Generative Artificial Intelligence Transforming Industries

Meriem "Mary" Hamzi, Ebube "Obie" Ezeobi, Mohit Jain, Sarah M. North
Computer Science Department, College of Computing and Software Engineering
Kennesaw State University, Kennesaw GA, USA

Max M. North
Information Systems & Security Department, Coles College of Business
Kennesaw State University, Kennesaw GA, USA

David Garofalo
Physics Department, College of Science & Mathematics,
Kennesaw State University, Kennesaw GA, USA

[Abstract] Generative artificial intelligence (AI) has emerged as one of the most consequential technological developments of the twenty-first century, fundamentally reshaping how organizations innovate, operate, and collaborate with intelligent systems. This paper examines the transformative role of generative AI across a broad range of industries, including healthcare, finance, marketing, education, energy, manufacturing, media, and professional services. Drawing on scholarly literature and industry reports, the study highlights how generative models support creativity, automate complex workflows, and enable new forms of human–machine collaboration in applications such as drug discovery, fraud detection, personalized learning, and smart manufacturing. In parallel, the paper addresses critical ethical and socioeconomic considerations, including workforce adaptation, intellectual property, governance, and algorithmic bias. Overall, generative AI is presented not merely as a productivity tool, but as a foundational force driving industrial evolution and blurring traditional boundaries between data, creativity, and intelligence.

[Keywords] generative artificial intelligence, digital transformation, human–ai collaboration, ethical ai, productivity and innovation

Introduction to Generative Artificial Intelligence

Artificial Intelligence as a field, dates back to the mid-1950s, when researchers such as John McCarthy and Alan Turing envisioned machines capable of reasoning and learning. Early efforts focused on what we call symbolic AI, systems that followed explicit rules rather than learning from data. However, limited computing power and narrow data availability kept progress slow for several decades. That changed in the 1980s, when we finally experienced the rise of expert systems, which mimicked human decision-making in specialized domains but struggled to scale.

A true resurgence began in the 2010s, driven by the explosion of data, affordable CPUs, GPUs, and the success of deep learning. In 2014, Generative Adversarial Networks (GANs) introduced by Ian Goodfellow and colleagues made it possible for computers to generate realistic images, sounds, and videos (Goodfellow et al., 2014). That same year, Variational Autoencoders (VAEs) provided a probabilistic approach to generative modeling (Kingma & Welling, 2014). The next major leap came in 2017, when Transformer architectures were introduced (Vaswani et al.,

2017), forming the foundation for today's large-scale models such as OpenAI's GPT and Google's Gemini.

Generative AI as we know today became widely recognized after 2022, when publicly available systems like ChatGPT and Stable Diffusion demonstrated the creative and linguistic power of these models to the public. Since then, its growth has been exponential. By 2024–2025, enterprise adoption had surged across sectors, from healthcare and education to finance and energy, making generative AI one of the fastest-diffusing technologies in modern history (McKinsey & Company, 2024; Stanford University, 2025).

At its core, generative AI operates through probabilistic modeling, using techniques such as Generative Adversarial Networks (Goodfellow et al., 2014), Variational Autoencoders (Kingma & Welling, 2014), and Transformer-based architectures like GPT and Gemini (Vaswani et al., 2017; Stanford University, 2025). These systems do not just mimic data; they simulate creative processes we once thought were unique to humans.

Based on the cross-industry analysis presented in this article, the following core research questions naturally emerge:

- Under what conditions does generative AI truly enhance performance, and when might it unintentionally slow down or complicate expert-level work?
- How can organizations design governance and oversight structures that allow generative AI to scale responsibly while managing risks such as bias, hallucination, and regulatory sensitivity?
- In what ways does generative AI reshape the relationship between human expertise and intelligent systems across different industries and regulatory environments?

Applications of Generative AI Across Selected Domains

This section offers a concise overview of how generative artificial intelligence is shaping a diverse set of industries. It explores applications across sectors such as healthcare and life sciences, finance and banking, marketing and advertising, media and entertainment, manufacturing and high-technology, automotive systems, energy and environmental services, legal and professional services, education, and hospitality and customer service. By moving beyond a single industry focus, the discussion identifies common trends in innovation, productivity, and human–AI collaboration, while also recognizing the unique challenges and ethical considerations each sector faces. Taken together, these perspectives demonstrate the wide-ranging and complex influence of generative AI on contemporary organizations and society.

