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How **Edge AI** can maximize resources and boost productivity

New survey of healthcare, manufacturing, and retail leaders reveals technology's transformative potential

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FOR MORE than a decade, organizations have gained valuable insights about their operations and customers from cloud-based artificial intelligence (AI) analytics. By deploying AI at the edge — where data is analyzed near its source and closest to the people who can reap immediate benefits from it — companies open the door to an entirely new set of possibilities, such as shorter response time, lower cost, less dependence on network bandwidth, and AI on confidential data that companies may prefer not to move to the cloud.

Whether it's pinpointing a tumor on a CT scan, reconfiguring a factory assembly line, or recognizing a head of lettuce at a grocery store checkout, edge AI is poised to transform operations across industries. It can help companies attract and retain customers, save money, and accelerate the development of sought-after products. Above all, it can supercharge productivity.

Not surprisingly, companies are increasing their edge AI investments. Worldwide spending on edge computing is expected to grow from $232 billion in 2024 to nearly $350 billion by 2027, according to IDC.[1]

But what, specifically, do organizations expect to gain from edge AI technology? How can they make sure they deploy it successfully? A new Foundry survey sponsored by Intel queried 500 U.S. business and technology executives in the healthcare, manufacturing, and retail industries to shed light on these questions. The results reveal that companies are using or planning a wide range of edge AI applications to boost efficiency and productivity, detect and prevent problems sooner, reduce costs, generate new revenue, and inspire customers to return.

At the same time, many have security and safety concerns about using AI and fear they lack the skills and expertise to implement or scale it successfully. This report delves into the survey's findings, revealing the current state of edge AI, its vast potential for the future, and how organizations can position themselves to take best advantage of it.

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Why today's organizations are adopting edge AI

Across all three industry segments in the survey — healthcare, manufacturing, and retail — 50% are currently investigating or planning to adopt edge AI applications and 37% are already deploying them for at least one use case.

The top goal — cited by 67% of manufacturers, 64% of retailers, and 58% of healthcare organizations — is improving productivity (see Figure 1). Due to labor shortages, organizations are creatively adapting to become more efficient. They are leveraging edge AI to streamline routine tasks, which, in turn, helps enrich the human aspect of work. This shift enables employees to dedicate more attention to meaningful and impactful activities. Using genAI agents as knowledgeable assistants, employees can concentrate on higher-level decision-making and devote more time to their customers or patients.

Boosting productivity will also help improve the balance sheet. A majority of respondents agree that edge AI has the potential to help their organization save time or money (79%) and/or grow revenue (75%) (see Figure 1).

How can edge AI help organizations achieve these goals? Leaders in each sector are eyeing applications to address their specific challenges and develop new opportunities.

Edge AI in healthcare: saving lives, time, and money

In addition to a shortage of caregivers and technicians, healthcare organizations are facing a burgeoning aging patient population with higher rates of chronic illnesses to manage, says Kaeli Tully, a healthcare and life sciences systems and solutions engineer at Intel. Edge AI can

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Figure 1 | **Primary motivators for companies' interest in edge AI**

SOURCE: FOUNDRY

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streamline workflows for practitioners and keep them focused on patients instead of paperwork.

In the survey, healthcare respondents listed improving patient safety by detecting medical machine malfunctions and dangerous patient behavior as the most appealing edge AI use case (see Figure 2).

Machine breakdowns can be life-threatening for patients in critical care. In diagnostics, a malfunctioning X-ray or ultrasound machine can wreak havoc with schedules, causing practitioners to get behind and have to reschedule appointments, delaying diagnosis and treatment.

Machines with embedded edge AI predictive analytics can alert technicians to brewing problems before a malfunction occurs, enabling them to quickly arrange for service after hours or during low-volume periods. Besides averting potential catastrophes, predictive maintenance improves productivity for machine technicians and caregivers.

Over half of the survey's healthcare respondents view remote and in-patient monitoring and detection of serious events such as seizures, strokes, or falls as an appealing edge AI use case. Alerting doctors and nurses to emergencies faster could enable them to perform lifesaving procedures during the narrow window of time when they are most likely to be successful. Remote patient monitoring can improve home care.

"Monitoring devices can provide alerts for risks and coordinate care between doctors and family members. Effective home care can keep patients from being readmitted to the hospital – an important goal of Medicare," says Abhishek Khowala, Principal AI Engineer for Health and Life Sciences at Intel.

Healthcare administrators spend enormous amounts of time managing schedules. In the survey, 58% of healthcare respondents said they'd like to use edge AI applications to optimize resources, including predicting patient flow and suggesting staff scheduling, instead of having administrators do it manually (see Figure 2).

For hospitals, AI-enabled resource optimization can save money.

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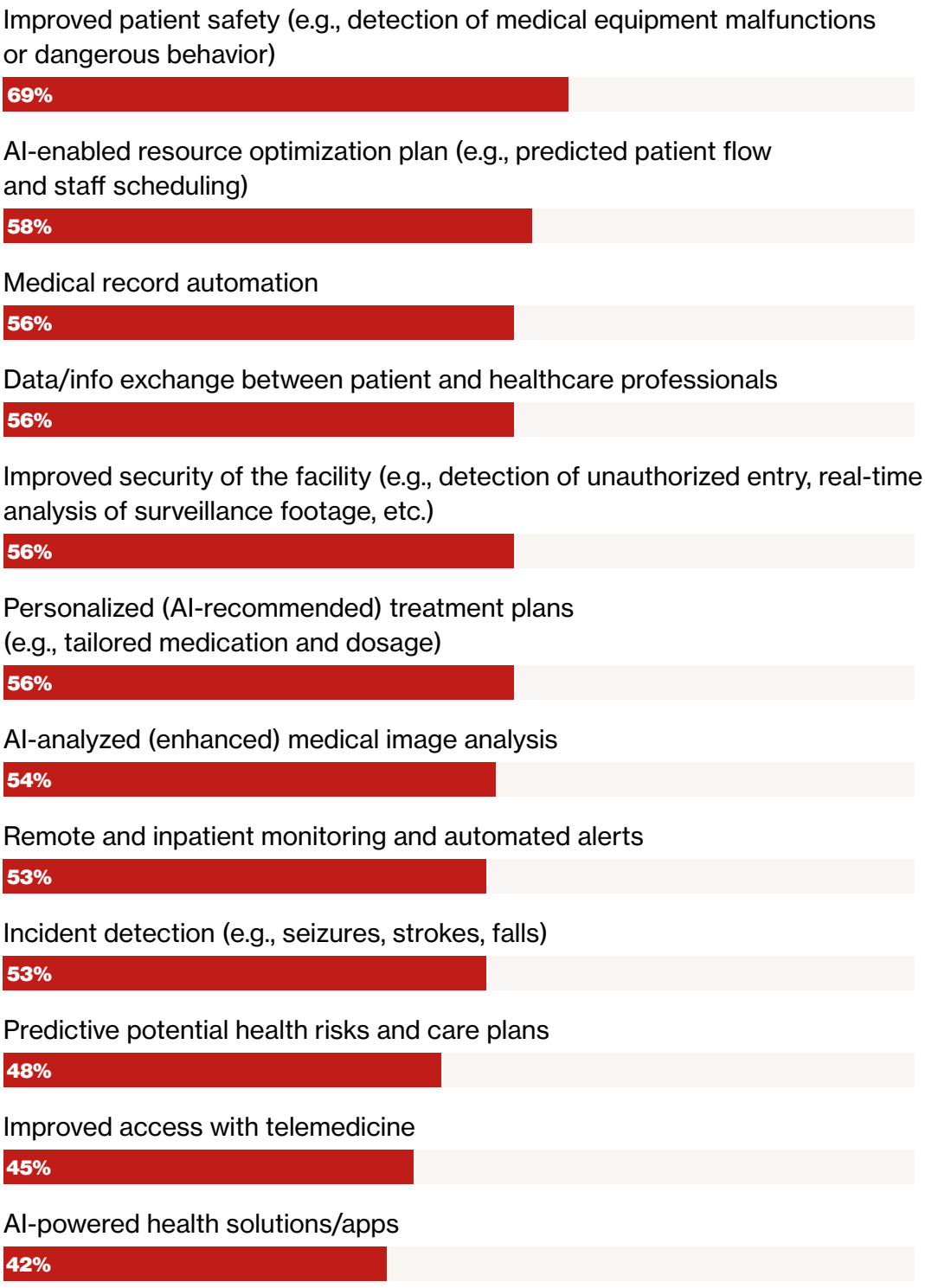
Figure 2 | **Most appealing uses for edge AI in healthcare**



