ACEC RESEARCH INSTITUTE

FIRM OF THE FUTURE

The Role of Artificial Intelligence in the Engineering Industry

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The Role of Artificial Intelligence in the Engineering Industry

Foreword

This study has a foreword written by Javier A. Baldor, Chief Executive Officer at BST Global.

The rapid advancement of artificial intelligence technologies has propelled the world headfirst into the Fourth Industrial Revolution — the Data Revolution. New developments in artificial intelligence are being introduced at a staggering and unprecedented rate.

OpenAI's 2022 introduction of ChatGPT, which was seen as the biggest technology revolution in recent years, has already been eclipsed by relative upstart DeepSeek. Released in January, its latest model, DeepSeek R1, rivalled OpenAI's capabilities while costing far less to create. In fact, tech investor Marc Andreessen declared DeepSeek R1 to be AI's "Sputnik moment," referencing the Soviet Union's 1957 launch of Earth's first artificial satellite, which stunned the Western world.

For the AEC industry, AI brings promising capabilities for innovative design, more sustainable practices, expedited workflows and beyond.

I believe three megatrends around AI and big data will transform our industry and the world at large.

1 The Superconsultancy

I have conceived and named this concept for our industry based on the outstanding research report introduced by McKinsey earlier this year titled "The Superagency in the Workplace." It chronicles a state where individuals empowered by AI supercharge their creativity, productivity and positive impact.

According to McKinsey, this is where firms are in their AI journey:

- Over the next three years, 92% of companies plan to increase their AI investments
- Three times more employees are using GenAI for a third or more of their work than their leaders imagine
- More than 70% of all employees believe that GenAI will change 30% or more of their work within two years
- Only 1% of leaders characterize their GenAI rollouts as mature

The report also presumes that GenAI and other emerging technologies have the potential to automate work activities that consume up to 70% of an employee's time every single day.

As this kind of thinking (and working) becomes more accessible, I see the opportunity for the data-driven firm of the future to employ the "superconsultancy," wherein the future of work will be unlike anything we have ever seen before. Shifts in operational efficiency like these will spur an evolution of our industry's underlying business model, which has remained unchanged for decades. Where today's consulting engineering firm operates largely on a time and materials basis, the superconsultancy of tomorrow will be empowered to operate on a value-based model.

2 The Super Agents

The next transformational frontier of GenAI tools is super agents. We are beginning an evolution from knowledge-based, GenAI-powered tools (e.g., chatbots that answer questions and generate content) to GenAI-enabled "agents" that use foundation models to execute complex, multistep workflows across a digital world. In short, the technology is moving from thought to action. In the future, you will work seamlessly with these GenAI agents or virtual coworkers to deliver tremendous productivity gains.

Imagine that a key client has invited you to propose on a new project. Today, you might reach out to your client manager for a relationship update and comb the client's website, press releases, and annual report for the latest developments. All of this is done manually and is very time consuming.

Now imagine deploying an army of super agents to help you. These agents can gather the projects that you have successfully delivered for your client in the past three years; highlight the skills, qualifications and availability of your team for this project; outline the client's project profitability and cash flow history; and align all this with what is currently being proposed.

But we wouldn't stop there. The super agents could also research competitive and market intelligence and risk and regulatory intelligence. They could calculate project feasibility, perform site analysis, conduct real-time competitor tracking, and even present GenAI-crafted and inspired designs based on the project scope. Imagine having all this data organized for you in a digital client packet so you come to the table ready to win.

There are many more use cases for super agents to transform project delivery and even the job site of the future, where humans will work seamlessly with agents and robots to improve job site safety and project outcomes. It's not only possible; it's coming in a big way.

3 The Superpower Within

Data is the key to unlocking the superpower within your organization. Your firm is literally sitting on a data gold mine, and you may not even recognize how it can transform your business. The opportunity lies in harnessing it, leveraging it and monetizing it.

Realizing these visions of advanced technologies requires a digital leader to activate the organization so it thinks and acts "data and AI first" when making any decision — someone who understands how to make your data easy to use, easy to track and easy to trust. This role is vital because, according to McKinsey, many companies will be approaching "data ubiquity" within the next five years. Not only will data be infused into systems, processes, channels, interactions, etc. but also in decision points that drive automated actions.

We also have the opportunity to embrace the superpower of predictive analytics and create a "live" data-driven consultancy by leveraging AI and machine learning. Imagine using the power of prediction to influence your business in key performance areas such as revenue, profit, cash flow and demand capacity modeling. It's like transforming the way you run your business from using a Rand McNally map to using a digital tool like Waze GPS.

Lastly, we can employ GenAI and other technologies to unlock "alpha" (a term investors use for obtaining returns above benchmark levels). According to McKinsey, data leaders need to have a clear focus on data strategies that can deliver a competitive advantage. For example, certain tools and strategies enable you to aggregate and anonymize client data, which can then be used to complement your current project service offerings as a subscription-monetized data product.

Some strategies to consider include:

- Customizing models using proprietary data
- Integrating data and AI with business systems
- Doubling down on high-value data products

The vast capacity for AI to shape the AEC firm of the future is why research initiatives like the ACEC Research Institute's quarterly Engineering Business Sentiment survey and BST Global's AI + Data Survey are so important. They're vital to gaining a deeper understanding of the potential benefits and barriers to AI in AEC. The resulting reports underscore the need to harness AI's potential while managing risk and bridging the digital skills gap and examine:

- Current AI adoption levels
- Strategic business implications of AI integration
- Different types of AI and their applications for AEC
- The critical role of data governance
- AI's far-reaching impact on the workforce

The insights shared in industry reports like the one you're about to read provide a perspective on the current state and future impact of AI and data advancements specific to the AEC industry.

> "Data is the key to unlocking the superpower within your organization. Your firm is literally sitting on a data gold mine ... The opportunity is in harnessing it, leveraging it and monetizing it."
>
> **— JAVIER A. BALDOR, CHIEF EXECUTIVE OFFICER, BST GLOBAL**

Executive Summary

Artificial Intelligence (AI) is fundamentally reshaping the engineering and design services industry. No longer confined to research labs or speculative forecasts, AI is now becoming embedded in the daily workflows of firms responsible for planning, designing, constructing, and maintaining the built environment. This report—developed by the ACEC Research Institute—traces the history of AI, examines how it is being used today, and looks ahead to the opportunities and challenges firms will face in the years to come.

A Historical Perspective

AI has a long history, from ancient philosophical ideas and early logic systems to the breakthroughs of the mid-20th century and the exponential growth driven by modern machine learning and deep learning. While much of AI's history is rooted in theoretical computer science and academic research, the engineering sector has long benefited from AI-adjacent technologies such as expert systems, computer-aided design (CAD), and predictive modeling. This historical context provides a useful lens for understanding how today's tools—particularly Narrow AI and Generative AI—fit into the broader evolution of intelligent systems.