Healthcare and Life Sciences

Generative AI is accelerating its impact on healthcare across three fonts: clinical/operational documentation, R&D and clinical development, and diagnostic imaging. At the system level, recent analyses show providers and payers moving from pilots to full-scale deployments in tasks like clinical note generation, coding, and patient-engagement workflows, as it significantly reduces time, allowing providers to focus more on their patients (McKinsey & Company, 2025).

In pharmaceutical research and development, the Harvard Business Review highlights that drug development strategy is shifting alongside new therapeutic modalities and platform capabilities. That is, companies must redesign their operating models and change how they are structured and how work gets done day-to-day, from making place for new roles like data scientists and engineers, new partnerships like AI vendors, or evidence-generation processes to collect the data necessary to take advantage of advanced tools such as generative AI across discovery, trial

design, and medical writing (Vadas, Holder, & Siebert, 2024).

Finally, in the medical field, specifically in diagnostics and imaging, Nature Medicine reports that gen AI is improving medical diagnostics in two major ways: first, some large AI models can synthesize medical images, such as X-rays, to augment scarce datasets due to cost or the rarity of some diseases. Diagnostic models will be able to train on these expanded datasets which will measurably boost downstream diagnostic performance across ophthalmology, chest, brain, and breast tasks ("average gains 12-17% across tasks" in their evaluations) and second, diffusion-based generators can make diagnostic predictions more equitable and fair across patient groups when applied to new or different patient populations by creating group-specific synthetic samples (Wang et al., 2024; Ktena, Wiles, & Gowal, 2024). This makes generative AI an important instrument for higher operational efficiency, scientific acceleration, and diagnostic improvement, marking a significant step toward a more intelligent and patient-centered healthcare system.

Finance and Banking

For our second industry, we turn our attention to finance and banking, a sector where generative AI is beginning to reshape core operations, risk management, and customer interaction. As with healthcare, much of the early impact comes from automating time-consuming documentation and analysis. Banks and financial institutions are now using generative models to support regulatory filing, credit analysis, and risk reporting, many other critical tasks that traditionally required large teams to interpret data, write summaries, and prepare oversight materials (Bank for International Settlements, 2024). These tools help analysts process complex datasets more efficiently while enabling institutions to maintain compliance in an environment of increasingly complex regulations.

Beyond back-office processes, generative AI is transforming fraud detection and financial crime prevention. According to Deloitte, modern AI systems can analyze millions of transactions, detect subtle anomalies, and generate narrative explanations that assist investigators during suspicious activity reviews (Deloitte, 2024). This blend of pattern recognition and automated reporting mirrors the kind of recursive analysis seen in human investigative work, but at a far greater speed and scale.

Next, customer-facing operations are evolving as well. McKinsey reports that banks are adopting generative AI to produce personalized financial insights, draft wealth-management summaries, and power conversational assistants that support clients with everyday banking needs (McKinsey & Company, 2024). These systems can explain investment trends, summarize account history, or outline loan options in a language understandable to non-experts. As a result, customer service is becoming more adaptive, more responsive, and increasingly tailored to individual financial goals.

Together, these developments show how generative AI is beginning to modernize financial workflows from the inside out, strengthening compliance, accelerating analysis, and improving client engagement. Yet, as noted by global financial authorities, this transformation also brings new challenges, including the risk of model hallucinations, data leakage, and adversarial misuse. As adoption continues to expand, strong governance and human oversight will remain essential to ensure that generative AI enhances financial services without compromising stability (Bank for International Settlements, 2024).

Marketing and Advertising

Let us now explore marketing and advertising, where generative AI is reshaping creative

workflows, personalization, and strategic insight generation in ways previously unimaginable. According to a 2023 McKinsey report, marketing teams can now launch campaigns in weeks rather than months by using gen AI to quickly create personalized text, images, and ads for large audiences. (Harkness, Robinson, & Stein, 2023). Marketing teams are actively using AI tools to automate content generation, divide audiences at highly granular levels into very small and specific groups, and free creative teams from repetitive tasks to focus on higher-level brand strategy (Hayes & Downie, 2024).