SOURCE: FOUNDRY

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"It costs, on average, approximately $60 a minute to use the operating room," Tully says. So, if a specialized piece of equipment is missing, someone has to scrub out, retrieve it, and scrub in again, wasting hundreds or thousands of dollars. Computer vision cameras can ensure that all equipment needed for an operation is in place before a procedure begins, identify workflow optimizations, and improve scheduling to reduce delays.

56%

of medical professionals are also eager to automate data and information exchanges with patients.

– **Healthcare respondents**

"Physicians and nurses are in the profession to care for patients. They want to look into patients' eyes while talking to them, not computer screens," Khowala says. "AI can capture all the conversation and get it into the system."

The next step could be deploying generative AI, which can analyze patient notes together with data from medical images, citing research from medical repositories. Then it can create reports and summaries for doctors to review. Nearly half of healthcare respondents said their organization is looking into genAI solutions, and 29% have deployed one for a business unit, although just 7% have taken it enterprise-wide.

Using personalized, AI-recommended treatment plans for medication and dosage, cited by 56%, is another solution that providers are watching closely for potential deployment. "Healthcare is not one-size-fits-all. Doctors, nurses, and patients are increasingly demanding the latest and greatest technology for personalized care," Khowala says.

That includes AI-enhanced medical image analysis, cited by 54%, which effortlessly sorts through large data sets to zero in on problems, saving physicians hours of time and speeding diagnosis.

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Edge AI in manufacturing: lowering costs and driving new revenue

Like healthcare organizations, manufacturers prioritize keeping people safe. At the top of their list of desired edge AI capabilities is detecting dangerous equipment malfunctions or workplace behavior, cited by 58% (see Figure 3).

Improving throughput and quality and controlling costs are also critical priorities.

"Inflation has driven labor costs much higher in recent years, and manufacturers are under intense pressure to optimize supply chains. They are seeking more automation to reduce expenses, increase output, and improve time to market for new products," says Ricky Watts, Industrial Solutions Director at Intel.

Specific capabilities on manufacturers' most-wanted list to help keep factories from shutting down production lines include:

- **51% – Predictive quality control**
- **49% – Real-time equipment monitoring**
- **49% – Real-time anomaly detection and alerts**

"In the oil and gas industry, if you take a large refinery plant offline, you lose over $60 million an hour," Watts says.

Less serious equipment problems still require time and labor to fix. Machines can be repaired more efficiently if technicians wear augmented reality glasses, which can display instructions or connect workers to colleagues with specialized expertise. "It's like having an extra toolkit on-demand," Watts says.

Preventing product defects and improving processes can also make a real difference to the bottom line. For example, an auto factory using AI to identify welding defects in real time improved product quality while also reducing material waste. "It was a highly significant improvement in good welds per vehicle without any defects. That had a huge impact on quality and thus profitability," Watts says.

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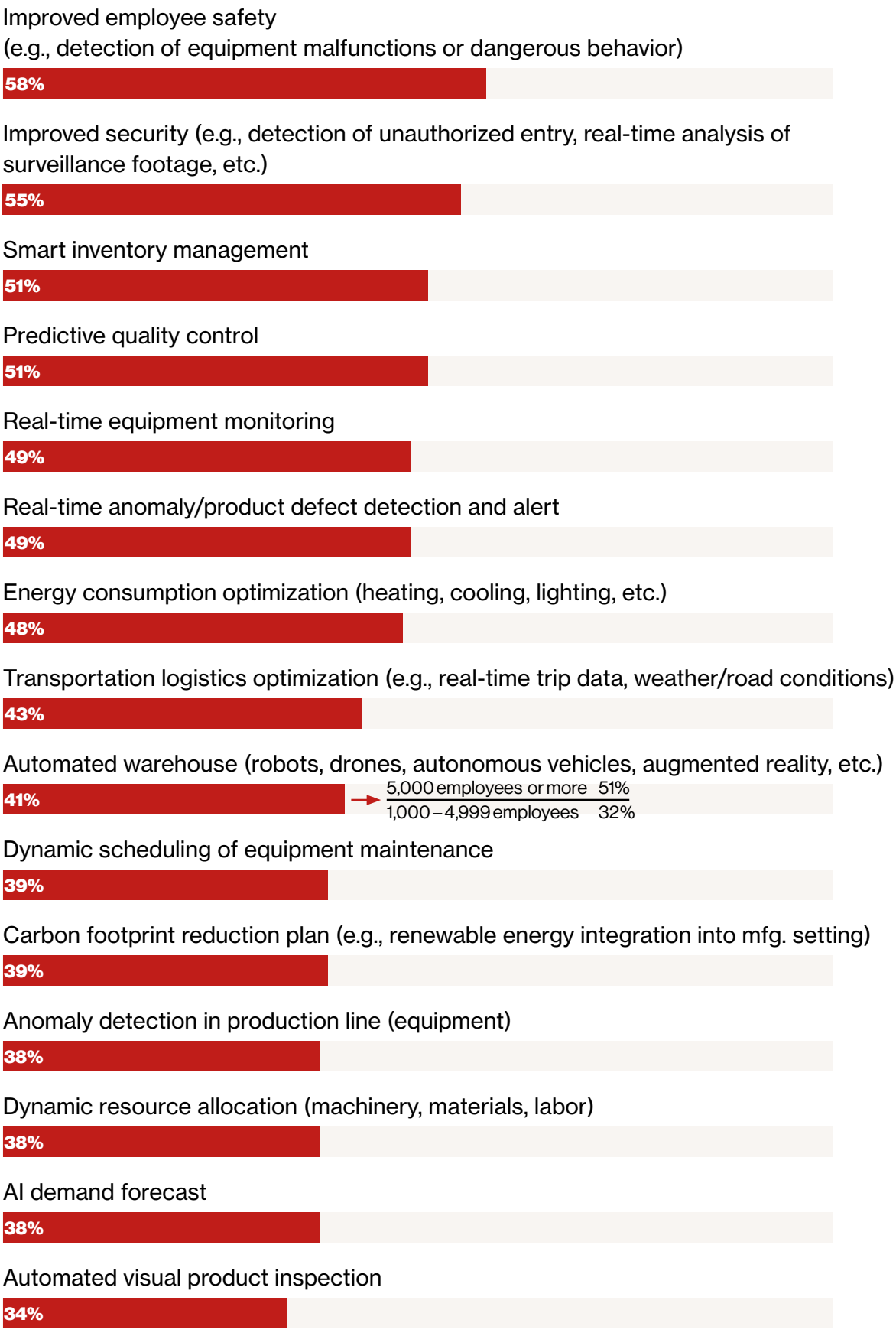
Figure 3 | **Most appealing uses for edge AI in manufacturing**



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Manufacturing facilities, which can consume enormous amounts of energy, can also lower costs by using edge AI to manage their power needs more efficiently. Nearly half of manufacturing survey respondents listed using edge AI to not only cut energy costs but also to shrink their carbon footprint.

