time, after all the initial excitement and rush to new launches/announcements, it's time for tech vendors to capitalize on 2023–2024 AI investments, move customers' POCs to concrete multiyear deals, and unlock exponential AI monetization. While they implement this, companies must keep in mind that AI is not without risks, especially when it comes to ethical AI and data privacy. Enterprises need to carefully consider the best use cases in order to implement AI effectively and to the benefit of the organization.

- **Context:** With intelligence becoming a key source of value creation, we are in the midst of an "intelligence revolution," in which AI and automation-oriented technology are major accelerators of business change. GenAI especially is a transformative force. This branch of AI enables machine-driven autonomous creation of new content, from images to music to even written text, with remarkable accuracy. Current business applications of GenAI include content and code generation, as well as personalized recommendations, but it is evolving quickly.

The Drive to Automate — Toward a Data-Driven Future

- **Description:** Broader automation use cases — which are different from just AI and generative AI — are now ubiquitous. Automating tasks that require human judgment and decision-making are becoming a key area of development. However, thoughtful implementation is crucial. This requires careful data management, quality, governance, and storage. Data quality and governance will become paramount as organizations strive to maintain accuracy in automation tools and comply with increasingly stringent regulations like GDPR and CCPA. Efficient storage and retrieval of vast data sets are also essential, prompting IT to explore scalable solutions like object storage or data lakes. As more employees access data tools and insights, fostering a culture of data sharing will be key. Breaking down data silos will be crucial for achieving a unified view for automation processes. This also means that while data generally becomes more open and accessible, protecting key information related to health, for example, becomes central to value and risk. Provided that data is thoughtfully managed and silos are appropriately broken down, hyperautomation, the combination of multiple automation tools and technologies, may become more prevalent. This approach, which aims to automate as many processes as possible within an organization, can greatly improve efficiency and agility.

- **Context:** Businesses are rethinking how to employ automation to maximize operational efficiency — from automating assembly in manufacturing to identifying opportunities for food waste reduction in hospitality to improved CX in digital banking. And as data is embedded in the core of strategic capability for

every organization, automation has become critical to scaling a digital business. This is evident in three domains: IT automation, process automation, and value stream automation — leading to autonomous operations, digital value engineering, and innovation velocity. From healthcare robotics to real-time data analytics, the applications are extensive.

Regulatory Flux — Navigating Compliance Challenges in a Shifting Policy Landscape

- **Description:** With frontier technologies like generative AI, geopolitical concerns, and cyber-risks, the tech legal landscape is rapidly changing. The tech regulatory landscape is shifting, from privacy/cybersecurity laws such as NIS 2 in the EU to various policies incentivizing nearshoring of critical technologies such as South Korea's tax incentives for the "K-Semiconductor Belt." Beyond that, however, are laws that fundamentally can change the market landscape in technology. The EU's Digital Services Act (DSA) and Digital Markets Act (DMA) aim to increase transparency and accountability for online platforms and attempt to prevent anticompetitive behavior from "gatekeepers," or large online platforms of significance. In China, a number of firms have withstood major fines and penalties for anticompetitive practices, breaches of data security, and consumer privacy rights. Other emerging efforts in jurisdictions like the United States, India, and Australia mean that tech giants may be seeing themselves caught in stricter compliance challenges. Regulations, however, are notably inconsistent in their rollout. While some regulations lag behind technology development — especially notable in the case of artificial intelligence across many jurisdictions — others lead, such as tariffs on imports. Regulations also are of course subject to political change. More than 70 countries worldwide are set to vote in 2024, and polls predict sweeping change in political agendas. These changes are not only going to impact society and the economy in the short term but may also have wide-reaching, long-term effects.

- **Context:** Businesses must navigate an increasing number of regulatory rules. Even if it is not always the primary focus, tech is often a crucial part of these regulations. Most of these rules are intended to hedge against risks, but some are entrenched in geopolitical divides, so those firms that stay ahead of the game and build resiliency will be best equipped to comply with these regulations. Moreover, regulations and policies are not always simply restraints — they are also often springboards for investment, with many regulations proposing tax subsidies and other kinds of incentives.

Expanding Digital Security Frontiers — Fortification Against Multiplying Threats

- **Description:** The era of digital business has resulted in a significant increase in the interconnectedness of devices, people, applications, data, and networks, alongside movement of workloads to the cloud. However, this progress means vulnerability to increasingly sophisticated cyberattacks. Phishing remains the most common form of cybercrime, and with the addition of powerful AI models, fooling victims is much easier than it used to be. Cybercrime as a service is also booming, allowing malicious actors to act with more agility and efficiency than ever before. The rise of AI also enables accidental insider threats — well-intentioned employees could unintentionally leak or access restricted, sensitive data when using services, a trend already noticeable with generative AI services. Finally, while quantum has not yet fully made it to the market, advances are marching forward, which also means that post-quantum cryptography is rising in importance. Organizations need to prepare for this and shift from reactiveness to proactiveness in their cyber-readiness and security postures. While this is already happening, the question remains as to whether organizations can sufficiently keep up with the pace of threats that are emerging. Cyber-resilience — the ability of an organization to anticipate, withstand, recover from, and adapt to any threats to its resources — is key for organizations to not only defend against cyberattacks but also prepare for swift response to and recovery from attacks.
- **Context:** According to the International Monetary Fund, cyberattacks have more than doubled since the COVID-19 pandemic. Cyberattacks have impacted all types of organizations, from governments to universities to businesses, and are oftentimes entangled in geopolitical motives. The increase in high-profile data breaches is furthermore leading to increased policy interventions regarding privacy and sovereignty. Organizations that are unprepared for cyberattacks may suffer various consequences, including data loss, financial implications, harm to their brand reputation, decreased employee morale, and loss of customers.