Generative AI today produces custom visual assets, drafts hundreds of ad variations, and analyzes unstructured consumer feedback to find emerging trends. For example, IBM reports that 67% of CMOs plan to implement generative AI within 12 months and 86% within 24 months, underlining the momentum behind this shift (Hayes & Downie, 2024). Meanwhile, McKinsey highlights how generative AI supports hyper-personalization: one retailer moved from personalizing 20% of its email campaigns to 95%, lifting click-through by 41% and reducing deployment costs by 25% (Harkness et al., 2023).

In sum, for marketing and advertising, generative AI is no longer a novelty but a core driver of creative scale, rapid experimentation, and individualized engagement. As organizations move from early pilots to integrated workflows, the function is shifting from "make the ad" to "curate the experience" and that marks a meaningful evolution in how brands connect with consumers.

Media and Entertainment

For our fourth industry, we shift into the world of media and entertainment, a sector undergoing one of its most visible and publicly debated transformations due to generative AI. Unlike other domains where AI operates mostly behind the scenes, here its presence is felt across the entire creative pipeline, from brainstorming and production to audience engagement and distribution. According to the World Economic Forum, generative AI enables media organizations to automate editing, localize content for global audiences, synthesize visual and audio assets, and even assist with real-time personalization of live broadcasts (World Economic Forum, 2025). These tools help creators iterate faster, experiment with new formats, and reach more diverse markets without the heavy operational overhead that was once required.

As a result, we now see generative AI being adopted across the broader technology-media-telecommunications (TMT) landscape to accelerate production cycles, enhance VFX workflows, and support scripting and pre-visualization through rapid content generation (McKinsey & Company, 2024). For example, studios now use AI-assisted storyboarding, automated B-roll creation, and voice synthesis to streamline early-stage production activities. These capabilities allow both large studios and smaller creators to reduce costs and shorten timelines, factors that historically define competitive advantage in the entertainment industry.

At the same time, gen AI is influencing the business side of entertainment. Companies are now adopting AI-driven audience insights to forecast demand, tailor marketing strategies, and optimize release schedules (Morgan Stanley, 2024). This includes analyzing trailers, viewer sentiment, and market trends to guide decisions about casting, distribution, and promotional campaigns. As a result, the boundary between creative development and data-driven decision-making is becoming increasingly integrated, allowing content producers to align storytelling choices with emerging audience preferences.

However, this rapid integration of generative AI also raises new concerns. Key challenges include potential displacement of creative labor, intellectual property ambiguity when AI models draw from large datasets, and the risk of deep fakes or synthetically altered media undermining

trust. Now more than ever, there is a need for clear governance frameworks, transparent model use, and human oversight to ensure that generative AI supports creativity rather than weakening or potentially undermining it (World Economic Forum, 2025; Morgan Stanley, 2024).

Thus, the media and entertainment sector illustrate both the immense creative promise and the ethical complexity of generative AI. As tools become more sophisticated and more deeply embedded into production pipelines, the industry is moving toward a hybrid model, one in which human creativity remains central, but is increasingly amplified by computational intelligence.

Manufacturing and High Technology

In the industrial domain, gen AI is emerging as a catalyst for faster design cycles, smarter factories, and more adaptive high-tech systems. Manufacturers, in particular, are beginning to view gen AI not as a peripheral experiment but as a core enabler of operational efficiency and research and development productivity. Early adopters are using generative models to optimize their designs, improve quality inspection, and streamline complex engineering workflows, ultimately reducing time-to-market for new products (McKinsey & Company, 2024). It also assists engineers by generating component variations, simulating performance under different constraints, and identifying failure risks before physical prototypes are built.