Edge AI applications can extend efficiencies throughout the supply chain, and manufacturers are looking to do that by deploying capabilities such as:

- **51% – Smart inventory management**
- **43% – Logistics optimization**
- **41% – Warehouse robotics and autonomous vehicles**

Looking ahead, respondents envision more comprehensive solutions, including AI-based demand forecasting (38%) and dynamic allocation of machinery, materials, and labor (38%). Nearly a third (31%) have deployed a generative AI application, with 13% extending it enterprise-wide.

One intriguing genAI use case involves generating code to quickly reconfigure production lines, Watts says. "Say you are producing red cars but consumers now prefer red-and-white models. Reconfiguring a PLC [programmable logic controller] to change the production line typically is a multimonth process. Generative AI will be able to do this in minutes, with several reconfigurations for you to consider."

Few manufacturers are deploying this technology yet — early experiments have been buggy, unrealistic, and prone to hallucinations. But accuracy has improved tremendously over the past year, Watts says, generating considerable interest. Delivering desirable products ahead of competitors is a surefire way to increase revenue, especially if the process can be repeated indefinitely.

Edge AI in retail: automation everywhere

Retailers are faced with chronic and severe labor shortages, high turnover, and intense competition. "The need to streamline operations and regain margins is driving them to use AI and automations at the edge," says

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Gustavo Reyna, Healthcare, Education, and Consumer Industries Market Strategist at Intel.

In the survey, the most appealing edge AI use case for retailers (cited by 54%) was smart shelves (see Figure 4). In these systems, shelves use computer vision cameras to track inventory and alert staff when it's running low. Counting inventory manually is extremely time-consuming for staff, not to mention tedious. A computer vision system can also send managers detailed information about when items are most and least in demand, helping them stock shelves to optimize sales.

Among the surveyed retailers, 50% embraced the concept of using self-checkout to prevent fraud.

Loss due to fraud and shrinkage amounted to over $112 billion in 2022, according to the National Retail Federation.[2] "It's one of the biggest problems in retail," Reyna says.

"Computer vision cameras and AI-assisted checkouts can help retailers mitigate shrinkage from intentional or unintentional customer scanning errors."

Thirty-nine percent of retailers were drawn to the idea of frictionless automated checkouts and self-service kiosks to mitigate labor shortages in the industry — and to benefit customers. "Retailers are implementing these solutions to provide a positive experience and encourage customers to shop again," Reyna says.

Automated checkout systems have been expanding from grocery stores to stadiums, where fans are particularly anxious to grab a snack and get back to the game. Faster throughput means higher revenue for operators.

Thirty-five percent of retailers expressed interest in using robots to help associates transport goods from storerooms to shelves, giving staff more time to spend with customers.

Customers using a store app can receive personalized offers and promotions when they enter — or as they approach the store if geofencing is used. In-store shopping becomes smoother and easier, more like the online experience today's shoppers have come to expect.

Personalization works even better if retailers use AI-determined dynamic pricing for targeted promotions and real-time deals (cited by 50%). Smart cameras with AI-powered analytics

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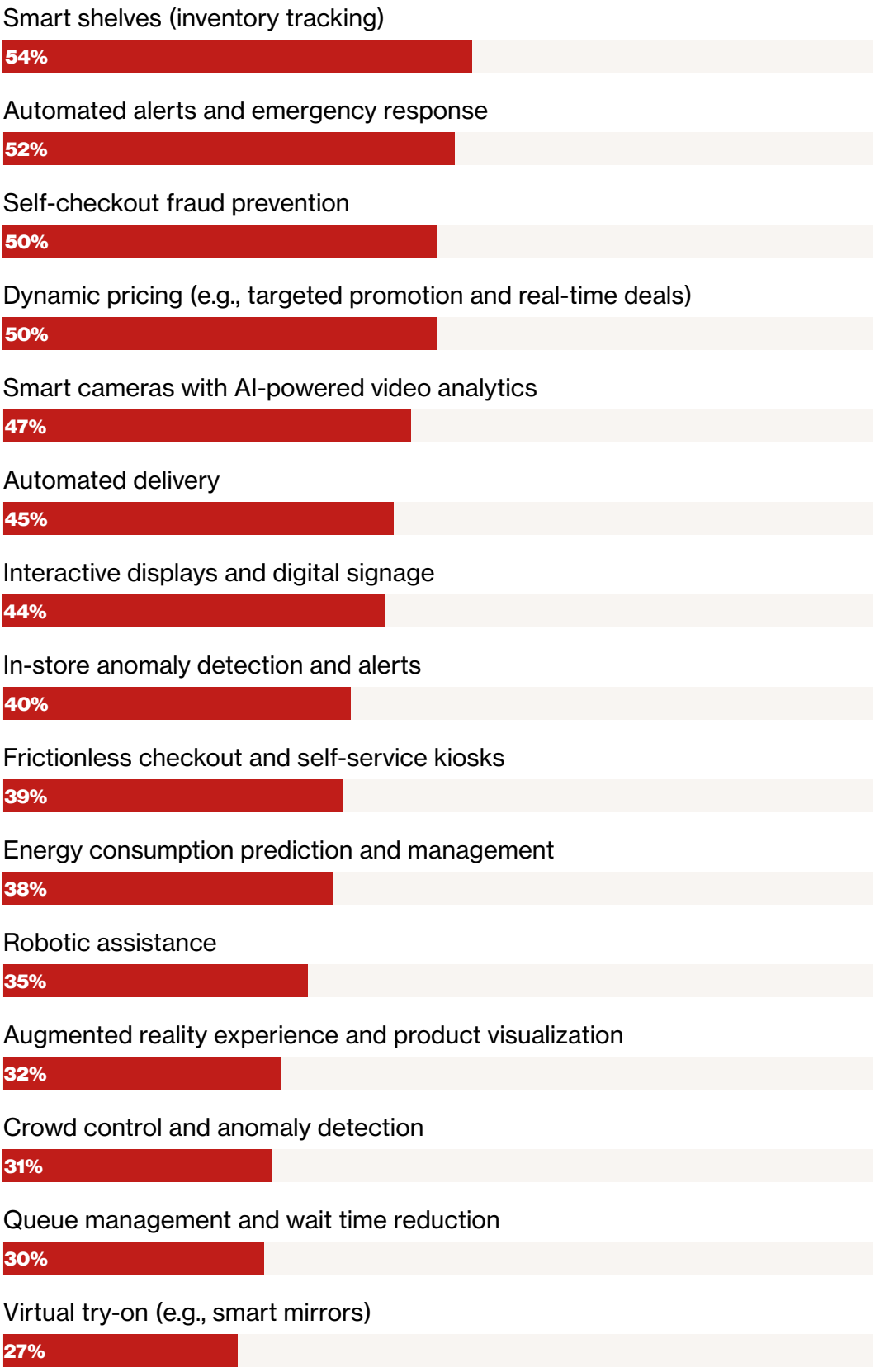
Figure 4 | **Most appealing uses for edge AI in retail**



SOURCE: FOUNDRY

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(cited by 47%) can analyze customer shopping preferences on the spot, enabling digital signs to automatically display relevant ads. The cameras also reveal where customers tend to linger — prime places for promotional displays. And they can measure how long customers have been waiting in line and send managers an alert if another cashier is needed.