AI in Engineering Today: Widespread but Uneven Adoption

While adoption is not yet universal, the research makes clear that AI is no longer in a pilot phase—it is being used strategically to deliver real value.

KEY FINDINGS INCLUDE:

AI is accelerating, not replacing, engineering talent. AI tools are enhancing employee productivity by offloading repetitive tasks, enabling faster knowledge access, and expanding the ability of junior engineers to contribute meaningfully. Senior engineers are increasingly using AI to focus on creativity, mentoring, and higher-order design thinking. AI is adding to the capacity for human talent.

AI is being used across both operations and technical disciplines. Common use cases include automated document search, AI-assisted proposal writing, code compliance review, generative design, infrastructure inspection, predictive maintenance, and design simulation.

AI policy and governance are emerging priorities. Many firms are developing internal frameworks to guide responsible use, including policies that address data protection, intellectual property, and ethical considerations, as well as addressing the risk and security of AI models. Several are appointing "AI champions" and forming internal committees to align AI use with business goals. ACEC has developed guidelines for firms to consider and will regularly update them. (https://www.acec.org/resource/guidelines-on-the-use-of-ai-by-design-professional-firms/)

Technology suppliers are shaping the ecosystem. While engineering firms are adopting and integrating tools, suppliers are building AI capabilities directly into design and analysis platforms. These partnerships are critical to scaling AI adoption across the industry.

AI program maturity varies widely. Regardless of firm size, some firms have formal strategies, governance structures, and implementation roadmaps, while others remain in an exploratory phase—running isolated pilots without a clear framework for scaling.

AI's Value to Firms

Participants shared numerous examples of how AI is delivering value across several dimensions:

Workforce Enablement

AI improves staff retention, engagement, and satisfaction by freeing engineers from repetitive tasks and creating opportunities for innovation and learning.

Client Differentiation

AI is helping firms win work by demonstrating enhanced capabilities, faster delivery, and new forms of value (e.g., predictive O&M costs, and automated compliance reports).

Design Innovation

Generative tools are expanding the range of design options teams can explore, particularly in early-phase planning and enabling rapid early-phase concept iteration.

Quality Enhancement

AI tools support higher-quality deliverables by identifying errors, inconsistencies, or code violations earlier in the process. From design simulations that flag structural issues to document review tools that ensure compliance and formatting accuracy, AI is helping firms reduce mistakes, enhance review cycles, and uphold technical standards.

Time Savings

AI reduces time spent on tasks such as formatting, document preparation, and knowledge retrieval—freeing up senior staff to focus on strategic or client-facing work.

Knowledge Management

AI-trained systems democratize access to institutional knowledge, creating a more level playing field for staff of varying experience levels. They can also speed up training cycles and close skills gaps.

The Road Ahead: Vision, Barriers, and Opportunities

What will AI look like in the next few years—and what do firms need to prepare for the future?

Vision for the Future: Firms anticipate AI evolving into a companion for engineers embedded in every design platform, capable of real-time simulation and optimization, and accessible to all levels of staff. This vision includes democratized design, dynamic project delivery, and deeper integration of AI into asset operations.

Barriers and Challenges: However, firms also face substantial obstacles to widespread adoption, including:

- Legal liability and ethical concerns about "black box" AI outputs.
- Business model misalignment (e.g., time-on-task billing vs. value-based pricing).
- Cultural resistance among senior staff, some highly specialized staff, and staff who are simply more set in their traditional ways of doing things.
- A lack of consistent standards, validation tools, and industry-wide frameworks.

Strategic Priorities: To overcome these challenges and realize AI's potential, firms must focus on:

- **People:** Investing in internal upskilling, AI fluency, and hybrid talent (e.g., data scientists and digital strategists).
- **Process:** Developing governance frameworks, pilot pathways, and risk mitigation strategies.
- **Partnerships:** Engaging with AI vendors, CAD software tool providers, peer firms, and professional associations to build shared learning ecosystems and common standards.

The engineering industry stands at a pivotal moment. AI is not merely a tool for optimization—it is a strategic capability that will reshape how firms define value, deliver services, and compete for talent and clients. The question is no longer whether to adopt AI but how to do so thoughtfully, ethically, and in alignment with the profession's core values. The firms that lead in this space will be those that treat AI as a long-term investment in people, innovation, and resilience. The firms that shape and embrace AI will have a competitive advantage.

It is also critical to recognize that creating new value for clients—value they are willing to pay for—at a rate faster than the efficiency gains enabled by AI tools will be essential to avoid the commoditization of engineering services. Firms must rethink not just how they do their work, but what they deliver. This shift requires reimagining service offerings to ensure they remain strategic, differentiated, and aligned with emerging client needs. The firms that succeed will be those who innovate on both the means and the ends of engineering work.

As highlighted in the ACEC Research Institute's *Firm of the Future* initiative, tomorrow's engineering firms will look and operate differently than they do today. AI will be a defining element of this transformation—reshaping how firms deliver value, organize teams, and engage with clients. From digital workflows to integrated data platforms and evolving business models, the firms that thrive will be those that embrace continuous reinvention.

> "AI doesn't replace engineers—it amplifies them. The future belongs to organizations that use AI to think bigger, not just move faster."
>
> **— NICOLAS MANGON, AUTODESK**

Part 1: The Evolution of Artificial Intelligence: From Concept to Reality

Artificial intelligence (AI) has rapidly evolved from a speculative concept to a pervasive technology, influencing many facets of modern life, including the field of engineering, where it is reshaping infrastructure planning, design, construction, and asset management. The first section of this report delves into the rich history of AI, exploring the key milestones that have shaped its development, the various types and subfields, and its broad range of applications today.

The Early Foundations of AI

PHILOSOPHICAL FOUNDATIONS

AI traces its philosophical roots back to ancient myths and legends where automata and mechanical beings were envisioned to perform human-like tasks. For example, in Greek mythology, Hephaestus, the god of fire, was said to have built mechanical servants. These early imaginings laid the groundwork for later philosophical inquiry into the nature of intelligence and the possibility of machines replicating ideas that would eventually influence how engineers design systems capable of autonomous decision-making in complex environments, such as smart infrastructure and automated construction.

Moving into the Enlightenment, philosophers like René Descartes and Thomas Hobbes explored the notion that human thought could be mechanized. Descartes famously posited that animals were mere automata—machines that could simulate behavior without conscious experience, suggesting that the mind itself might be subject to mechanistic explanation. In addition, Gottfried Wilhelm Leibniz's idea of a "universal language" for rational thought also hinted at the potential for mechanized reasoning.

MATHEMATICAL AND LOGICAL FOUNDATIONS

In the mid-19th century, George Boole developed Boolean algebra, a system of logic that laid the foundation for digital computing. Boole's work allowed for the representation of logical statements in a mathematical framework, enabling the future development of circuits and algorithms that could perform logical operations.