Just like all the fields we have covered so far, Industrial and high-tech organizations are also gradually scaling generative AI beyond isolated pilots. One of the most promising applications lies in combining generative models with digital twins; virtual representations that mirror the behavior of factories, machines, and entire supply chains. When paired with generative simulations, these twins allow teams to test new process configurations, optimize production lines, and evaluate performance scenarios without interrupting real-world operations (Boston Consulting Group, 2024). In software-heavy parts of the high-tech sector, generative AI is also supporting code generation, hardware-software integration, and rapid configuration of embedded systems, strengthening the link between digital development and physical manufacturing.

International Business Machines (IBM) highlights how generative AI is reshaping day-to-day operations as well. Manufacturers are deploying AI-based visual inspection systems that detect surface defects and flag anomalies in real time, capabilities that reduce scrap and improve consistency (IBM, 2024). Supply chain teams are using generative models to analyze vendor data, forecast inventory needs, and generate mitigation plans for disruptions. Meanwhile, maintenance teams are benefiting from AI-generated diagnostics, which interpret sensor data and suggest repair strategies long before equipment failure occurs.

These developments show us how gen AI is helping manufacturers move toward more resilient, efficient, and digitally integrated production systems. Technology not only accelerates innovation at the design and engineering level but also strengthens operations across quality control, supply chain management, and predictive maintenance. As adoption continues to scale, generative AI is positioned to become a foundational layer for modern manufacturing, one that blends advanced computation with human expertise to enable smarter, faster, and more adaptive industrial ecosystems.

Automotive

Next, in the automotive sector, generative AI is emerging as a powerful catalyst for innovation, particularly as industry shifts from mechanical engineering to software-defined vehicles. Auto manufacturers are increasingly adopting generative models to accelerate software development, streamline code generation, and support complex functions such as autonomous-driving systems

and in-vehicle user experiences (McKinsey & Company, 2024). These tools allow engineering teams to simulate driving conditions, generate alternative design architectures, and test system behaviors virtually, significantly reducing development cycles that once required extensive manual coding and physical validation.

Today, generative AI and related digital technologies are expected to drive major transformations in automotive operations, with organizations projecting productivity gains of up to 30% as workflows are reshaped by 2030 (Bain & Company, 2025). This includes improvements in manufacturing scheduling, supply-chain coordination, predictive maintenance, and customer-facing services such as personalized vehicle recommendations and digital retailing tools. Gen AI assists in these areas by synthesizing data from vehicles, sensors, and production systems to generate actionable insights and guide better operational decisions.

IBM adds that generative AI is also driving advancements on the factory floor, where AI-enabled diagnostics, automated quality inspection, and real-time monitoring help manufacturers detect issues earlier and reduce downtime (IBM, 2024). By integrating generative models with connected-vehicle data and IoT systems, automotive companies can create predictive models that anticipate failures, optimize repair processes, and personalize maintenance schedules for drivers.

Overall, generative AI is strengthening every layer of the automotive value chain from engineering and production to customer engagement and long-term vehicle management. The industry's rapid digital evolution underscores how computational intelligence is becoming as essential as traditional engineering, enabling automakers to innovate at a faster pace while maintaining the precision and reliability required in this highly regulated field.

Energy and Environmental Services

In energy and environmental services, gen AI is helping organizations become more sustainable by improving planning, operations, and emissions reduction. The World Economic Forum underscores that AI systems can now model complex environmental dynamics, from ecosystem change to resource depletion, and assist companies and governments in designing proactive response strategies (World Economic Forum, 2018) so as a result, it enables organizations to anticipate environmental risks and evaluate intervention strategies before real-world impacts occur, and thus protecting ecosystems, infrastructure, and human lives.

At the building-and-infrastructure level, it helps reduce emissions by creating tailored upgrade plans for existing buildings, simulating energy flows, and forecasting performance under varying climate scenarios, all while delivering profitable margins (Boland et al., 2023). Meanwhile, the Deloitte dossier points to major opportunities in the energy-resources-industrial segment: gen AI is helping balance power grids, predict equipment failures, and design renewable energy systems, even though many organizations still struggle with limited data and workforce readiness (Mittal and Saif, 2025).

Together, these insights show that generative AI is not simply enhancing operational efficiency in energy and environment; it is becoming a strategic tool for aligning industry with climate, resilience, and sustainability goals. By combining simulation, optimization, and intelligence at scale, generative AI enables stakeholders to plan for transition scenarios, reduce carbon footprints, and ensure that real-world assets keep up with digital change.