Challenges to adoption and deployment

Despite the growing interest in edge AI, many companies are concerned about the technology's potential for errors or malfunctions, a worry cited by 50%. Nearly as many (48%) are concerned about costs and budgeting. These doubts are inhibiting investment in the technology (see Figure 5).

Figure 5 | **Challenges inhibiting organizations' investment in edge AI**

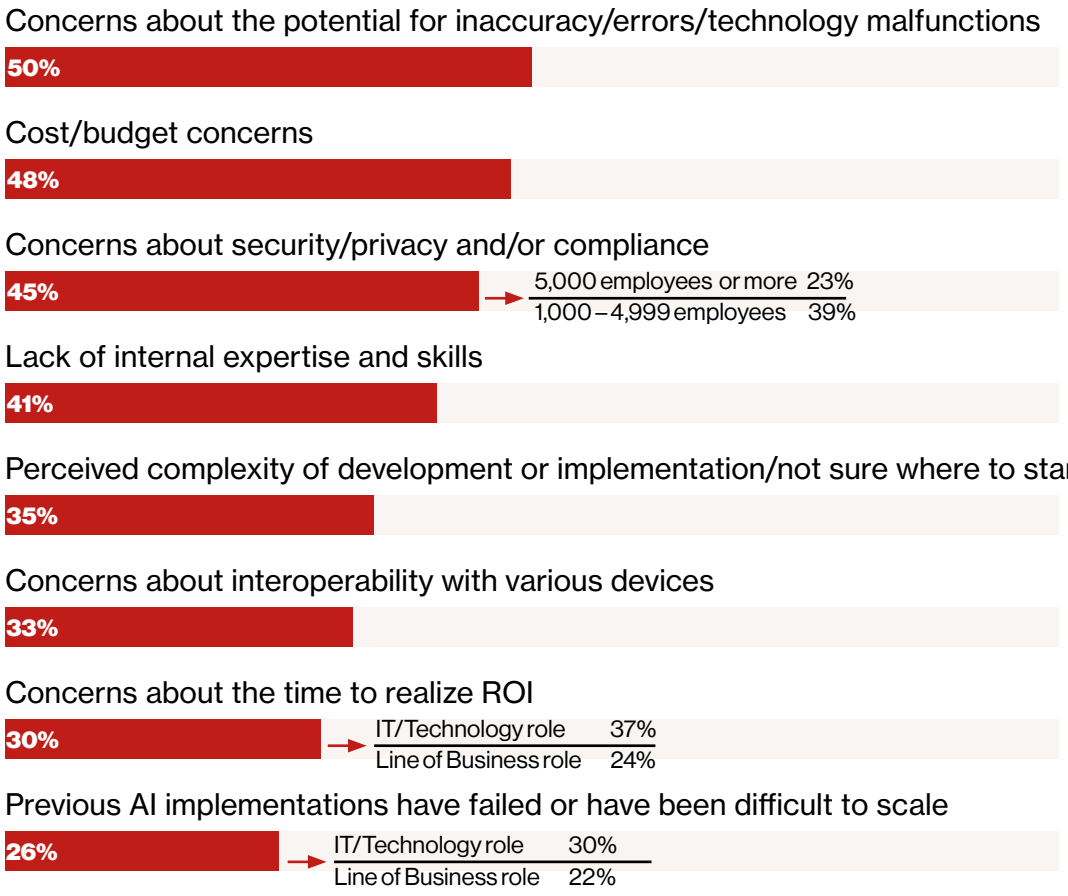

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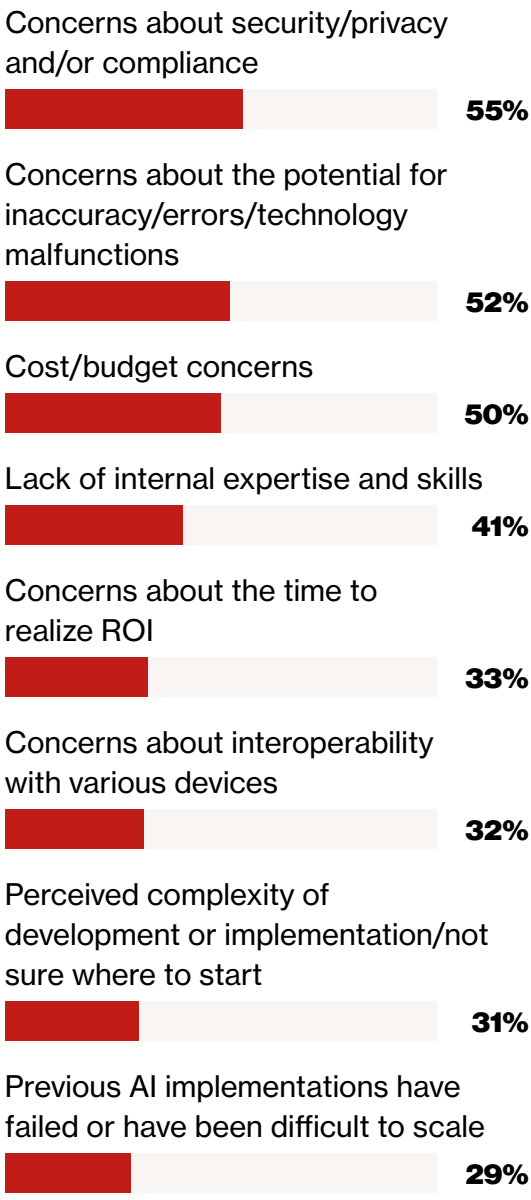
Figure 6 | **Top challenges of edge AI for healthcare organizations**



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Companies are also concerned about security and compliance (45%), especially healthcare organizations (55%), which are heavily regulated and have experienced serious disruptions from cyberattacks (see Figure 6).

"Healthcare is super-sensitive to malfunctions. In acute care, the ICU, neonatal care, and the operating room, there is no room for error," Khowala says. "That's why the industry is not at the forefront of AI — they want the technology proved in other industries before they adopt it."

Cost concerns (50%) and time to ROI (33%) are also holding some healthcare organizations back.

Manufacturers, too, worry about errors and malfunctions, with 49% citing such concerns (see Figure 7). Cost (40%) and security and compliance (40%) were also significant causes of concern.

