Deliver Smarter AI with the Right Information Architecture

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The strategic importance of AI in healthcare

Instead of asking 'Should I invest in this new technology?' the question is, 'How do I survive the digital revolution and thrive in the next 10 years?' The answer is to get started on the AI journey, because AI is key to meeting the challenges facing the healthcare industry.

FRANK LEE | HEALTHCARE AND LIFE SCIENCES INDUSTRY LEADER | IBM SYSTEMS GROUP

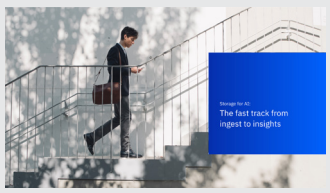
The digitization of healthcare has led to an enormous increase in the volume, variety, velocity and veracity of healthcare data. But without a means to analyze that data and apply the insights hidden therein, the data is useless. That is why artificial intelligence (AI) has become essential for today's hospitals and health systems.

HIMSS, in collaboration with IBM, conducted a study in January 2020 to examine how U.S. hospitals and health systems are positioning themselves to leverage the power and promise of computing-intensive data analytics and AI.[1] (Note that computing-intensive data analytics can be a precursor to AI, but is not synonymous with AI). More than 200 C-suite executives, senior managers and managers, employed in hospitals and health systems with 100 or more beds, participated. Half represented IT roles, while the other half were from outside IT.

Two of every three respondents (64%) said their organization places a "critical" (27%) or "high" (37%) strategic priority on computing-intensive data analytics and/or AI. Healthcare organizations are deploying analytics and AI across the enterprise, including clinical, business and research use cases. Respondents reported varying levels of success across these areas, including descriptive, predictive and prescriptive applications. As organizations look to the future, they are taking steps to improve AI capabilities across all use cases and applications (Figure 1).

"AI is at the point where medical imaging machines were 20 years ago or genomic sequencers were 10 years ago," said Frank Lee, Healthcare and Life Sciences Industry Leader, IBM Systems Group. "Back then, hospitals struggled to justify investing in new digital technologies, but now they've become an essential part of the clinical or research infrastructure. The difference now is that instead of asking 'Should I invest in this new technology?' the question is, 'How do I survive the digital revolution and thrive in the next 10 years?' The answer is to get started on the AI journey, because AI is key to meeting the challenges facing the healthcare industry."

Read the IDC report on accelerating and operationalizing AI deployments using AI-optimized infrastructure



Read about how to store and scale AI data properly

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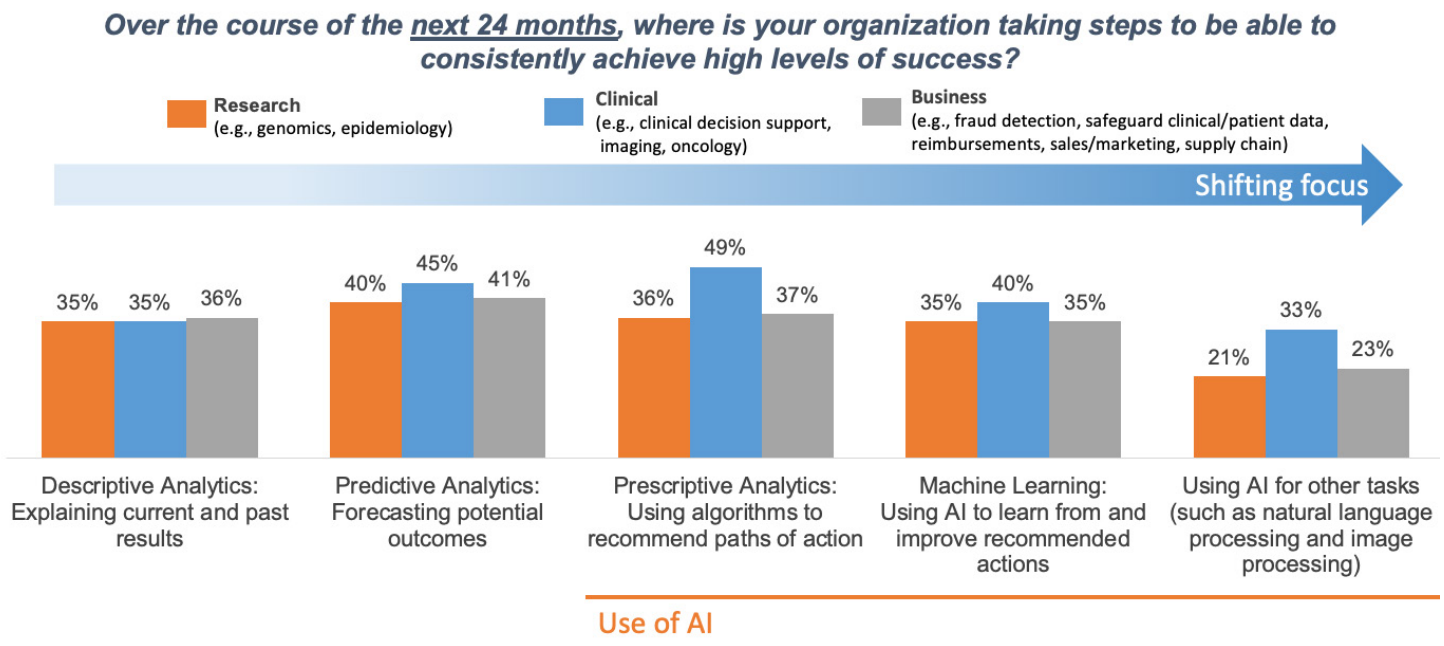
FIGURE 1. Organizations look to improve AI success across use cases in the future



Source: *Journey to AI in Healthcare*, conducted by HIMSS Media and sponsored by IBM, January 2020

Information architecture for the future of AI

The foundation for AI is data. But before you can analyze that data, you have to understand how you are going to collect, organize and share it. You can't do any of that unless you first have a well-thought-out information architecture in place.