Legal and Professional Services

The impact of gen AI is not just limited to manufacturing and entertainment, legal and professional services are also undergoing a quiet but profound transformation thanks to it, as advisory firms,

law firms, and consulting practices integrate generative models into their workflows. According to the 2024 report from Thomson Reuters, professionals are deploying generative AI across contract drafting and review, e-discovery, regulatory filings, and even client matter summarization, where models generate first drafts, extract risk clauses, and create consistent outputs that human practitioners then refine (Warren et al., 2024). These applications are helping firms scale expertise, reduce routine work, and respond to evolving regulatory demands more effectively.

From a legal innovation perspective, the American Bar Association emphasizes both the promise and the caution of this transformation. Generative AI offers improved access to legal services through document automation and virtual legal assistants, but also carries risks, especially around confidentiality, model bias, and the duty of competence that lawyers owe their clients (Clio, 2024). This duality is forcing firms to rethink not just workflows, but ethical frameworks, verification practices, and governance mechanisms as AI becomes part of their practice.

In consulting, generative AI is changing how professionals work with clients by handling routine tasks such as creating slides, running scenario analyses, and building early solution prototypes. This allows consultants to spend more time on strategy and client relationships (Garg, 2023). As generative tools take on more of the "first draft" labor, professionals are increasingly stepping into editorial roles shaping, verifying, and adding value to AI-generated insights.

Thus, generative AI is expanding professional capacity and redefining work in the legal and consulting sectors, not by replacing human judgment, but by amplifying it. The implications are far-reaching: firms that embrace AI will likely see efficiency gains and deeper client engagements. However, they must also put in place robust governance, maintain human oversight, and ensure ethical use if they wish for gen AI to become a reliable ally rather than a liability.

Education

One of the most controversial applications of generative AI would be in this field, where it touches human learning, teaching practices, and the very development of future generations. In K-12 and higher-education environments alike, gen AI is sure to transform how students learn, how teachers teach, and how institutions operate. In recent years, teachers have been increasingly supported by AI tools that generate lesson plans, automate the grading of assignments and essays, and produce personalized tutoring pathways, allowing educators to dedicate more time to interaction and mentorship rather than administrative tasks (Bryant et al., 2024). These changes promise to shift the teacher's role from primarily an information-deliverer towards a learning facilitator, but they also provoke debate about teacher-student relationships, authenticity of learning, and reliance on algorithmic tools.

From a policy and governance perspective, the UNESCO guidance report underscores both the potential benefits and the risks of deploying generative AI in education, particularly with respect to equity, data privacy, and algorithmic transparency (Miao and Holmes, 2023). In regions with limited resources, AI-driven platforms may offer tailored content where teacher shortages exist, but they may also widen the gap if infrastructure or digital literacy is lacking. The insistence on governance frameworks, human oversight, and inclusive deployment becomes critical to ensure AI support rather than simply replaces teaching.

Meanwhile, the Brookings Institution argues that implementing generative AI in schools requires careful design, not just of technology, but of pedagogy, training, and assessment. AI can assist with personalized quizzes, essay feedback, and simulated lab environments, but without proper alignment to learning objectives and human guidance, the outcomes may be shallow or

even counterproductive (Goulas, 2024). Effective adoption thus depends on educator-AI collaboration, continuous professional development, and robust evaluation of learning outcomes to validate that AI truly adds educational value.

Hospitality and Customer Service

Over the last few years, we have all interacted with automated chatbots or phone systems, often without thinking twice. And although many of these early systems were rule-based, they set the stage for the gen AI-powered service tools now reshaping hospitality and customer support. In this industry, generative models are powering systems that can understand natural language, generate tailored responses, and personalize guest interactions on a scale. According to IBM, AI-powered chatbots, virtual agents and smart routing systems now handle common service inquiries, freeing human agents to focus on more complex or emotionally sensitive tasks (Finio & Downie, 2025) moving customer-service roles from reactive support toward strategic engagement.