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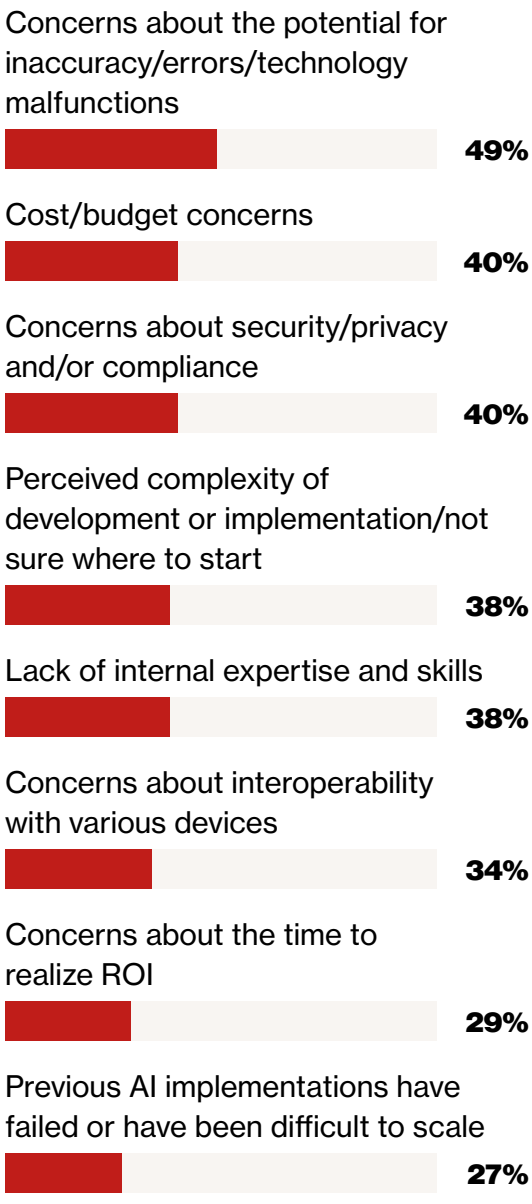
Figure 7 | **Top challenges of edge AI for manufacturers**



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"In the factory, data must be absolutely spot-on — bad input equals bad output," Watts says. "It's essential to have a reliable, robust infrastructure layer with safety and security front and center."

To achieve optimal reliability and security, some manufacturers are building digital twins. "With these models, they can run various scenarios and view outcomes in the digital world before applying AI in the physical world," Watts says.

Retailers (see Figure 8), struggling with tight margins, are most concerned about costs (55%), with worries about errors and inaccuracies coming second (47%). They also have concerns about the complexity of implementing edge AI solutions (38%) and their interoperability with existing technology and devices (32%).

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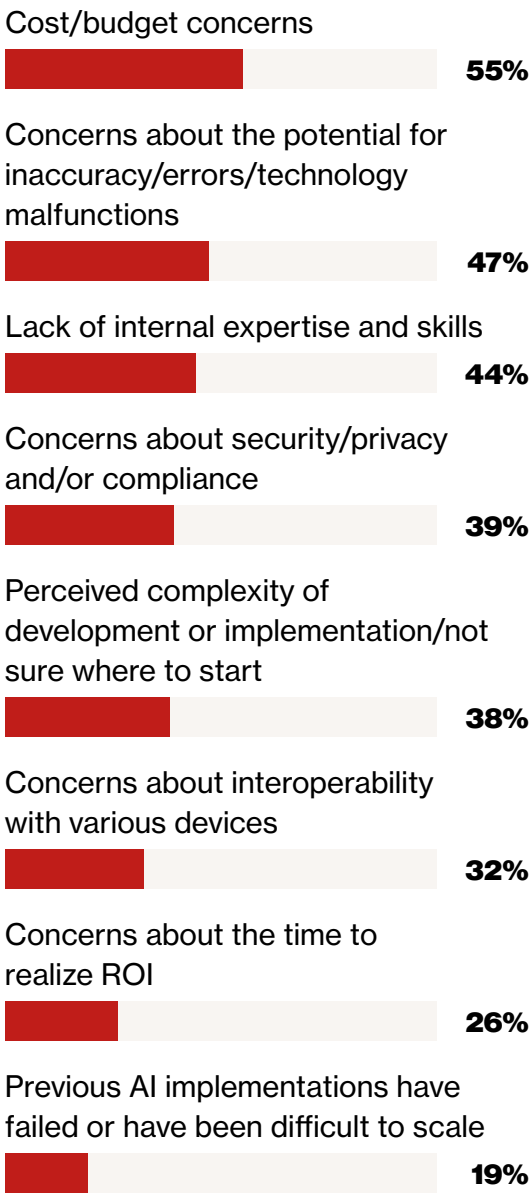
Figure 8 | **Top challenges of edge AI for retailers**



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In all three sectors, a lack of edge AI know-how is holding decision-makers back from advancing their initiatives, although they don't perceive themselves to be lagging behind others. Asked about their pace of adopting edge AI solutions, surveyed leaders, on average, said they believe their industry is either ahead of (36%) or on pace with (47%) other sectors (see Figure 9).

On average, nearly a third (32%) view their own organization as being a leader in edge AI adoption, with 48% seeing themselves as on pace with competitors and just 19% feeling they are behind (see Figure 10).

Nevertheless, large percentages of retailers (49%), healthcare organizations (45%), and manufacturers (54%) said they are at best only somewhat confident they have the internal expertise to implement edge AI solutions. On average, only half of surveyed organizations are very or extremely confident in their ability to implement, operationalize, and manage edge AI technology (see Figure 11).

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Figure 9 | **How industry sectors view their progress with edge AI**

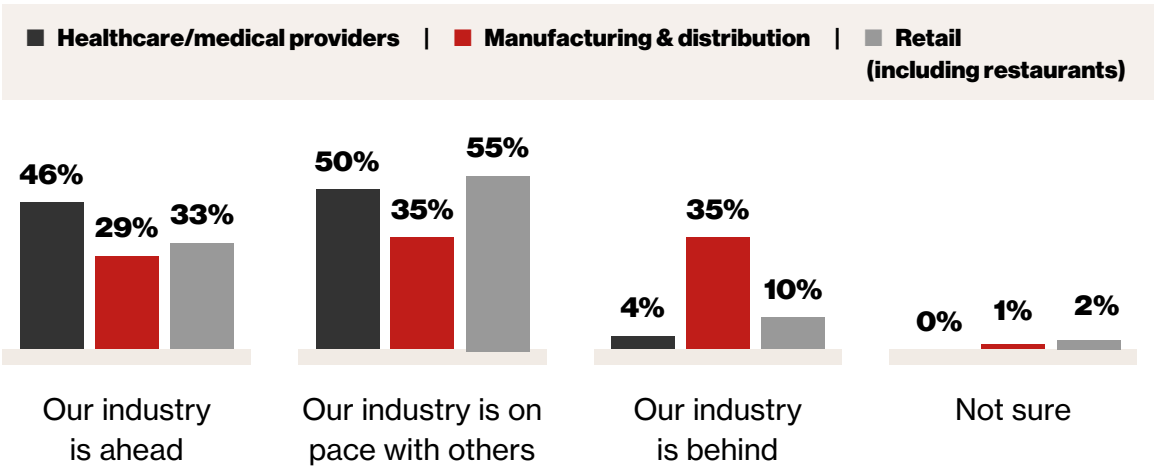

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Figure 10 | **How companies compare their edge AI progress with competitors'**