In 1936, Alan Turing introduced the concept of the Turing Machine, an abstract mathematical model that could simulate any algorithm's logic. Turing's 1950 paper, "Computing Machinery and Intelligence," further advanced the field by proposing the Turing Test, a criterion for determining whether a machine could exhibit intelligent behavior indistinguishable from that of a human.

ADVANCES IN COMPUTING POWER

The development of early computers, such as the ENIAC (Electronic Numerical Integrator and Computer) in the 1940s, marked a significant milestone in AI's history. These machines, though primitive by today's standards, could perform calculations at unprecedented speeds, enabling early experimentation with algorithmic models. In engineering, this capability laid the foundation for structural analysis software, traffic simulation, and computer-aided design (CAD) systems that are integral to modern engineering workflows.

John von Neumann's architecture for computers, which included a processing unit, a control unit, memory, and input/output mechanisms, became the blueprint for modern computing. This architecture allowed for the stored-program concept, where instructions and data could be stored in memory, enabling more flexible and complex computations.

INSTITUTIONAL SUPPORT AND FUNDING

After World War II, governments and institutions recognized the potential of AI and computing technologies. DARPA (Defense Advanced Research Projects Agency) in the United States played a crucial role in funding early AI research, particularly in areas that could have military applications.

Universities such as MIT and Stanford established dedicated AI research labs in the 1950s and 1960s, attracting top talent and fostering innovations that would drive the field forward. These labs became the breeding grounds for many of the key developments in AI during the latter half of the 20th century.

The First AI Program

THE LOGIC THEORIST (1956)

The Logic Theorist, developed by Allen Newell and Herbert A. Simon, is considered the first AI program. It was designed to prove theorems from Principia Mathematica by Bertrand Russell and Alfred North Whitehead. The program successfully proved 38 of the first 52 theorems, including one where it found a more elegant proof than the original authors.

The Logic Theorist demonstrated that machines could perform logical reasoning, a foundational element of intelligence. This success marked a major milestone in AI, showcasing the potential of symbolic reasoning and heuristics in problem-solving.

THE DARTMOUTH CONFERENCE (1956)

In the summer of 1956, a group of scientists, including John McCarthy, Marvin Minsky, Nathaniel Rochester, and Claude Shannon, organized the Dartmouth Conference, which brought together pioneers who would go on to shape the future of AI. This event is often cited as the official birth of AI as a field of study.

The discussions and collaborations that emerged from this meeting laid the groundwork for future AI research, focusing on areas such as symbolic reasoning, neural networks, and natural language processing. The conference proposed that “every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it.”

EARLY AI PROGRAMS

Following the Logic Theorist, Newell and Simon developed the General Problem Solver (GPS), a program designed to solve a wide range of problems by breaking them down into smaller, more manageable tasks. GPS was a significant step forward in AI because it introduced the concept of heuristics to guide problem-solving in complex domains—an approach later mirrored in engineering applications such as automated project scheduling, structural optimization, and geotechnical modeling.

Another early AI program was Arthur Samuel’s checkers-playing program, which was one of the first examples of machine learning. Samuel’s program improved its gameplay over time by analyzing its previous games, demonstrating the potential for machines to learn from experience.

Evolution of AI

EARLY OPTIMISM AND CHALLENGES (1950s-1970s)

The early years of AI were marked by significant optimism. Researchers believed that the creation of machines with human-like intelligence was just a matter of time. Early successes, such as the Logic Theorist and GPS, fueled this optimism. Below are examples of advances in the engineering industry:

Structural Analysis Software - SAP2000, introduced in 1975 by Computers and Structures Inc., was among the first to integrate complex structural analysis and design into an accessible software platform. Its capability to handle various structural forms and materials streamlined design processes and significantly influenced modern structural engineering.

Development of the SWMM Model - The Storm Water Management Model (SWMM), first developed by the U.S. Environmental Protection Agency in 1971, is a comprehensive computer model used for simulating rainfall-runoff processes and urban drainage systems. Its development marked a significant advancement in environmental engineering, enabling engineers to accurately assess, predict, and manage stormwater impacts on urban infrastructure, thus influencing sustainable urban planning and water management practices.

However, the field soon encountered significant challenges. The limitations of early computing power, coupled with the inherent complexity of human cognition, led to a series of setbacks. Declining enthusiasm due to the slow progress in achieving general AI led to periods of reduced funding in the 1970s and 1980s.

> "AI efficiency at this point is just helping us meet the demand that's out there. We're still struggling to find enough people, so it's not replacing anyone yet."
>
> — **GREG WOLTERSTORFF , V3 COMPANIES**

EXPERT SYSTEMS AND KNOWLEDGE ENGINEERING (1980s)

In the 1980s, AI research shifted focus towards expert systems, which were designed to mimic the decision-making abilities of a human expert in specific domains. MYCIN, an expert system for diagnosing bacterial infections and recommending treatments, is one of the most famous examples. Expert systems were widely adopted in industries such as healthcare, finance, and engineering, including engineering applications like bridge health diagnostics, groundwater modeling, and design compliance verification.

The success of expert systems led to a resurgence in AI research and investment. Companies began to see the practical applications of AI, leading to the commercialization of AI technologies. However, the limitations of expert systems, such as their reliance on extensive rule-based programming, eventually led to a decline in their use as more flexible machine-learning approaches emerged.

Examples of advances in the engineering industry are:

Early CAD Systems - The introduction of AutoCAD in 1982 was revolutionary, significantly improving drafting efficiency. AutoCAD allowed engineers to create detailed 2D and eventually 3D models digitally, drastically reducing manual drafting time and errors, thereby becoming an indispensable tool for engineers worldwide.

AI and Neural Networks in Engineering - The late 1980s and early 1990s saw early experimental integration of AI technologies, including neural networks, in engineering applications such as predictive maintenance, system identification, and fault diagnosis. Specific examples include early neural network models developed for predictive maintenance of rotating machinery and equipment by monitoring vibration patterns, AI systems used for fault detection in manufacturing processes by analyzing sensor data, and AI-driven system identification used to predict structural responses to environmental loads.

> "In collaboration with AI, engineers can now generate and analyze hundreds of design alternatives in just hours, what once took weeks or months to create without AI."
>
> — **MEHDI NOURBAKHSH, YEGATECH**

MACHINE LEARNING AND NEURAL NETWORKS (1990s-2000s)

The 1990s marked a significant shift in AI with the rise of machine learning, a subfield of AI focused on developing algorithms that could learn from and make predictions based on data. Unlike earlier AI approaches, which relied heavily on rule-based systems, machine learning emphasized data-driven approaches.