In the hospitality field in particular, hotels and travel companies are using AI not just to automate tasks, but to reinvent guest experiences, from check-in and room personalization to real-time recommendations during a stay (Jiwnani, 2024). AI models can now analyze guest preferences, booking histories, and contextual data to craft personalized offers, adjust services dynamically, and even anticipate needs before the guest asks. Thus, reshaping how organizations deliver service and turning it into a data-driven dialogue rather than a one-time transaction.

But again, the adoption of generative AI in service contexts brings new questions around authenticity, transparency, and labor impact. While the chatbot you talked to last week may have solved your issue quickly, you may not have realized whether it was powered by a script or a generative model. The distinction matters because true generative AI can create novel responses and learn from context, whereas older chatbots follow rigid rules and fail when the query diverges. Ensuring that guest interactions remain trustworthy and human-centric means companies must build strong governance, guardrails and human-in-the-loop oversight (Finio & Downie, 2025; Jiwnani, 2024).

Global Management Implications of Generative AI

Drawing on the cross-industry evidence presented here, global management implications center on the need for multinational firms to move beyond a one-size-fits-all AI strategy and instead design governance structures that adapt to diverse regulatory regimes. As generative AI expands across healthcare, finance, education, and professional services, international firms must navigate varying data protection laws, intellectual property standards, transparency requirements, and sector-specific compliance rules across jurisdictions. Effective global management therefore requires centralized ethical principles combined with localized regulatory expertise, ensuring that AI systems are aligned with regional privacy frameworks, financial oversight bodies, and emerging AI governance standards. Firms that proactively integrate cross-border compliance, human oversight, and audit mechanisms into their AI deployment strategies will be better positioned to scale responsibly while maintaining trust, operational continuity, and competitive advantage in a fragmented global regulatory landscape.

Discussion

The evidence reviewed across the industries in this paper suggests that generative artificial intelligence is delivering meaningful benefits in many organizational contexts, particularly where tasks involve large volumes of data, repetitive documentation, early-stage ideation, or exploratory

analysis. In sectors such as healthcare, finance, manufacturing, and professional services, generative AI has demonstrated the ability to reduce administrative burden, accelerate workflows, and support more informed decision-making. These gains, however, are not uniform, and the effectiveness of generative AI appears to be highly dependent on task type, domain complexity, and the experience level of the user.

Importantly, the analysis also reveals that generative AI can, in certain cases, hinder performance rather than enhance it. This is especially evident in highly specialized technical domains. A notable example is the study conducted by Becker et al. (2025), which examined how generative AI affects experienced open-source software developers. In their study, 16 developers with long-term contributions to large repositories averaging over 22,000 stars and more than one million lines of code, were asked to work on real issues from their own projects. Developers were allowed to use generative AI for some tasks while being explicitly prohibited from using it for others, creating a direct comparison within authentic development settings.

Contrary to widespread expectations, the results showed that developers spent, on average, 19% longer time completing tasks when using generative AI than when they worked without it. These findings stood in sharp contrast to forecasts from economics experts, machine learning specialists, and even the developers themselves, all of whom had predicted efficiency gains from AI assistance. While the study does not suggest that generative AI universally slows software development, it provides strong empirical evidence that AI support can introduce cognitive overhead, verification costs, and workflow disruptions in complex, familiarity-driven tasks. In such contexts, developers may spend additional time evaluating, correcting, or integrating AI-generated output that does not align cleanly with existing system architecture or personal mental models.

This phenomenon resonates with patterns observed in other industries discussed in paper. In finance and legal services, generative AI accelerates document production but increases the need for careful review due to hallucination risks and regulatory sensitivity. In media and entertainment, creative productivity expands, yet concerns surrounding originality, ownership, and trust become more pronounced. In education, generative AI enhances personalization and access but simultaneously challenges assessment integrity and learning authenticity. Across domains, these trade-offs suggest that generative AI's value is not purely a function of model capability, but of how well the technology is integrated into human-centered workflows.

Taken together, these findings reinforce the idea that generative AI should be understood as an augmentative tool rather than a guaranteed productivity multiplier. Its benefits are most pronounced when it supports humans in exploratory, low-risk, or repetitive tasks, while its limitations become more visible in high-stakes, expertise-intensive work. Organizations that acknowledge this variability and design governance structures, training programs, and evaluation mechanisms, accordingly, are more likely to realize sustainable benefits while avoiding unintended performance degradation.