SUMIT GUPTA | VICE PRESIDENT | AI STRATEGY AND CTO | DATA AND AI | IBM CLOUD AND COGNITIVE SOFTWARE

"You can't have AI without IA," said Marisa de Peralta, Global Program Director, Healthcare & Life Sciences Business Development and Solutions, IBM. "'IA' refers to *information architecture*, the backbone of AI solutions. It's not possible to have a well-performing AI without first investing in the information architecture that's needed to support it."

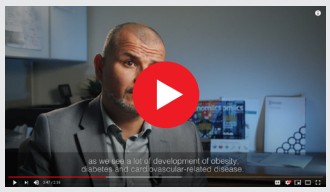
"The information architecture serves as a framework and blueprint for building, supporting and maintaining the infrastructure for shared data and applications for AI," explained Lee. "Like an architecture for a building or city, having a proven design in place enables an organization to bring together different technologies and allow them to work together. That blueprint helps organizations create a scalable infrastructure that can grow over time."

In that sense, the information architecture is a way to future-proof an organization's investment in AI. "Starting with the information architecture allows organizations to comprehensively consider factors such as cost efficiency, ease of use and high performance and incorporate them as they are building and deploying the information infrastructure," said Lee.

The HIMSS research found that organizations lack confidence that they have the right infrastructure in place to support computing-intensive data analytics and AI initiatives. Fewer than 4 of 10 respondents believed they have the "best possible solution" (8%) or a "largely workable solution" (29%) in place to support their analytics and AI goals (Figure 2).

"The foundation for AI is data," said Sumit Gupta, Vice President, AI Strategy and CTO, Data and AI, IBM Cloud and Cognitive Software. "But before you can analyze that data, you have to understand how you are going to collect, organize and share it. You can't do any of that unless you first have a well-thought-out information architecture in place."

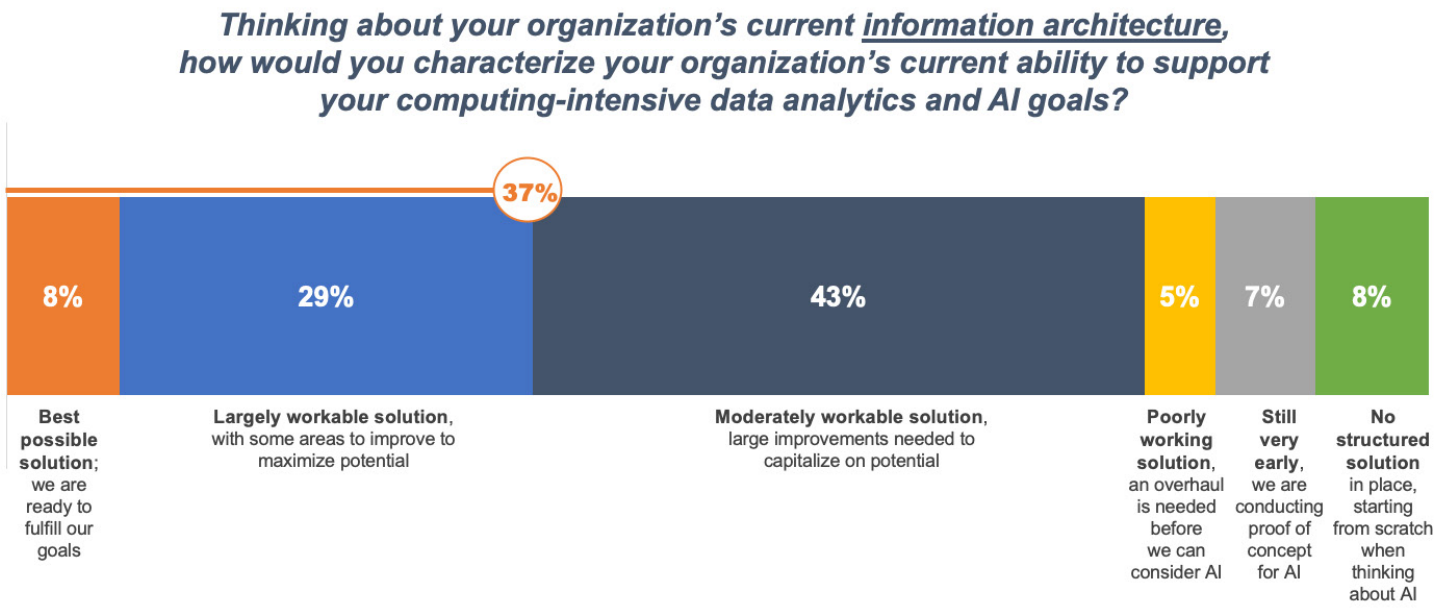
See how Washington University in St. Louis and Vanderbilt University collaborate on AI to improve medical imaging



See how game-changing genomics research is improving the health of a nation. Sidra Medical and Research Center

Watch The journey to AI: Modernize your information architecture

FIGURE 2. Fewer than 4 of 10 believe they have the "best possible" or a "largely workable" information architecture for AI



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The role of data integration and data governance in information architecture

Data integration is one of the biggest challenges healthcare organizations face in building an information architecture. They have many silos of data — silos by function and form. They must take a prescriptive approach to integrate different types and sources of data in order for it to be considered useful data to power AI.