Neural networks, inspired by the human brain's structure, experienced a revival during this period. The development of the backpropagation algorithm, which allowed for more effective training of multi-layer networks, played a crucial role in this resurgence. Neural networks began to outperform traditional AI methods in tasks such as image recognition and natural language processing.

In addition to neural networks, statistical methods such as support vector machines (SVMs) gained prominence. These techniques were particularly effective in handling high dimensional data, making them well-suited for tasks like classification and regression— applications now found in engineering for detecting pavement distress, predicting traffic congestion, and evaluating material properties from sensor data.

BIG DATA AND DEEP LEARNING (2010s-PRESENT)

The advent of big data in the 2010s, driven by the exponential growth of data generated by the internet and digital devices, provided a new impetus for AI research. With vast amounts of data available for training, AI models became more accurate and powerful, leading to breakthroughs in various fields.

Deep learning, a subset of machine learning based on deep neural networks, became the dominant approach in AI research during this period. Deep learning models, such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs), achieved state-of-the-art performance in tasks like image recognition, speech recognition, and natural language processing.

One of the most publicized successes of deep learning was Google DeepMind's AlphaGo, which defeated the world champion Go player in 2016. This victory was significant because Go is a game with more possible moves than atoms in the universe, making it a formidable challenge for AI.

The most recent milestone was the public release of ChatGPT in November 2022, which brought the power of AI to the masses and renewed enthusiasm about the future uses of AI.

Types of AI

NARROW AI (WEAK AI)

Narrow AI, also known as Weak AI, refers to systems that are designed to perform specific tasks. These systems are highly specialized and excel at their designated functions, but they lack the general intelligence or flexibility to perform tasks outside of their programmed scope. Examples of narrow AI include the following:

Virtual Assistants: Siri, Alexa, and Google Assistant are prime examples of narrow AI. They can perform tasks such as setting reminders, answering questions, playing music, and controlling smart home devices, but they cannot perform functions beyond their programming.

Recommendation Systems: Platforms like Netflix and Amazon use narrow AI to recommend products or media based on user preferences and past behavior. These systems analyze user data to suggest items, but their capabilities are confined to this specific application.

Spam Filters: Email services use narrow AI to detect and filter out spam. These systems use algorithms to analyze email content and identify patterns indicative of spam, but they are specialized for this task.

ChatGPT: ChatGPT is an advanced example of narrow AI focused on natural language tasks. It is highly specialized and powerful in its domain but doesn't possess the broader capabilities of General AI, which would be able to learn and adapt to a wide variety of tasks independently.

Generative AI: Generative AI refers to AI systems that can create new content—such as text, images, music, or code—based on patterns learned from large datasets. While generative AI models are capable of producing highly realistic or creative outputs, they are still a form of narrow AI because they are limited to their specialized tasks of content generation. Generative AI models use machine learning, particularly deep learning techniques, to mimic patterns from data and generate novel outputs in response to user inputs.

In engineering, Generative AI is increasingly being used to create project narratives, draft technical documentation, generate code for automation scripts, and even design early-stage schematic layouts. Despite their advanced outputs, these models remain narrow AI systems—confined to specific content generation tasks based on training data.

GENERAL AI (STRONG AI)

General AI, also known as Strong AI or Artificial General Intelligence (AGI), refers to systems with the ability to understand, learn, and apply knowledge in a manner equivalent to human cognitive capabilities. AGI would be able to perform any intellectual task that a human can, with the flexibility and adaptability of human intelligence.

As of now, AGI remains a theoretical concept. While significant progress has been made in narrow AI, creating a system with the general intelligence and adaptability of a human is still beyond our reach. Research in AGI involves addressing complex questions related to consciousness, reasoning, and self-awareness.

Developing AGI poses numerous technical and philosophical challenges. These include ensuring that AGI systems align with human values and ethics, understanding the nature of consciousness, and preventing potential risks associated with highly intelligent machines.

SUPERINTELLIGENT AI

Superintelligent AI refers to hypothetical systems that surpass human intelligence in all aspects, including creativity, problem-solving, and emotional understanding. Such systems would be capable of outperforming the best human minds in every field, including scientific research, strategic planning, and social interaction.

The concept of superintelligent AI raises both exciting possibilities and significant risks. On the one hand, superintelligent AI could lead to unprecedented advancements in technology and knowledge. On the other hand, there are concerns about ensuring that such entities act in ways that are beneficial to humanity and avoid potential existential threats.

The development of superintelligent AI necessitates careful consideration of ethical and safety issues. Discussions around ensuring that AI aligns with human values, prevent misuse, and manages potential risks are ongoing among researchers, ethicists, and policymakers.

Subfields of Narrow AI

MACHINE LEARNING (ML)

Machine learning is a subfield of AI focused on developing algorithms that enable systems to learn from and make predictions or decisions based on data. It encompasses various techniques, including supervised learning, unsupervised learning, and reinforcement learning. Examples and applications include the following:

Supervised Learning: Involves training a model on labeled data to make predictions. Examples include image classification (e.g., identifying objects in photos) and sentiment analysis (e.g., determining the sentiment of a text).

Unsupervised Learning: Involves training a model on unlabeled data to find hidden patterns or structures. Examples include clustering (e.g., grouping similar customers for targeted marketing) and dimensionality reduction (e.g., simplifying data for visualization).

Reinforcement Learning: Involves training an agent to make decisions by rewarding desirable actions and penalizing undesirable ones. Examples include training AI agents to play games (e.g., AlphaGo) or control robotic systems.

NATURAL LANGUAGE PROCESSING (NLP)

NLP focuses on the interaction between computers and human language, enabling machines to understand, interpret, and generate natural language. It involves various techniques, including text analysis, machine translation, and speech recognition. Examples and applications include the following:

Machine Translation: Services like Google Translate use NLP to translate text between languages, making it easier to communicate across linguistic barriers.

Sentiment Analysis: NLP techniques analyze text to determine the sentiment expressed, which is useful for monitoring social media, customer feedback, and market research.

Chatbots and Virtual Assistants: NLP powers conversational agents that interact with users through text or voice, providing support, answering questions, and performing tasks.

ROBOTICS

Robotics involves designing, constructing, and operating robots—machines that can perform tasks autonomously or semi-autonomously. Robotics combines AI with mechanical engineering to create systems capable of physical interaction with the environment. Examples and applications include the following:

Industrial Robots: Used in manufacturing and assembly lines, industrial robots perform repetitive tasks such as welding, painting, and packaging with high precision and speed.

Service Robots: Includes robots designed for tasks such as cleaning (e.g., robotic vacuum cleaners) and assistance in healthcare settings (e.g., surgical robots).

Autonomous Vehicles: Self-driving cars and drones are examples of robotics integrated with AI to navigate and perform tasks without human intervention.