Conclusion

This paper sets out to examine how generative artificial intelligence is reshaping a broad range of industries, and the evidence suggests that its influence is both profound and nuanced. Generative AI is rapidly becoming a foundational layer across healthcare, finance, manufacturing, education, energy, and professional services, enabling new forms of creativity, analysis, and collaboration. However, its impact cannot be reduced to simple productivity gains or technological substitution.

The cross-industry perspective presented here demonstrates that generative AI delivers its greatest benefits when deployed as a complement to human expertise, not a replacement for it.

While technology excels at synthesis, pattern recognition, and rapid content generation, human judgment remains essential for contextual understanding, ethical reasoning, and strategic decision-making. Importantly, the inclusion of empirical evidence showing negative or mixed productivity outcomes challenges overly optimistic narratives and reinforces the need for careful, evidence-based adoption.

Looking ahead, the long-term success of generative AI will depend less on incremental model improvements and more on how organizations integrate these systems into existing workflows, governance frameworks, and professional cultures. Issues such as transparency, fairness, accountability, and workforce adaptation will play a decisive role in determining whether generative AI serves as a catalyst for sustainable innovation or a source of unintended disruption.

In sum, generative artificial intelligence should be understood not as a universal solution, but as a powerful and evolving capability whose value emerges through thoughtful design, responsible use, and continuous human oversight. When approached with realism rather than hype, generative AI has the potential to meaningfully enhance industrial performance while preserving the central role of human intelligence.

Acknowledgments and AI Disclaimer

The leading authors of this article are Meriem "Mary" Hamzi, Ebube "Obie" Ezeobi, and Mohit Jain, undergraduate students at Kennesaw State University. The coauthors, Sarah North, Max North, and David Garofalo, are researchers at the Immersive Visualization Environment Research and Metaverse Superclusters at Coles College, Kennesaw State University (https://coles.kennesaw.edu/ive and https://coles.kennesaw.edu/metaverse).

AI Disclaimer: This paper was created with the assistance of AI-based tools (such as ChatGPT) for tasks including drafting, editing, grammar correction, and idea refinement. However, all intellectual direction, critical analysis, final content decisions, and academic integrity of the work are solely the responsibility of the authors. The use of AI was supplementary and did not replace human judgment, originality, or authorship. The content of this article does not reflect the opinion, position, or policy of the Information Systems & Security Department, Coles College of Business; the Computer Science Department, College of Computing and Software Engineering; or the Physics Department, College of Science & Mathematics at Kennesaw State University.

References

Deloitte AI Institute. (2024). *The State of Generative AI in the Enterprise 2024.* Deloitte Insights. https://www2.deloitte.com/us/en/pages/consulting/articles/state-of-generative-ai-in-enterprise.html

Goodfellow, I., Pouget-Abadie, J., Mirza, M., Xu, B., Warde-Farley, D., Ozair, S., Courville, A., & Bengio, Y. (2014). Generative Adversarial Nets. *Advances in Neural Information Processing Systems,* 27.

Ktena, I., Wiles, O., & Gowal, S. (2024, March 19). Generative models improve fairness of medical classifiers under distribution shifts. https://www.nature.com/articles/s41591-024-02838-6

Kingma, D. P., & Welling, M. (2014). Auto-Encoding Variational Bayes. arXiv:1312.6114.