MARISA DE PERALTA | GLOBAL PROGRAM DIRECTOR | HEALTHCARE & LIFE SCIENCES BUSINESS DEVELOPMENT AND SOLUTIONS | IBM

Hospitals and health systems have taken steps to align their information architecture with their AI goals (Figure 3). The top two steps are "integrating all data sources, including EHR and real-world evidence" (44%) and "establishing data governance best practice" (39%).

"Data integration is one of the biggest challenges healthcare organizations face in building an information architecture," said de Peralta. "They have many silos of data – silos by function and form. They must take a prescriptive approach to integrate different types and sources of data in order for it to be considered useful data to power AI."

For example, if a hospital wants to examine the time patients spend in the waiting room, they might have to integrate appointment system data with medical record system data. "That can be a difficult integration task, because the data is being collected in different systems, built by different companies," said Gupta. "Organizations need to have a common information architecture in order for those systems to exchange or correlate data."

Data governance also plays a role. It has three aspects:

1. Ensuring that data is properly protected and stored, from the time it comes into the health system, up through when the data is accessed, processed and eventually archived.

2. Creating and using standards for sharing data. Lee said, "Every institution working in the AI space needs to have a data governance committee to establish how data sharing is going to be standardized."

3. Cataloguing. "Creating a unified data catalog that is connected with all of the data sources, combined with the data standards, and that conforms to the information architecture is a critical play for data governance and AI," said Lee.

Dive into the information architecture blueprint! Read now

Read now to learn about a hybrid multicloud AI solution for enterprises

Watch The journey to AI: Collect data to make it simple and accessible

FIGURE 3. Data integration and data governance are among the top steps taken to align information architecture with AI goals

Source: *Journey to AI in Healthcare*, conducted by HIMSS Media and sponsored by IBM, January 2020

Importance versus performance of elements of information architecture

Cost, ease of use and performance are important aspects of an information architecture. I see healthcare organizations make the mistake of viewing these challenges as separate problems, which they have to attack individually, instead of holistically. The fact is, these elements are all linked together, and investing in the right information architecture can address all of these interrelated problems at once.

MARISA DE PERALTA | GLOBAL PROGRAM DIRECTOR | HEALTHCARE & LIFE SCIENCES BUSINESS DEVELOPMENT AND SOLUTIONS | IBM

A workable information architecture comprises a number of different elements or characteristics. Survey respondents ranked eight different elements in order of importance in advancing AI goals. The three most important elements were "cost efficient" (69%), "easy to use and manage" (64%) and "compliant with regulations" (58%).

In a separate question, respondents were asked to assess how well their current information architecture was performing in each of the same eight areas. By comparing the results of the two questions, researchers were able to identify the three elements in which the largest gaps between "importance" and "performance" occur (Figure 4). The areas with the greatest discrepancies were "cost efficient" (-36% gap), "easy to use and manage" (-29% gap) and "high performance (defined as fast time to results)" (-13% gap).

"Cost, ease of use and performance are important aspects of an information architecture," said de Peralta. "I see healthcare organizations make the mistake of viewing these challenges as separate problems, which they have to attack individually, instead of holistically. The fact is, these elements are all linked together, and investing in the right information architecture can address all of these interrelated problems at once.

"For example, when you deploy AI, start small and choose a pilot from which you and your team can learn. Leverage industry-proven machine-learning, deep-learning and AI tools to enable rapid deployment and deliver faster insights. Don't settle for commodity servers or storage, but instead evaluate enterprise-class servers and storage, with complementary system software, that will allow you scale your AI solution across the organization and protect your data with end-to-end security."

Watch The journey to AI: Organize data to create a business-ready analytics foundation

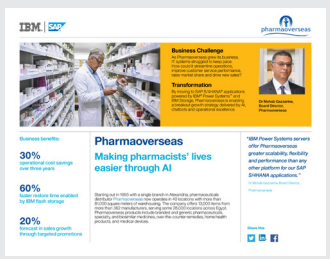

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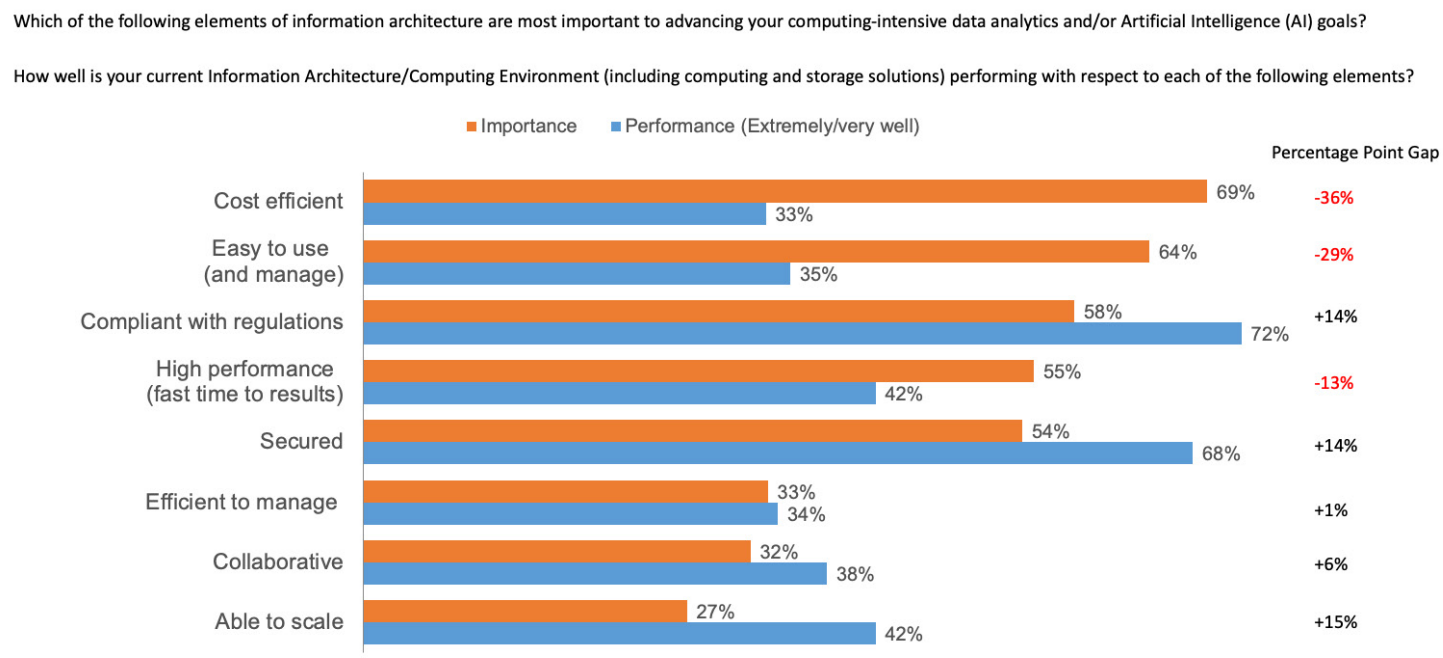
FIGURE 4. Healthcare organizations experience gaps between the importance and performance of information architecture elements