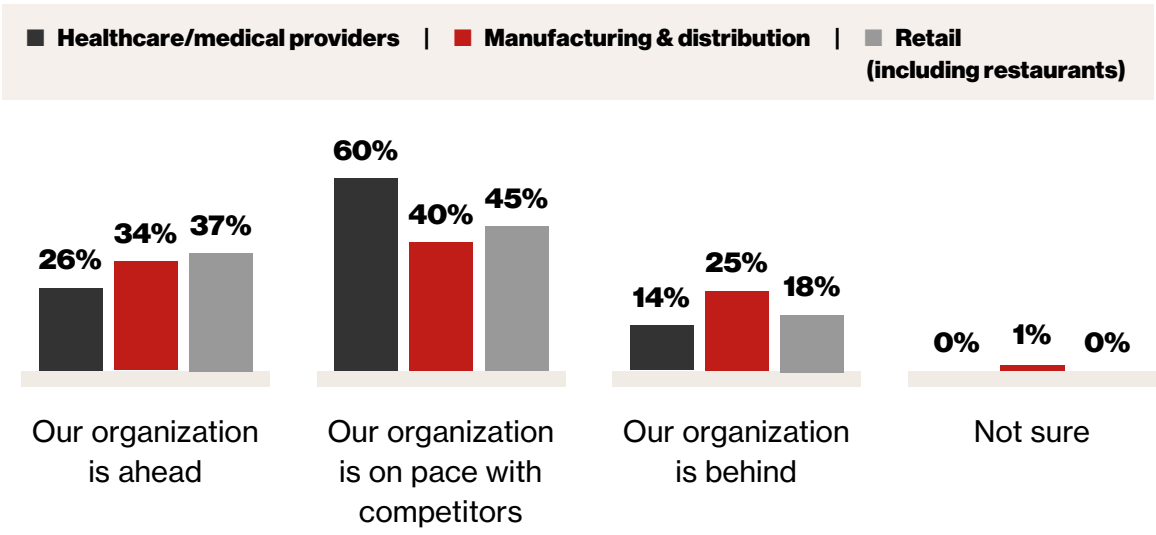

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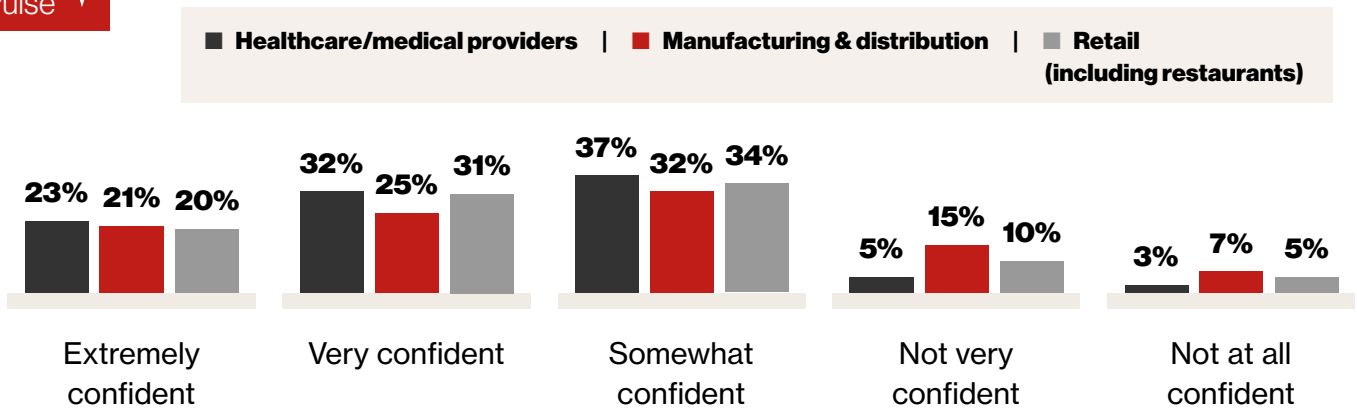
Figure 11 | **Confidence in in-house skills for managing edge AI**



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Some early adopters have already tasted the bitterness of defeat — 26% said previous AI implementations failed or proved difficult to scale.

The perception of leadership may be based on the kinds of solutions companies feel they can successfully deploy. Decision-makers view some edge AI use cases as more easily attainable than others.

In healthcare (see Figure 12), leaders said more attainable solutions include establishing data exchanges between providers and patients (53%), enabling medical record automation (49%), and doing AI-enabled scheduling (45%). These applications are also productivity drivers that rank high on the industry's most-wanted list.

Manufacturers (see Figure 13) listed the most attainable use cases as improving employee safety by detecting equipment malfunctions and dangerous behavior (55%), followed by smart inventory management (53%) and improved security surveillance (49%). Again, these capabilities are considered the most desirable to implement.

For retailers (see Figure 14), self-checkout fraud prevention (55%), smart shelves for inventory tracking

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Figure 12 | **Most attainable edge AI solutions for healthcare organizations**