COMPUTER VISION

Computer vision focuses on enabling machines to interpret and understand visual information from the world, such as images and videos. It involves techniques like image processing, object detection, and image recognition. Examples and applications include the following:

Image Recognition: AI systems can identify objects, faces, or scenes in images. For example, facial recognition technology is used for security and user authentication. In engineering, image recognition may also support site documentation by classifying building elements or materials in field photos.

Object Detection: Computer vision algorithms detect and locate objects within an image or video. This capability is used in applications such as autonomous driving, construction site surveillance, and safety monitoring—e.g., identifying whether workers are wearing required safety gear.

Medical Imaging: AI systems analyze medical images (e.g., X-rays, MRIs) to assist in diagnosing diseases and conditions, improving accuracy and efficiency in healthcare. Similarly, engineering applications include analyzing non-destructive testing images (e.g., thermal imaging or ultrasonic scans) for defects in infrastructure.

Pattern Recognition: One of the foundational capabilities in computer vision, pattern recognition involves identifying recurring visual features or textures across large datasets. In engineering, this can be used for feature extraction from aerial images, automated crack detection in pavements or concrete, and material surface analysis in quality control. It enables faster, more consistent analysis compared to manual methods.

Uses of AI Today

AI has a variety of uses today across numerous industries, including significant applications in engineering. From infrastructure maintenance and construction management to transportation optimization and environmental monitoring, AI technologies are transforming how engineers plan, design, build, and manage the built environment. We will dive into these uses in more detail in the next section of the report. A few other examples particularly relevant to engineering are highlighted in this section.

AUTONOMOUS SYSTEMS

Self-Driving Cars: AI enables vehicles to navigate and operate autonomously, using sensors and machine learning algorithms to interpret the environment and make driving decisions. Companies like Waymo and Tesla are leading the development of autonomous driving technology.

Drones: AI-powered drones are used for various applications, including aerial photography, agriculture, and delivery services. Drones equipped with AI can perform tasks such as monitoring crop health and delivering packages to specific locations.

Robotics: AI-driven robots perform complex tasks in environments ranging from warehouses to outer space. For example, Boston Dynamics' robots are used for tasks such as material handling and exploration.

MANUFACTURING

Predictive Maintenance: AI systems predict equipment failures before they occur by analyzing data from sensors and machines. This approach reduces downtime and maintenance costs in industries such as automotive and aerospace.

Quality Control: AI-powered inspection systems identify defects and inconsistencies in manufactured products, improving quality and reducing waste. For example, AI is used in semiconductor manufacturing to detect defects in microchips.

Automation: AI-driven robots and automation systems enhance production efficiency by performing repetitive tasks with precision and speed. This includes automated assembly lines and material handling systems.

> "AI is a way to leverage our data and make better decisions in a quicker way—to produce more value for our customers in a more efficient and consistent manner."
>
> — **KURT BIALOBRESKI, HANSON**

FINANCE

Algorithmic Trading: AI-driven algorithms execute trades based on market data and trends, optimizing trading strategies and improving investment returns. Firms like Renaissance Technologies use AI to develop sophisticated trading models.

Fraud Detection: AI systems analyze transaction data to detect and prevent fraudulent activities. For example, banks use machine learning models to identify unusual patterns and flag potentially fraudulent transactions.

Credit Scoring: AI improves credit scoring by analyzing a wide range of financial data to assess creditworthiness more accurately. Companies like ZestFinance use AI to provide more inclusive and precise credit scoring models.

REFLECTIONS

Artificial intelligence has undergone a remarkable evolution from its theoretical roots to its status as a transformative technology. From the philosophical foundations and early programs to the rise of machine learning and deep learning, AI has progressed through various stages, each marked by significant achievements and challenges. The diverse applications of AI today—spanning finance, manufacturing, consumer services, and autonomous systems—demonstrate its profound impact on modern society.

As AI continues to advance, addressing ethical considerations and ensuring that its development aligns with human values will be crucial. The future of AI holds immense potential, with ongoing research and innovation poised to drive further breakthroughs and shape the next era of intelligent systems.

> "In two years, AI will be embedded in everything we do. The way we operate and price work will change. Much of our time will go into prompt engineering."
>
> — **RAJ ARORA, JENSEN HUGHES**

Part 2: AI in the Engineering and Design Services Industry Today

85%

believe AI is important to their firm's success

87%

feel AI will enhance their job performance and satisfaction

Artificial intelligence is no longer a future concept for engineering and design firms—it is already reshaping how organizations deliver projects, manage knowledge, and compete in the marketplace. While adoption levels vary, firms across the built environment are actively exploring AI to solve real-world problems, improve business outcomes, and add value for clients.

The BST Global AI + Data Survey of ACEC member firms reveals that 85 percent of firms believe AI is important to their firm's success. In addition, 87 percent of respondents feel that AI will enhance their job performance and satisfaction. This underscores the reasons firms are moving towards developing AI strategies and policies and ultimately utilizing AI tools.

Insights gathered come from leaders at a wide range of firms—spanning local consultants to global engineering and design firms—alongside technology providers developing AI tools for the AEC sector. Their perspectives reflect both cautious, incremental adoption and more disruptive, innovation-driven approaches.

Together, these insights reveal a clear shift: AI is moving from experimentation to integration. Engineering firms are building internal policies, piloting tools, and aligning AI initiatives with business and client needs. Meanwhile, suppliers are investing in platforms that will shape the future of design, compliance, and infrastructure delivery.

What follows is a look at how firms are crafting strategy, implementing governance, and applying AI to everything from client proposals to technical design—illustrating how AI is becoming embedded in the day-to-day work of engineering.

29%

of firms already have an AI strategy in place

34%

are in the process of developing an AI strategy

+11 POINTS IN ONE YEAR

32%

do not yet have an AI strategy

AI Strategy and Policies

Many engineering and design services firms are approaching artificial intelligence strategically, but not all are (yet). A recent survey by the ACEC Research Institute of firm leaders at ACEC member firms in January 2025 indicated that 29 percent of firms already have an AI strategy in place, and another one-third (34 percent) are in the process of developing one. This represents an increase of 11 percentage points in just one year; however, nearly one-third of firms (32 percent) do not yet have an AI strategy.

Among those firms who have or are developing AI strategies and policies, the focus is on creating governance structures, aligning AI with business objectives, and setting internal policies to guide adoption and responsible use.

AI USE POLICIES

Employee policy development is gaining traction. Organizations are drafting guidelines for using AI responsibly, including the protection of client data and the prevention of intellectual property leakage. Some have restricted public AI tool usage until enterprise-secure alternatives are in place. One firm created a proprietary AI chatbot trained only on internal documentation to avoid risk. Training programs, governance frameworks, and “AI champions” are becoming more common.

DIFFERENCES BETWEEN FIRMS AND SUPPLIERS

Firms are aiming to streamline internal operations and client deliverables. Suppliers are working to embed AI deeply in the platforms used across the industry, often in partnership with large software ecosystems.