McKinsey & Company. (2024). *The State of AI in Early 2024: Gen AI Adoption Spikes and Value Starts to Show.* McKinsey Digital. https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai-2024

McKinsey & Company. (2025, March 26). Generative AI in healthcare: Current trends and future outlook. https://www.mckinsey.com/industries/healthcare/our-insights/generative-ai-in-

healthcare-current-trends-and-future-outlook
Stanford University. (2025). *The 2025 AI Index Report.* Stanford Human-Centered AI Institute. https://hai.stanford.edu/ai-index/2025-ai-index-report
Vadas, A., Holder, J., & Siebert, A. (2024, February 27). A new generation of drug therapies requires new business strategies. Harvard Business Review. https://hbr.org/2024/02/a-new-generation-of-drug-therapies-requires-new-business-strategies
Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., Kaiser, Ł., & Polosukhin, I. (2017). Attention Is All You Need. *Advances in Neural Information Processing Systems,* 30.
Wang, J., Wang, K., Yu, Y., Lu, Y., Xiao, W., Sun, Z., … Qu, J. (2024, December 11). Self-improving generative foundation model for synthetic medical image generation and clinical applications. https://www.nature.com/articles/s41591-024-03359-y
Boland, Brodie, et al. "A New Way to Decarbonize Buildings Can Lower Emissions—Profitably | McKinsey." *Www.mckinsey.com*, 29 Nov. 2023, www.mckinsey.com/industries/real-estate/our-insights/a-new-way-to-decarbonize-buildings-can-lower-emissions-profitably.
Bryant, Jake, et al. "Artificial Intelligence in Education: How Will It Impact K-12 Teachers." *Www.mckinsey.com*, 14 Jan. 2020, www.mckinsey.com/industries/education/our-insights/how-artificial-intelligence-will-impact-k-12-teachers.
Clio. "Legal Innovation and AI: Risks and Opportunities." *Americanbar.org*, 2024, www.americanbar.org/groups/law_practice/resources/law-technology-today/2024/legal-innovation-and-ai-risks-and-opportunities/.
Finio, Matthew, and Amanda Downie. "AI in Customer Service." *Ibm.com*, 15 May 2025, www.ibm.com/think/topics/ai-in-customer-service.
Garg, Prashant. "How Generative AI Is Transforming the Consulting Industry." *Ey.com*, 2023, www.ey.com/en_in/media/podcasts/generative-ai/2023/07/episode-4-how-generative-ai-is-transforming-the-consulting-industry.
Goulas, Sofoklis. "Making AI Work for Schools." *Brookings*, 31 July 2025, www.brookings.edu/articles/making-ai-work-for-schools/.
Jiwnani, Leila. "AI's Transformative Role in the Hospitality Industry | Deloitte UK." *Www.deloitte.com*, 13 Feb. 2024, www.deloitte.com/uk/en/Industries/consumer/blogs/embracing-the-future-ais-transformative-role-in-hospitality.html.
Miao, Fengchun, and Wayne Holmes. "Guidance for Generative AI in Education and Research." *Unesco.org*, 2023, unesdoc.unesco.org/ark:/48223/pf0000386693?posInSet=1&queryId=af9eefd9-d0eb-43fc-9595-3d15ee6ae0e3. Accessed 7 Nov. 2025.
Mittal, Nitin, and Irfan Saif. *The Energy, Resources & Industrials AI Dossier by Deloitte AI Institute 01*. 2025.
Warren, Zach , et al. *Perceptions, Usage & Impact on the Future of Work THOMSON REUTERS INSTITUTE 2024 Generative AI in Professional Services*. 2024.
World Economic Forum. *Fourth Industrial Revolution for the Earth Series Harnessing Artificial Intelligence for the Earth in Collaboration with PwC and Stanford Woods Institute for the Environment*. 2018.
Bain & Company. *How generative AI is transforming the automotive industry*. Bain & Company. 2025.
Bank for International Settlements. (2024). *Artificial intelligence and machine learning in*

financial services: Opportunities and challenges. BIS.
Harkness, M., Robinson, K., & Stein, I. (2023). *The economic potential of generative AI: The next productivity frontier — Marketing and sales implications*. McKinsey & Company.
World Economic Forum. (2025). *Generative AI in media and entertainment: Opportunities, risks, and governance considerations.* World Economic Forum.
Morgan Stanley. (2024). *Generative AI and the future of media and entertainment*. Morgan Stanley Research.
Boston Consulting Group. (2024). *Scaling generative AI in industrial and high-tech organizations*. BCG.
Becker, J., Rush, N., Barnes, E., & Rein, D. (2025). *Measuring the impact of early-2025 AI on experienced open-source developer productivity* (arXiv:2507.09089) [Preprint].