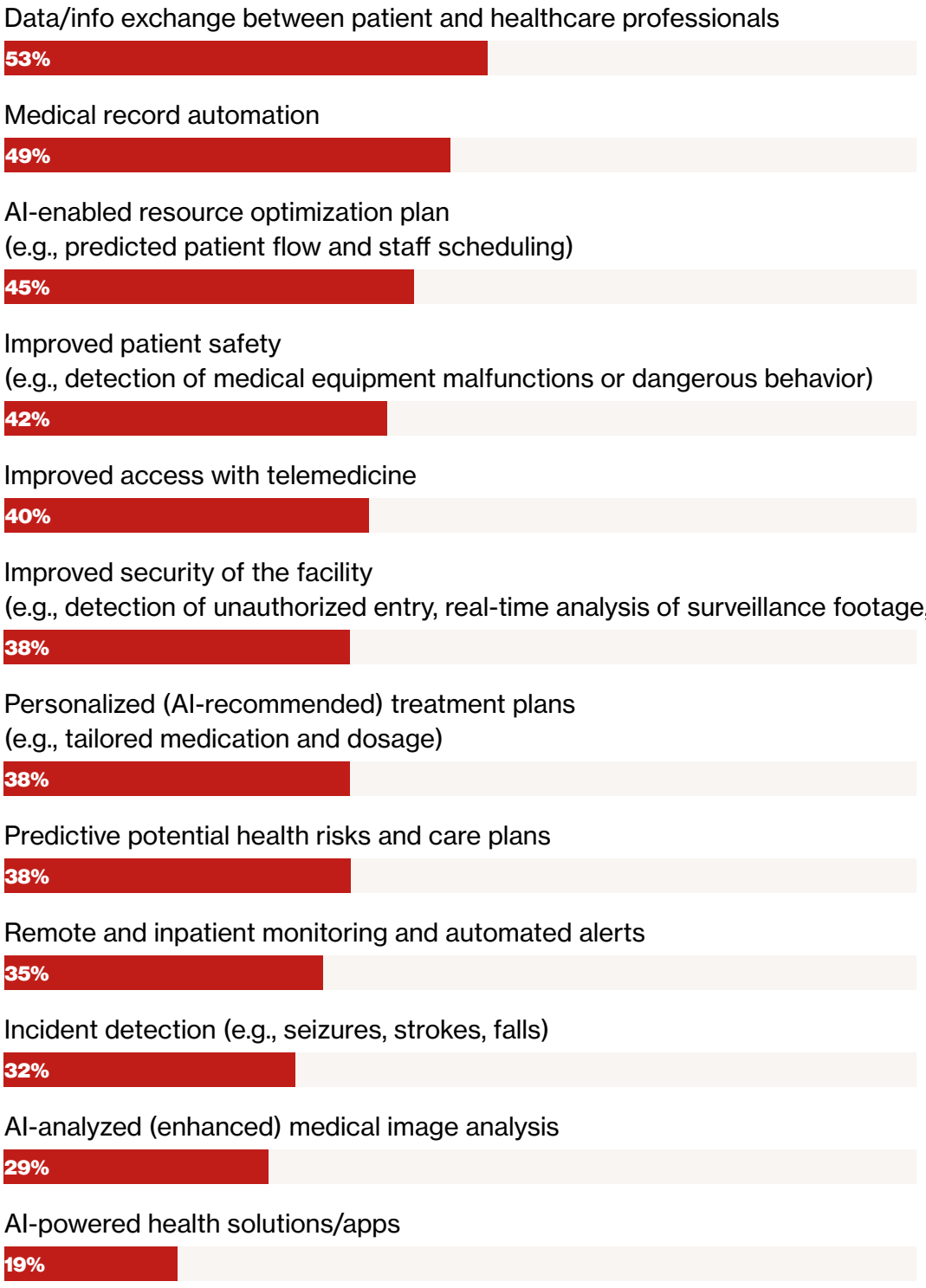

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Figure 13 | **Most attainable edge AI solutions for manufacturers**

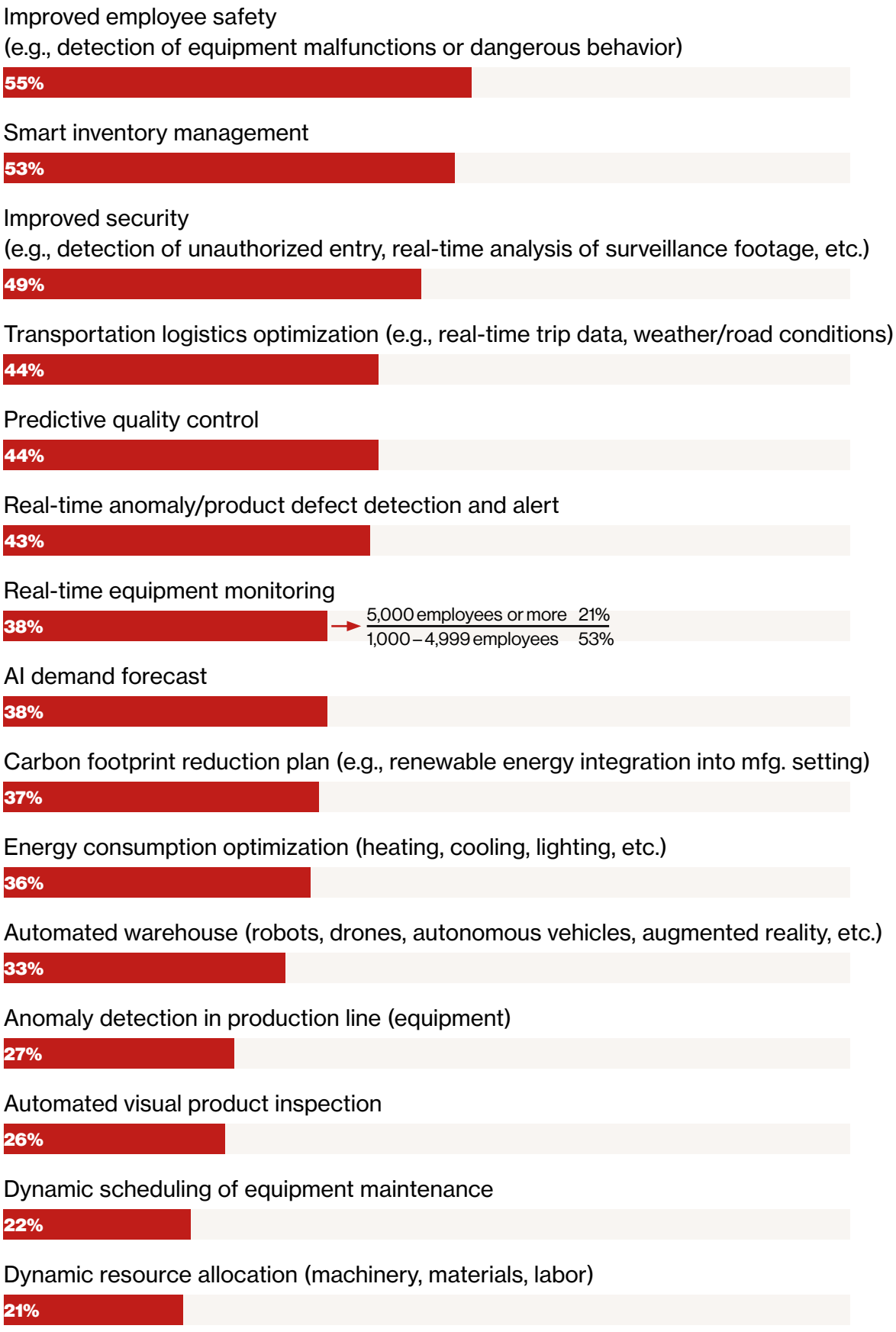

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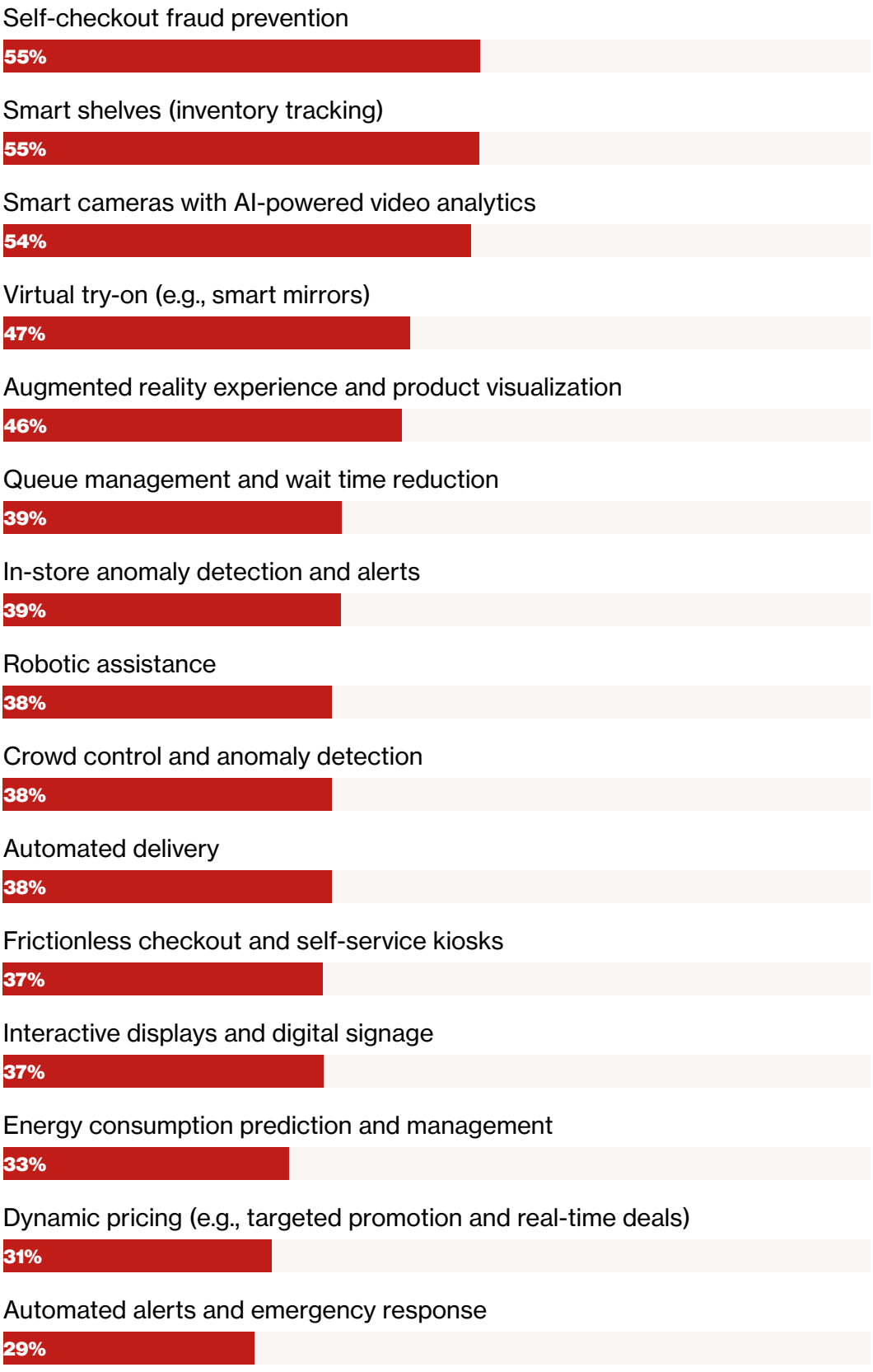
Figure 14 | **Most attainable edge AI solutions in retail**