On the supplier side, the strategy involves educating clients and embedding AI capabilities into existing design tools. They are thinking long-term: how to create tools that engineers will rely on five to 10 years from now.

Leading firms are developing structured methodologies to identify and prioritize AI use cases. These typically start with high-impact, low-risk opportunities—such as proposal generation, internal knowledge search, or compliance.

To ensure scalability, firms use pilot programs with clearly defined success metrics before expanding across business units. Several organizations referenced internal "AI steering committees" responsible for evaluating ROI, tracking adoption metrics, and aligning initiatives with firm-wide strategy. One firm developed an AI opportunity matrix, scoring potential projects based on business value, technical feasibility, and alignment with strategic goals. Firms also highlighted the use of KPIs such as time savings, proposal win rates, and project margin improvements to track the return on AI investments.

Across the board, organizational leaders recognize AI's disruptive potential, but strategic maturity varies. Some organizations are developing formal AI committees and strategic plans, while others are experimenting in isolated business units or geographies.

Finally, it is important to know that agencies are also creating policies that firms need to be aware of and maintain compliance with, such as disclosure statement requirements on projects and procurement on future projects.

Current Uses of AI

While some firms are fully embracing AI in all areas of their organization, the majority of firms are still in their infancy with AI use. In fact, the BST Global AI + Data Survey of ACEC member firms reveals that 57 percent of firms are at the first stage of AI maturity, which is called AI Experimenters, according to a maturity model developed by Accenture. Another 17 percent of firms are in the second stage, AI Builders. Only 18 describe their firm as an AI Innovator, the top maturity level.

57%

of firms are at the first stage of AI maturity, **AI Experimenters**

17%

are at the second stage, **AI Builders**

18%

describe their firm as an **AI Innovator**, the top maturity level

The survey also provides insight into the areas in which the firm is using AI. By far, the areas with the highest use of AI are marketing and sales (81 percent). This makes sense as this is a low-risk area within a firm. The second most used area for AI is project design and delivery, but at only 36 percent, showing firms are being much more cautious in this high-risk area. Other areas of use are project management (30 percent), human resources (28 percent), and corporate strategy and finance (26 percent).

The individuals who participated in our qualitative interviews are much more representative of more mature organizations. Below are ten of the most prevalent and innovative ways that these engineering and design firms are currently leveraging artificial intelligence. They fall into two main areas: operational versus engineering and design.

AREAS AI IS BEING USED

81%	36%	30%
Marketing and Sales	Project Design and Delivery	Project Management

OPERATIONS

- Organizations are leveraging AI-powered writing assistants to create proposals, RFP responses, and technical documents. These tools can automatically populate content based on project type, client history, and compliance needs, significantly reducing proposal cycle times and increasing win rates.
- Custom AI search tools are trained on internal documentation, project archives, and standards libraries. Staff can query these systems using natural language to quickly find precedent projects, technical specifications, or process guidelines, eliminating hours of manual digging. “We’re feeding our internal large language model, Chat VHB, with VHB-specific data so people can query insights like team experience across project types.” — Dave Mulholland, Chief Technology Officer, VHB
- Natural language chatbots trained on employee handbooks and firm-specific workflows provide instant answers to staff questions. This improves onboarding, ensures consistent knowledge distribution, and reduces reliance on HR project teams for routine support.

Beyond operational guidelines, leading firms are beginning to implement governance strategies for managing AI model risks. These include ensuring explainability—the ability to understand and trace how an AI system arrives at a decision—as well as actively addressing bias, inappropriate content generation, and hallucination (false or fabricated outputs).

> “Externally, we use AI to enhance various management tools and add value for clients—speeding up work, improving accuracy, and aligning closely with client needs.”
>
> — **NICK OTTO, KIMLEY-HORN**

ENGINEERING AND DESIGN

- Artificial intelligence is being used to generate initial design concepts for infrastructure such as roadways, solar farms, and utility layouts. These tools speed up the feasibility phase by producing base models that engineers can refine rather than build from scratch.
- By inputting zoning, environmental, and utility constraints, AI systems can generate and rank site layout alternatives for developments. This allows engineers and planners to explore multiple design options early in the project and select the most cost-effective and compliant solution.
- AI tools can read and interpret building codes or firm-specific standards and then apply those rules to digital drawings or models. They flag non-compliance issues and suggest corrections, reducing review cycles and enhancing quality control.
- AI-enhanced design platforms offer real-time calculations and impact analysis as engineers adjust variables. For example, changing materials or dimensions in a structural model immediately updates estimates for cost, sustainability, or compliance.
- Sensor data from buildings, bridges, and equipment is fed into AI models that predict failures or required maintenance. This allows clients to plan work proactively, reducing unexpected downtime and extending asset life cycles.
- Using dashcam or drone footage, AI models can identify signage, striping conditions, or traffic behaviors. This provides rich data for safety audits and traffic flow analysis without the need for traditional field studies.
- Artificial intelligence is used to analyze imagery and LiDAR data captured during bridge, roadway, or structural inspections. These models can identify surface anomalies and structural concerns and then generate reports with annotated images, reducing manual review time and increasing objectivity.

Some firms are applying model validation checkpoints and incorporating third-party tools to detect model drift over time, which occurs when an AI system's performance degrades due to changing inputs. Others are limiting the use of generative models to specific, controlled domains to mitigate reputational risk.

Artificial intelligence is actively transforming how engineering and design firms operate—not only in how they execute technical work, but also in how they manage knowledge, serve clients, and streamline internal processes. Across interviews, a wide array of use cases emerged, showing that artificial intelligence is not limited to one domain but is instead influencing the full project lifecycle.

Value of AI

AI delivers measurable value to engineering and design firms across multiple domains. This is one of the primary motivating factors for using AI. In fact, the BST Global AI + Data Survey of ACEC member firms shows that more than two-thirds of firms (68 percent) believe they can automate between 10 percent and 29 percent of current work tasks. If realized, this would have a monumental impact on productivity and allow workers to do more with the same amount of time. As a result, the survey shows that for three-fourths of firms (74 percent), AI will allow them to maintain current levels of staffing with additional output. Only nine percent of firms feel AI will lead to a decrease in their workforce.

Survey participants also indicated that the top expected benefit of AI is cost savings, as cited by 79 percent of respondents. Other top benefits include improved decision-making (72 percent), increased employee productivity (72 percent), and increased operational efficiencies (72 percent). The expected benefits of AI are quite extensive.

The insights from our interviews below illustrate how AI is enabling smarter workflows, enhancing project outcomes, and improving workforce efficiency and client engagement for many firms.