Source: *Journey to AI in Healthcare*, conducted by HIMSS Media and sponsored by IBM, January 2020

Overcoming the top three barriers to AI

Too often, organizations start with just one piece. They decide, 'We will build the best information architecture in the world.' But you can't solve for just that one piece and get anywhere. You have to have a well-thought-out roadmap to success. That's why we call it a journey *to AI.*

SUMIT GUPTA | VICE PRESIDENT | AI STRATEGY AND CTO | DATA AND AI | IBM CLOUD AND COGNITIVE SOFTWARE

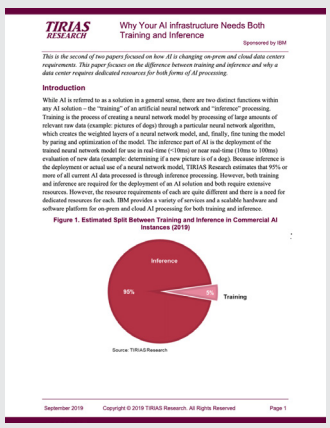
Lack of resources, security concerns and a lack of direction were identified as the top barriers to successful implementation of AI initiatives (Figure 5). The top challenge was "underinvestment in needed resources" (36%). One of the reasons behind the lack of investment, said Gupta, is a lack of clarity around where the organization is headed with respect to AI.

"You need to start with a clearly defined vision of what you want to achieve," Gupta said. "Then you work your way back from that vision: That is, to achieve this specific answer or this AI solution, I will need this particular information architecture, the integration of these specific data sources, a certain type of hardware infrastructure, the following data science teams and skills and so on. After you scope out the project, you will understand the investment required.

"Too often, organizations start with just one piece. They decide, 'We will build the best information architecture in the world.' But you can't solve for just that one piece and get anywhere. You have to have a well-thought-out roadmap to success. That's why we call it a *journey* to AI," Gupta said.

As is the case with other aspects of AI, collaboration can be useful. Establishing an AI roadmap within the context of a broader ecosystem is often beneficial. A partner – such as another health system, a consortium or an industry vendor – can provide valuable support. "An industry vendor, with expertise in healthcare, can help organizations to define a blueprint and design an architecture that aligns with their goals. They can also help design a plan that addresses concerns, such as privacy and security requirements," said Lee. "The bottom line is: Have a point of view, and then back it up with a plan."

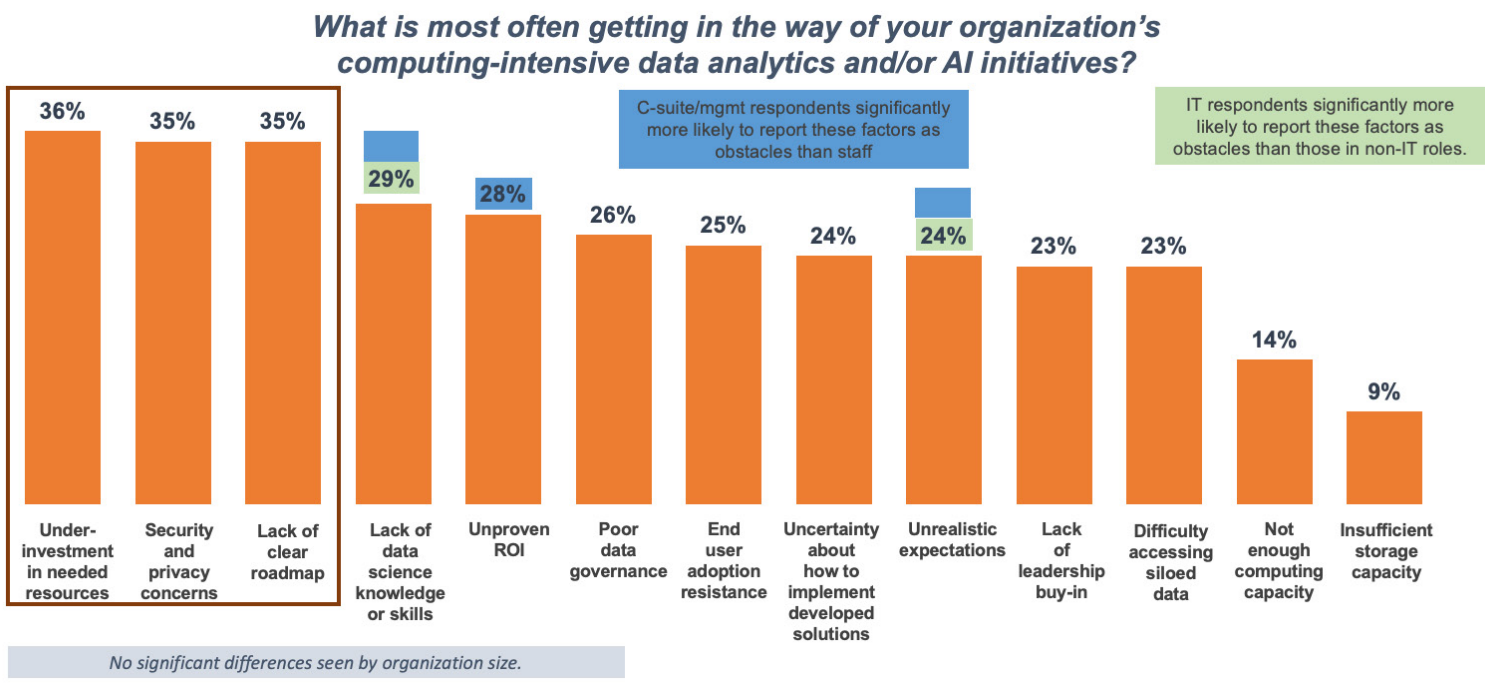
Read the Tirias report: Why your current IT infrastructure won't work for AI