Responsible and Human-Centric Technology — Ethics in the Enterprise

- **Description:** Enterprises are increasingly conscious of the broader societal impacts of their business models and of certain technologies, especially emerging technologies. Most topical at the moment is AI. AI may provide lower-cost, higher-value solutions, but it has significant ethical (and incipient legal) implications that companies will increasingly need to adapt to. There are significant questions over issues like copyright, trust, safety, and misinformation

distribution. Beyond that, organizations must grapple with issues like privacy and consent around data, reproduction of biases and toxicity, generation of harmful content, insufficient security against third-party manipulation, and accountability and transparency of processes. As a result, countries around the world are keen to regulate AI, from the EU to Brazil to China. Aside from AI, new emerging technologies like quantum also have ethical challenges, and new branches such as quantum ethics are being developed. With quantum ethics, in light of the power of quantum computing, questions remain about how to ensure equity, transparency, and appropriate usage given its power to crack encryption. Roboethics grapples with the ethical questions that the use of robotics pose, especially those used in healthcare, military applications, and others. And beyond emerging technologies, supply chain ethics are also being questioned, as many raw materials such as critical minerals are mined under circumstances that may implicate human rights questions, and jurisdictions from Canada to the EU to Japan have created laws requiring more stringent oversight of suppliers. Businesses are also still grappling with inclusivity and corporate responsibility. Having a diverse workforce can often be a benefit for businesses to ensure a greater amount of skill sets, and promoting corporate responsibility can be a way to attract and retain talent. And though these issues are often politicized, neglect of ethics in the business isn't just a moral quandary either — it is increasingly viewed as a significant business risk that can mean less trust, less control, and less ability to advance technologies in an optimal way.

- **Context:** AI is bringing the "S" (social) and "G" (governance) in ESG to the forefront of conversation in a way that is distinct from conversations around "E," the environment. Businesses are increasingly discussing AI ethics due to rising public and regulatory scrutiny, concerns about privacy and bias, and high-profile AI missteps. Adhering to ethical standards enhances reputation, builds consumer trust, and ensures sustainable, responsible innovation. This shift underscores the importance of developing and using AI technologies ethically and transparently.

Battling Against Technical Debt — Overcoming Hurdles to IT Modernization

- **Description:** As technology becomes increasingly central to business operations, the role of IT leadership is evolving into business leadership, highlighting the critical importance of managing technical debt. This debt, exacerbated by the rapid advancements and growing complexity of IT systems, not only inflates maintenance costs but also poses significant challenges to operational efficiency, profitability, and market adaptability. Accumulated technical debt manifests in software bugs, security vulnerabilities, and system inefficiencies, leading to increased operational costs, data breaches, and a loss of customer trust. For

developers, working with outdated systems diminishes morale and productivity, while businesses face hurdles in adapting to new technologies or market demands swiftly. Specifically, in the realm of AI, "data debt" — stemming from poor data quality, inadequate architecture, and insufficient documentation — complicates maintenance, reduces system flexibility, and hampers accurate decision-making. These issues, along with the struggle to maintain legacy systems and navigate technical heterogeneity, slow down development processes, delaying the launch of new features or products. There is a cascading effect that arises with technical debt (e.g., cloud laggards will become AI laggards).

- **Context:** In recent years, technical debt is a growing concern due to accelerated digital transformation, increased reliance on complex software systems, and the urgent need for rapid innovation. The pressure to deliver software quickly often leads to compromises in code quality, resulting in a backlog of maintenance issues. Businesses face mounting pressure to address outdated code and quick fixes to maintain system reliability, security, and scalability amid evolving technological demands. As systems become more complex, the cost and effort to address these issues escalate, impacting operational efficiency and innovation.

Customer Experience Squared — Consumer and Citizen Expectations for Digital Services

- **Description:** Businesses are reimagining how they engage with their customers, striving to provide seamless, personalized, and efficient service experiences — and customers are demanding this. Their expectations are changing due to emerging technologies like AI-enabled devices, and customers are ever-increasingly savvy with digital. AI and automation technologies are at the forefront of revolutionizing customer service. AI-powered chatbots and virtual assistants are now capable of handling a wide range of customer inquiries with precision and personalization. These technologies improve response times and allow human agents to focus on more complex and sensitive issues, thereby enhancing overall customer satisfaction. The proliferation of mobile devices and IoT technology requires businesses to continue to adapt their customer service strategies to cater to a more connected, mobile-first audience. AR/VR, the metaverse, and 5G/6G will also influence end-user experience in the future. On top of this, omni-channel support is growing to ensure a cohesive, consistent experience across all platforms and touch points — social media, email, phone, or live chat. Businesses are leveraging data analytics and CRM systems to integrate these channels, providing a seamless transition and a holistic view of the customer journey. In the B2B2C model, this transformation is even more pronounced, as businesses must navigate the complexities of serving both the

direct customers and the end consumers. Yet, despite the transformative effects of new technologies, the human element remains crucial in customer service. There is a growing emphasis on emotional intelligence and empathy in customer interactions. Training programs are increasingly focusing on developing these skills in customer service representatives, recognizing that understanding and addressing the emotional needs of customers can significantly enhance the service experience.

- **Context:** The landscape of customer service is undergoing a transformative shift, driven by advancements in technology and changing consumer expectations. The shift toward mobile and device-centric customer service strategies underscores the need for businesses to be agile and responsive, leveraging technology to meet customers where they are. Businesses now face the dual challenge of satisfying direct customers and end consumers in a digital, mobile-first world. Adapting to this landscape demands agility and a tech-savvy approach to meet evolving expectations and enhance connectivity.

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