68%

of firms believe they can automate 10-29 percent of current work tasks

74%

believe AI will allow them to maintain current levels of staffing with additional output

9%

believe AI will lead to a decrease in their workforce

TOP EXPECTED BENEFITS OF AI

79%

of firms cited cost savings as the top benefit

72%

also cited

- improved decision-making
- increased employee productivity
- increased operation efficiencies

Workforce Enablement: Artificial intelligence is far from replacing employees; it is enhancing the productivity and satisfaction of staff. Engineers appreciate having repetitive tasks offloaded so they can focus on design challenges and mentoring. The real opportunity lies in automating the boring and redundant and freeing people to do the creative, strategic work that they're best at doing.

When it comes to workforce, the BST Global AI + Data Survey of ACEC member firms reveals firms are more likely to cultivate AI knowledge from within their organization than to hire experienced professionals with AI skills. Perhaps this is due to the fact that there are so few experienced AI professionals.

Client Differentiation: Artificial intelligence is becoming a strategic differentiator in competitive pursuits. Firms that can show AI-enhanced deliverables—such as predictive risk models, 3D visualizations, or automated compliance checks—are gaining a reputational edge and competitive advantage. In one case, a firm won a major municipal contract specifically because its pitch included automated long-term O&M cost forecasts enabled by AI.

Knowledge Access: Organizations are using AI to break down silos. By training AI models on internal project archives, organizations are democratizing access to institutional knowledge. This is especially helpful for onboarding new team members or when navigating multidisciplinary projects.

Design Innovation: Artificial intelligence facilitates exploration. Generative tools can produce multiple versions of a design based on performance criteria, allowing project teams to evaluate and compare options that might have been overlooked due to time or resource constraints. For example, engineers are using AI to optimize wind turbine spacing, solar layouts, and stormwater management basins in a way that meets both regulatory and sustainability goals. Firms are looking at AI not just for internal efficiencies, but also to build digital products that complement the design services they can offer clients.s.

Time Savings and Efficiency: Nearly all participants emphasized that artificial intelligence is a time multiplier. Tasks that once took hours—such as formatting proposals, drafting specifications, or reviewing legacy project data—can now be completed in minutes. This frees up senior staff to focus on mentoring, client engagement, and complex design work.

Part 3: The Future of AI

The future of AI is now. According to the BST Global AI + Data Survey of ACEC member firms, nine out of 10 firms believe AI will transform the business model of the industry and their firms, and most of the respondents believe it will happen in the next three to five years. In addition, according to the January 2025 ACEC Research Institute data, three-fourths (78 percent) of firms believe that AI will have a positive impact on their firm in the coming year, up 15 points from 2024. Expectations are certainly running high, but the reality may be quite different. Those interviewed for this report were much more circumspect when it came to predicting the future.

> "We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten."
>
> **– BILL GATES, FOUNDER, MICROSOFT**

In many senses, the past, present, and future of AI are all happening at the same time. For the typical firm utilizing AI, it has only been developing and using AI for a few years, and those projects are only now coming to fruition. The future will mean further refinement of those projects and extending those capabilities incrementally further. At least in the AEC sector, AI can be rather slow and unglamorous, a far cry from what we have seen on television shows like *The Jetsons* and *Futurama*.

That said, we are seeing a vision for AI taking shape—as well as the barriers that may emerge as AI expands into ever greater roles within the AEC sector.

Vision for AI

Looking forward, interviewees consistently described a vision in which AI is not just a tool but a collaborative agent. Interviewees highlighted several ways in which the anticipated developments in AI will shape their practices—from embedded intelligence to real-time design simulation.

DEMOCRATIZED ACCESS

AI will lower the barrier for junior engineers to take on complex tasks. Firms will be able to tap into the knowledge of every staff member, not just those with decades of experience.

REAL-TIME SIMULATION

AI will support what-if analysis, risk mitigation, and performance prediction as engineers work—transforming design from static to dynamic. This helps not only design but also operations and maintenance forecasting.

COMPANION MODEL

Interviewees envision a future where AI acts as a design partner— embedded in every tool. For example, an engineer could sketch a bridge, and AI will do load analysis in real-time.

The future of AI is expected to revolve around co-creation, embedded intelligence, and real-time insight. Several leaders emphasized that AI is not only changing how work is done—it will transform the business model of engineering firms. However, unlike industries such as automotive or media, the timeline may be longer due to regulatory, contractual, and cultural constraints.

Interviewees expect this transformation to unfold incrementally over the next five to 10 years, aligning with shifts in client expectations, procurement practices, and liability frameworks. Drawing parallels to the automotive industry—where software-enabled services are projected to account for over 50 percent of revenue by 2035—engineering firms may similarly move toward digital service layers, including design automation subscriptions, predictive maintenance platforms, and AI-powered decision support. AI is not just enabling efficiency—it is accelerating time to market for innovation.

Looking further ahead, several participants described a future in which orchestrated automation spans not just internal workflows but also cross-organizational platforms. In this model, engineering firms, clients, contractors, and regulators collaborate on shared digital environments—where designs, approvals, and project data flow securely and in real-time. AI agents could coordinate tasks across systems and stakeholders, reducing friction in multi-party project delivery. While still aspirational, this model hints at a future where AI doesn't just enhance individual firm performance but reshapes the architecture of the entire project ecosystem.

Barriers and Concerns

Despite broad enthusiasm for AI's potential, significant challenges remain. Pressing concerns—technical, organizational, and ethical—remain that firms must navigate to ensure responsible and sustainable adoption. According to the BST Global AI + Data Survey of ACEC member firms, the biggest challenge cited by firms in launching AI initiatives is identifying the use cases with the greatest business value. The most prevalent use cases among those we interviewed are listed in the previous section. In addition, the biggest challenge in scaling the use of AI is choosing the right AI technologies to achieve the desired objectives. Clearly, firms have a long way to go.

Other barriers and concerns cited by interviewees are as follows: :

LEGAL AND ETHICAL RISKS

Who is responsible when AI gets it wrong? Interviewees emphasized the importance of transparency and auditability. Many organizations will not accept black box outputs for design-critical decisions.

BUSINESS MODEL MISALIGNMENT

Firms still billing hourly fear lost revenue if AI reduces time-on-task. This is prompting movement toward value-based billing, lump sum contracting, outcome guarantees, or subscription models for consulting services.

CULTURAL RESISTANCE

There remains skepticism among seasoned professionals. "We've done it this way for 40 years—why change now?" is a common refrain. Organizations are using internal champions and proof-of-concept wins to overcome this barrier.

INTEROPERABILITY

This remains a major concern, especially for firms with extensive legacy systems. Integrating AI into existing infrastructure often requires bridging gaps between outdated platforms and modern tools. For example, many firms struggle to harmonize Enterprise File Management systems, collaboration platforms, and internal knowledge hubs with newer AI applications. These disconnects can create bottlenecks, prevent seamless data sharing, and limit the usefulness of AI tools trained on fragmented or siloed information.