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(55%), and smart cameras for video analytics (54%) topped the most attainable list. All are among the top five on the most desired list.

But easily attainable solutions are not the end of the line for edge AI. Organizations that fail to move on to more advanced applications and wider deployments will miss out on incremental productivity gains as well as cost-saving and revenue-generating opportunities. To deploy solutions sooner and fully realize the value of their investments, organizations may need to obtain help from partners with the expertise to guide more complex projects to success.

The path forward

Few organizations plan to undertake their edge AI journey alone. To implement edge solutions, nearly three-fourths (72%) are considering using a third-party purpose-built AI solution, either by itself (41%) or in combination with in-house solutions (32%).

More than eight in 10 of the decision-makers said their organization is likely to use external partners to support various aspects of edge AI adoption, for strategy and planning, technology selection, solution implementation, model optimization, or some combination of these services (see Figure 15). Organizations are most likely to rely on an OEM partner for help (57%) while also hoping to gain assistance from software vendors (45%), systems integrators (41%), or operational technology (OT) solutions integrators (36%).

Healthcare organizations are the most likely to use external partners to support each stage of edge AI adoption.

"Healthcare is undergoing tremendous transformation, and nearly every workflow can gain value from AI," Khowala says. "At the same time, the industry is running on fumes with budget and labor shortages. Companies need to focus on the top use cases and keep projects simple and less costly. A good way to do that is to work with partners."

Manufacturers plan to rely most heavily on OEM partners for edge AI support (60%).

"Mechanical and electrical engineers understand how to build products, but they don't necessarily understand AI

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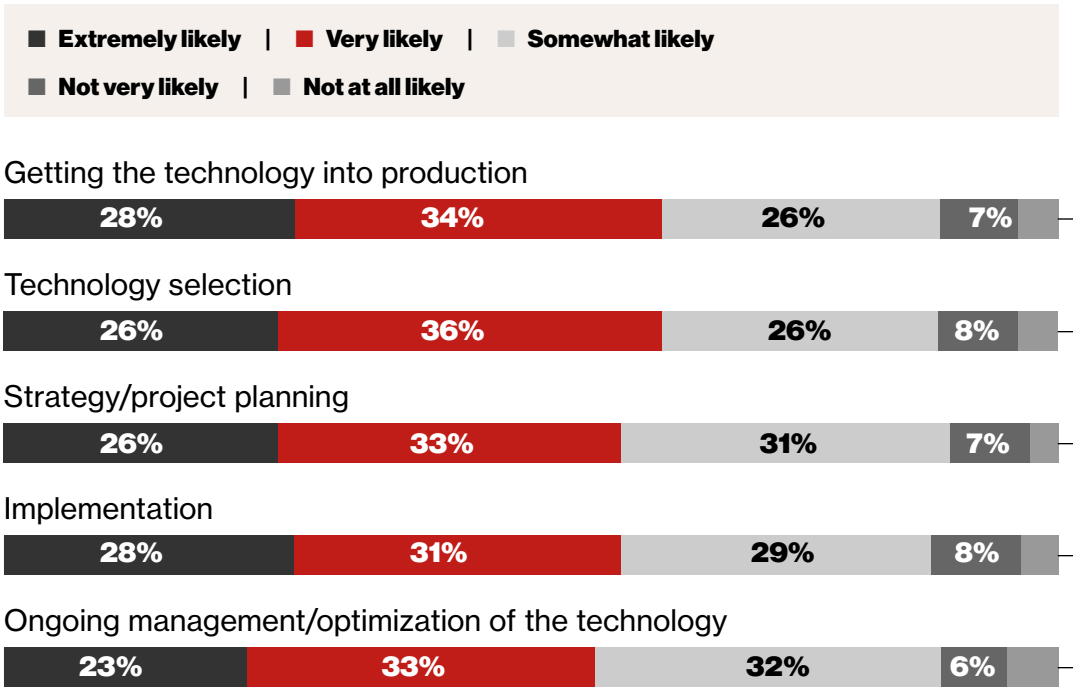
Figure 15 | **How companies plan to use partners for edge AI support**



SOURCE: FOUNDRY

at the chip level," Watts says. "With the right partners, they can build proper models for the solutions they are trying to achieve and use their knowledge of the manufacturing process to be expert custodians and optimize outcomes."

Retailers say they need help with technology selection (68%), strategy and project planning (60%), implementation (61%), and managing and optimizing their use of edge AI technology (59%).

Most use a hybrid model for AI, deploying solutions both at the edge and in the cloud. Knowing how to balance the two implementations may be the key to expanding AI while containing costs, Watts says.

"Many retailers already have the equipment they need to implement AI solutions. The right partners can help them understand how to optimize its use and scale solutions efficiently and affordably."

Making the most of edge AI investment

Edge AI represents a powerful new phase of digital transformation, opening the door to unprecedented

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gains in productivity; more effective safety and security; and a smoother, more convenient experience for customers and employees. As the technology gains momentum across industries, new solutions are developing rapidly, but many organizations worry they lack the expertise to implement and manage them successfully.

Working with the right partners can jump-start the learning curve, helping organizations keep up with competitors and develop their own unique edge applications for employees and customers faster. In the survey, 74% of decision-makers in healthcare, 79% in manufacturing, and 85% in retail said they believe increased AI adoption will help them survive heightened competition in years to come. As their AI models gather more information, analytics will reveal a host of new operational insights, enabling companies to optimize their existing edge applications and discover new ones to meet their changing needs.

To learn how edge AI can help your organization attain new levels of efficiency and productivity, visit intel.com.

1 "New IDC Spending Guide Forecasts Edge Computing Investments Will Reach $232 Billion in 2024," IDC, March 24, 2014.

2 "National Retail Security Survey 2023," National Retail Federation, Sept. 26, 2023.