Read the Tirias report: Why your AI infrastructure needs both training and inference

Watch The journey to AI: Analyze – build and scale AI

FIGURE 5. Resources, security and direction identified as the top three barriers to AI success



Source: *Journey to AI in Healthcare*, conducted by HIMSS Media and sponsored by IBM, January 2020

AI services and solutions: Build or buy?

If an organization can leverage an AI solution that is already available, and that can be easily customized to their use case, they should. It will be cheaper, faster to use and faster to get to market.

SUMIT GUPTA | VICE PRESIDENT | AI STRATEGY AND CTO | DATA AND AI | IBM CLOUD AND COGNITIVE SOFTWARE

When it comes to obtaining AI services and solutions, about half of healthcare organizations are using a combination "build/buy" approach. This holds true across research- (51%), clinical- (47%) and business- (51%) use cases (Figure 6). Other common approaches include either fully outsourcing a custom solution or buying or renting an off-the-shelf product. The least common approach, across all use cases except for research, is building something in-house.

"Healthcare organizations are not in the business of IT and they are not in the business of AI. So, it makes sense for them to use solutions offered by companies that are in the business of IT and AI, instead of trying to build something themselves," said Gupta. "If an organization can leverage an AI solution that is already available, and that can be easily customized to their use case, they should. It will be cheaper, faster to use and faster to get to market."

Buying or renting a pre-built solution also can help mitigate the data science talent gap many organizations are experiencing. "Today, we have intuitive AI tools that make deep learning and machine learning capabilities more accessible to data scientists, medical practitioners and subject matter experts," said de Peralta. "These are tools they can use even if they don't have coding or deep learning expertise. That means these tools can reduce the time it takes to deploy AI models. Decreasing the time between the initial prototype and organization-wide deployment means that organizations see faster results."

As healthcare organizations evaluate vendor-offered AI solutions and services, it's important to also determine whether or not the solution being considered is 'architecture-ready.' A solution that isn't easily integrated into the organization's information architecture can end up being a silo solution, limiting its usefulness. The right solution will integrate with the organization's information architecture and enhance the organization's overall AI capabilities.

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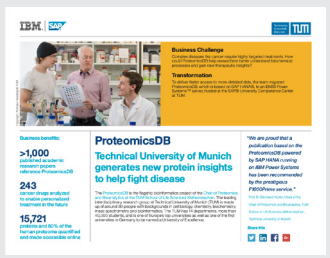

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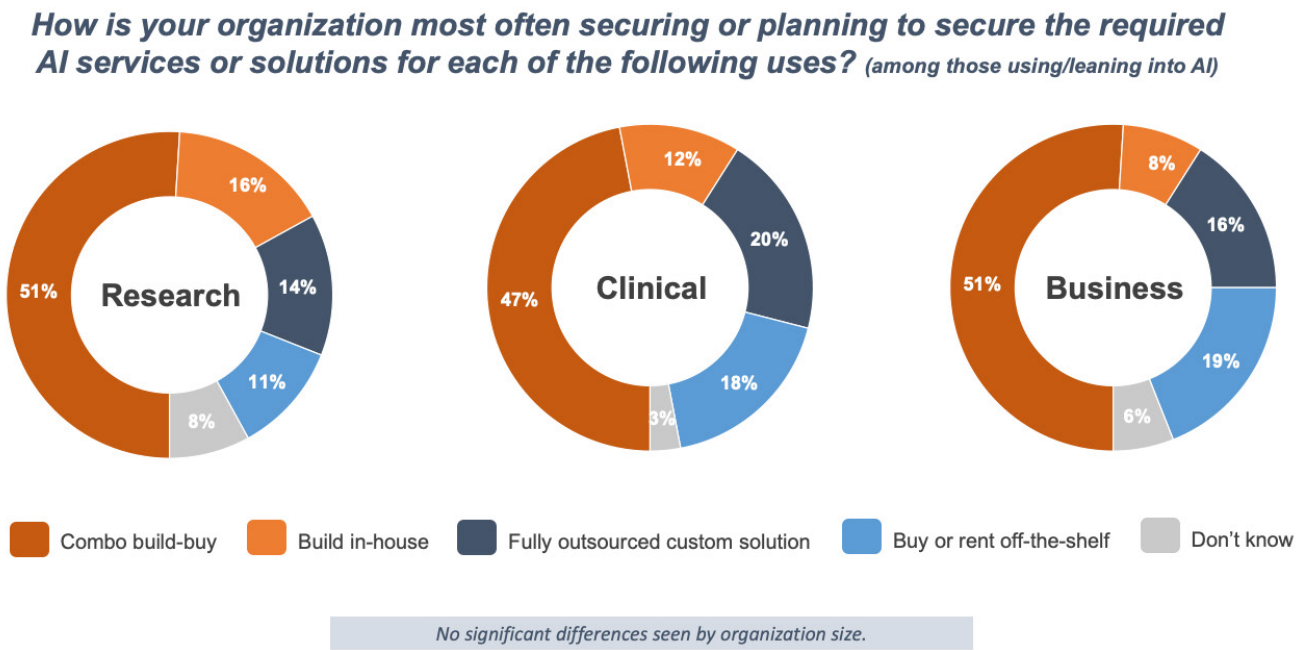
FIGURE 6. Half of organizations are securing AI services and solutions using a combination approach that includes both "build" and "buy"