STANDARDIZATION

Without consistent industry-wide frameworks for training data, model validation, or performance metrics, firms must develop their own practices—often duplicating effort or operating with uncertainty. Several interviewees expressed the need for shared benchmarks and validation protocols, particularly for models used in safety-critical or regulatory-sensitive applications.

CYBER SECURITY

As AI tools increasingly interact with sensitive engineering data—including client deliverables, project financials, and proprietary models—firms are elevating their security posture. Real-world examples shared during interviews include the use of AI-enabled monitoring tools to detect anomalies in user behavior, identify threats in real-time, and prevent unauthorized access to confidential data. At the same time, firms are rethinking user permissions management and enterprise-wide data governance. In an AI-driven environment, protecting not just the data but how it is used, accessed, and interpreted becomes vital to preserving trust, ensuring compliance, and preventing inadvertent disclosure.

Interviewees voiced consistent concerns about implementation risks, ethical considerations, and the need for validation.

Needs and Opportunities

To move from experimentation to meaningful transformation, both firms and suppliers highlighted the need for investment in three core areas: people, processes, and partnerships. This transition requires more than access to tools; it demands cultural readiness, organizational leadership commitment, and shared learning frameworks. Suppliers are guiding firms through this process, but it is important to remember that this is a slow process and one that, for many firms, is only in its beginning stages.

PEOPLE

Organizations are increasingly focused on building AI fluency across their workforce. This includes offering formal training on prompt engineering, data literacy, and ethical AI use. Firms cannot afford to wait for the perfect AI hire to come along. Instead, organizations are promoting internal upskilling and designating 'AI champions' in each department to lead by example.

Beyond technical roles, many organizations are also bringing non-engineering talent into the fold, such as data scientists, digital strategists, and product managers, to accelerate AI adoption. These hybrid roles are bridging the gap between traditional project teams and emerging AI-enabled workflows.

PROCESS

Governance remains a high priority. Multiple interviewees referenced the need for firm-level playbooks that outline approved tools, responsible use guidelines, and risk mitigation strategies. These documents serve as a foundation for consistent implementation, especially across multi-office or multidisciplinary environments.

Organizations are also formalizing pilot processes to test new AI applications before scaling. They are developing safe sandboxes as ways to fail without consequences. One firm developed a three-phase innovation framework to move from exploration to enterprise-wide deployment.

PARTNERSHIPS

Suppliers and member firms alike emphasized the importance of external collaboration. Strategic partnerships with AI vendors, engineering software tool providers, academic institutions, and peer organizations create new opportunities for co-development and shared insights.

Several participants expressed interest in more industry-wide initiatives like, for example, a consortium approach to AI standards. These alliances could address shared concerns such as liability, data ownership, and model validation.

> "We want to move from just consulting dollars for hours into actually selling services, using AI and other technologies to deliver solutions that clients will pay for."
>
> **— MICHAEL MARTEL, PARAMETRIX**

Part 4: Conclusion

78%

of firms believe that AI will have a positive impact on their firm in the coming year

+15 POINTS IN ONE YEAR

Artificial intelligence has shifted from being a theoretical innovation to a practical and transformative force in the engineering and design services industry. The insights gathered through this research reveal a sector in the midst of meaningful transition—where curiosity, experimentation, and strategic planning are converging to reshape how organizations operate, deliver value, and stay competitive.

Based on the January 2025 Engineering Business Sentiment survey, three-fourths (78 percent) of firms believe that AI will have a positive impact on their firm in the coming year, up 15 points from 2024.

Across both firms and suppliers, there is a clear recognition that artificial intelligence is not simply a tool to automate existing tasks. Rather, it is a catalyst for cultural and business model evolution. Organizations are beginning to reimagine roles, redefine processes, and recalibrate how they measure performance and deliver service. Those who lead in this space are not just adopting AI—they are embedding it into their DNA.

What sets the most forward-thinking organizations apart is not the breadth of their AI investments, but the clarity of their vision and ability to execute quickly. These organizations understand that true transformation comes from aligning technology with human insight. They are investing in workforce development, instituting governance frameworks, and setting ethical guardrails to ensure AI serves their people, clients, and communities responsibly.

> “AI helps us automate the grunt work so we can focus on trusted advisor-level value. It’s not taking jobs—it’s assisting them.”
>
> **— KEITH HORN, POWER ENGINEERS**

While concerns about liability, transparency, and data security remain valid, they are not insurmountable. Firms that address these challenges with transparency and collaboration are laying the groundwork for long-term trust and innovation. The industry is poised not just to overcome these barriers but also to lead in establishing best practices that can serve as models for other sectors.

In short, the engineering and design services industry stands at a turning point. The choice is not whether to adopt AI, but how to do so thoughtfully and strategically, and in a manner that both recognizes the need to move quickly but with caution, as is the hallmark of the engineering profession. Those who act with intention—balancing ambition with accountability—will define the next generation of infrastructure, sustainability, and innovation.

> “Nothing is permanent except change.”
>
> **— HERACLITUS, GREEK PHILOSOPHER**

Methodology

The historical information contained in this report was synthesized following a literature review of various background resources regarding the evolution of AI. The remainder of the report is informed by qualitative insights gathered through in-depth interviews with leaders across the engineering and design services industry. Nineteen interviews were conducted with professionals representing a wide spectrum of organizations, from small and mid-sized firms to large global organizations, as well as technology suppliers developing AI tools for the AEC sector.

Participants held titles such as Chief Technology Officer, Chief Innovation Officer, Chief Information Officer, and Head of AI Strategy. Their organizations varied in size, geography, and AI maturity, offering perspectives that ranged from early experimentation to enterprise-wide adoption.

These interviews were designed to explore how AI is being used today, the value it provides, the barriers to adoption, and the vision for future integration. Responses were synthesized to identify common themes, unique insights, and practical examples of AI in use in the firm and across the project lifecycle.

The findings are organized into four sections:

1. **The Evolution of AI –** A brief history of AI development and its core subfields.
2. **AI in the Industry Today –** Insights on strategy, governance, and ten leading use cases across operations and engineering.
3. **The Future of AI –** Emerging trends, potential barriers, and opportunities for transformation.
4. **Conclusion –** Key takeaways for firms aiming to embed AI into their long-term strategy.

All participant quotes have been anonymized or attributed with permission. The intent of this research is not to predict the future but to capture the current state of AI adoption in engineering and provide guidance for organizations navigating this rapidly changing landscape.

In addition to the qualitative interviews, data from two recent surveys is included in this report. The first is the ACEC Research Institute's quarterly Engineering Business Sentiment survey of 644 firm leaders at ACEC member firms conducted in January 2025, and the second is the AI + Data Insights 2025: Global AEC Industry Report, based on a survey conducted by BST Global in the first quarter of 2025. Data cited in this report is based ONLY on the 47 ACEC member firms included in the BST Global survey.

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