Source: *Journey to AI in Healthcare*, conducted by HIMSS Media and sponsored by IBM, January 2020

Data science knowledge: Closing the talent gap

Data science is still an emerging field. There are not enough skills out there to meet the demand in any industry, let alone healthcare. That is why hiring consultants who are experts in data science to augment your internal team can accelerate your AI initiatives.

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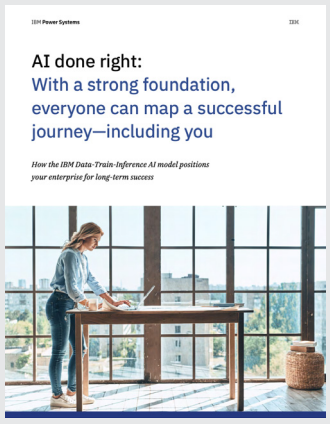
A lack of data science talent is a significant barrier for hospitals and health systems trying to advance AI initiatives. One of three C-suite respondents (32%) and a third of senior managers (33%) identified lack of data science knowledge and skills as a problem. And nearly 4 of 10 respondents (37%) from the IT side of the house agreed with that assessment.

"Data science is still an emerging field. There are not enough skills out there to meet the demand in any industry, let alone healthcare," said Gupta. "That is why hiring consultants who are experts in data science to augment your internal team can accelerate your AI initiatives." The research found that 45% of organizations are "drawing on third-party and/or contracted talent" to address the AI talent gap (Figure 7).

The right software and information architecture can make a difference, too. The use of auto AI and auto machine learning software can reduce the need for deep learning expertise within the organization. Deploying an information architecture that enables internal teamwork and facilitates external collaboration is also important.

"Consortiums and collaboration around AI are becoming more and more common," said Lee. "But in order to take advantage of these opportunities, you need to offer more than one individual with a single laptop or workstation to represent your organization. You really need to have an internal team and a platform in place that enables collaboration, built on the appropriate information architecture.

"Another advantage to having these pieces in place is that people want to go to where they can apply their talents," Lee added. "So, if your institution offers a robust and productive data science environment, with an engaged team, institutional support and the appropriate infrastructure, you will attract more AI talent."



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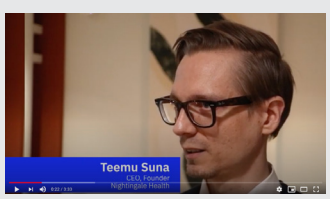
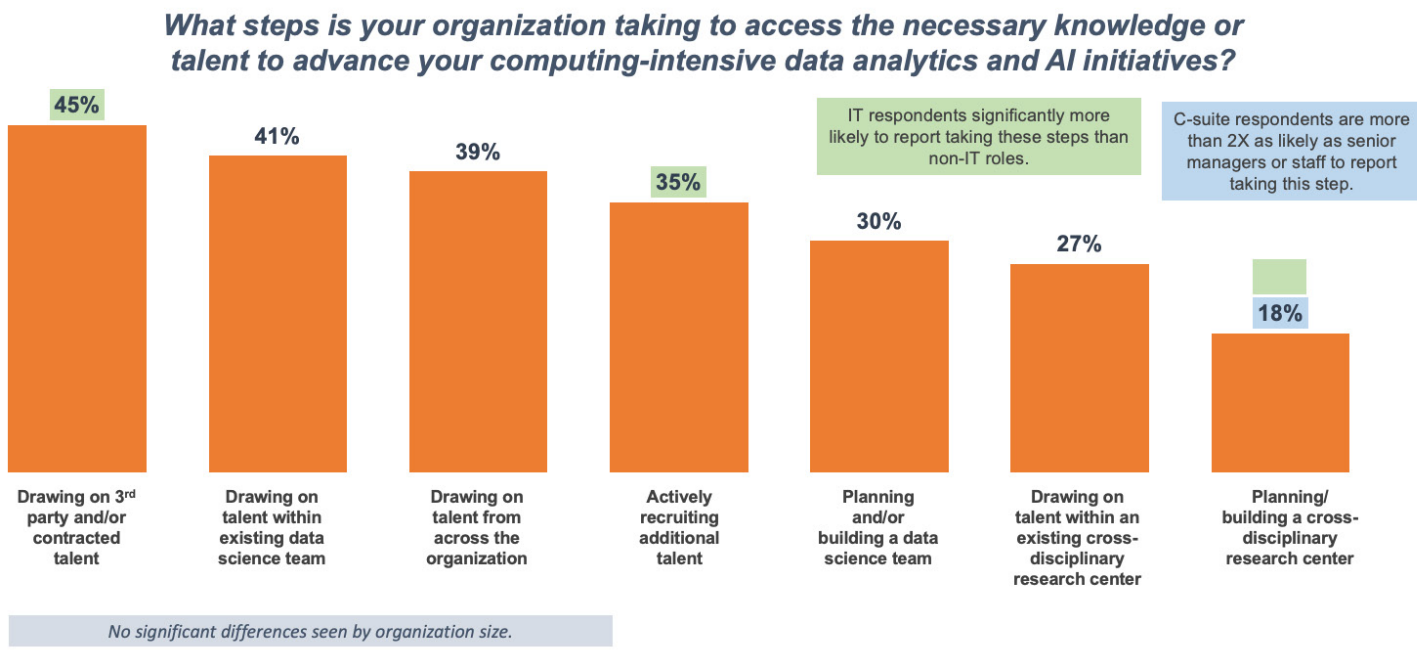


Read how Nightingale Health, a biotech company, grew its IT infrastructure...to enable everyone to live healthier lives

FIGURE 7. Healthcare organizations are drawing on third-party talent to advance AI initiatives



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The importance of the cloud in information architecture

Healthcare organizations do not have to choose between on-premise deployment and cloud deployment. It's really about using a combination, a synergistic integration between the two. In fact, using a hybrid, multi-cloud model is an essential solution design for high-performance data and AI architecture.

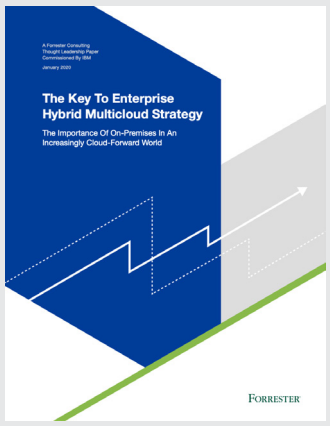
FRANK LEE | HEALTHCARE AND LIFE SCIENCES INDUSTRY LEADER | IBM SYSTEMS GROUP

Healthcare organizations reported using the cloud for almost half (47%) of their computing-intensive data analytics and AI workloads and 45% of their data storage needs (Figure 8). As the data makes clear, using the cloud is not an "either/or" proposition. "Healthcare organizations do not have to choose between on-premise deployment and cloud deployment," said Lee. "It's really about using a combination, a synergistic integration between the two. In fact, using a hybrid, multi-cloud model is an essential solution design for high-performance data and AI architecture."

Using a model that incorporates a public, or hybrid, multi-cloud deployment offers several advantages over on-premise only deployment. One advantage is that the cloud provides organizations with easy access to infrastructure resources such as computers, storage networks and pre-built platforms. "The cloud enables the information architecture to be deployed faster than if an organization was trying to build everything from the ground up," said Lee. "The cloud – especially an infrastructure-as-a-service type of cloud – can accelerate the deployment of an information architecture."

An information architecture that includes the cloud also offers flexibility in terms of capacity. On-premise deployments may be constrained by variables such as the size of the data center, the available space, and limited power or cooling resources. By using "cloud bursting" – the dynamic deployment of applications into the public cloud when a work load becomes too much for their private cloud – organizations can enhance the capacity and performance of their AI capabilities.

In addition, the cloud can play a role in facilitating external collaboration. "Infrastructure built inside the hospital is often inaccessible to external collaborators," said Lee. "Having a deployment or sandbox in the cloud can help facilitate the collaboration and sharing that are so important in AI."



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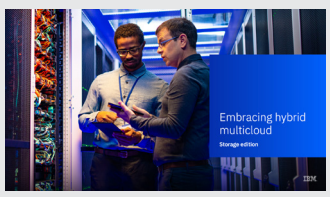

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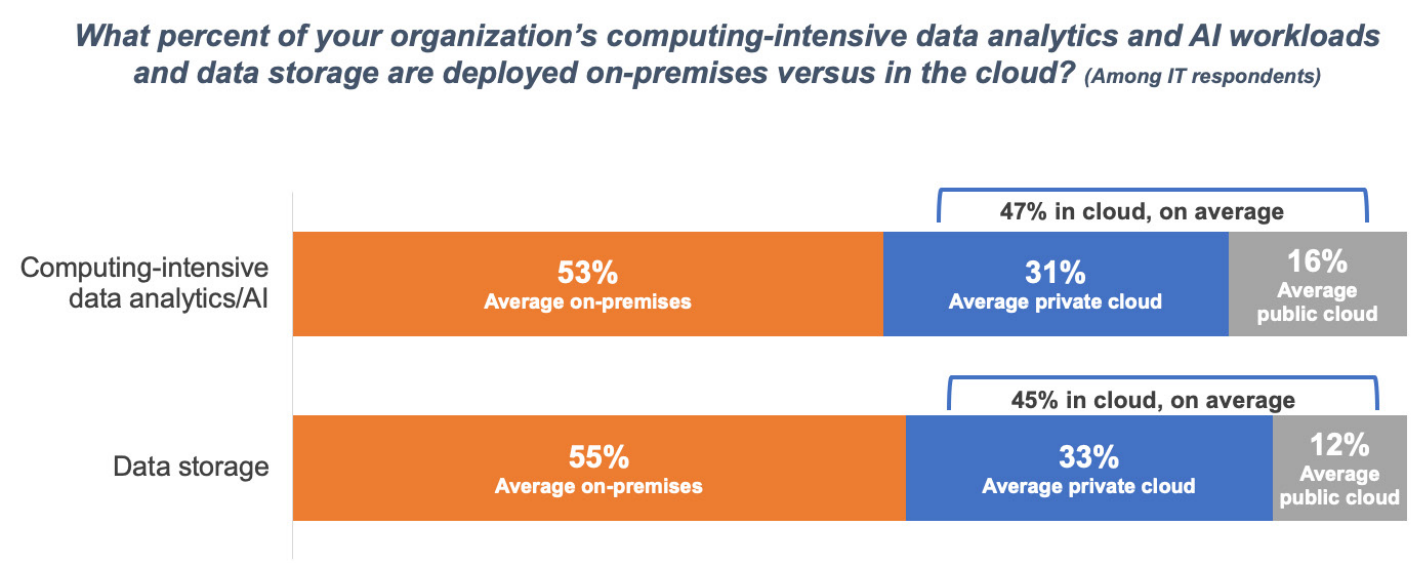
FIGURE 8. Healthcare organizations are using the cloud for almost half of computing-intensive data analytics and AI workloads and just under half of their data storage requirements



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The ideal approach to information architecture

An experienced partner can help you achieve early successes that demonstrate the value of AI to the rest of the stakeholders in your community. Those quick wins are the first steps toward expanding your AI capabilities.

SUMIT GUPTA | VICE PRESIDENT | AI STRATEGY AND CTO | DATA AND AI | IBM CLOUD AND COGNITIVE SOFTWARE

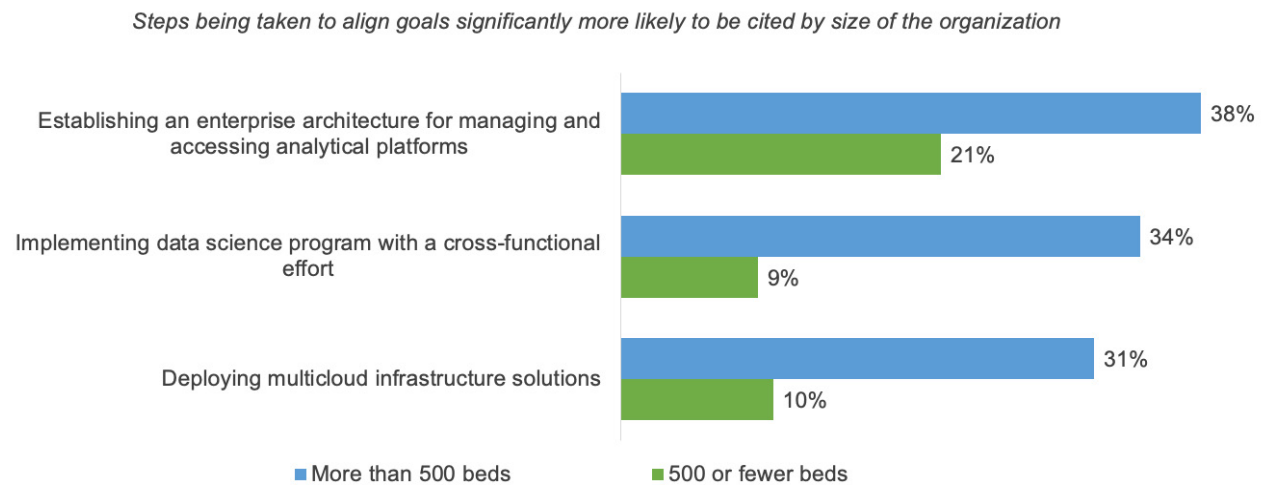
The right approach to information architecture can help hospitals and health systems move forward on their AI journey. Many healthcare organizations are already taking steps to align their information architecture with their AI goals. For example, 38% of large (more than 500 beds) hospitals and health systems are establishing an enterprise architecture for managing and accessing analytical platforms (Figure 9). One of five smaller organizations (500 or fewer beds) have also taken that step.

"You need to begin by defining the outcomes you want, because all of the different aspects of the information architecture follow from that," said Gupta. "When you understand your desired outcomes, you can identify the data elements you need and establish a plan for integrating those data elements. You can think through how you will manage your data and govern your data. And you can identify who will need to be a part of your data science team.

"Then you need to think through all of the other elements that lead to success: What actual data science or AI approach will you use? What software platforms will you use? What compute infrastructure will you use? Will you leverage a hybrid cloud or multi-cloud model?" he said.

"AI is a complex endeavor. That's why I recommend that organizations work with consulting partners who have done this before – whether that is an AI consulting company or an information architecture company," said Gupta. "An experienced partner can help you achieve early successes that demonstrate the value of AI to the rest of the stakeholders in your community. Those quick wins are the first steps toward expanding your AI capabilities."

FIGURE 9. Large organizations are more likely to be taking significant steps to align their information architecture with their AI goals



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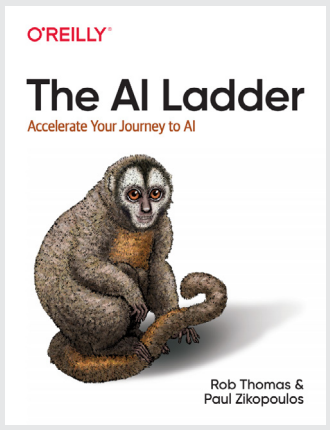

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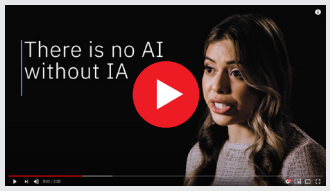

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