Generative Artificial Intelligence's Impact on New Jersey's Technology and Life Sciences Sectors: A Literature Review

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Introduction

Generative artificial intelligence (GenAI), a specific type of artificial intelligence (AI), describes the process of generating new content using inputted or gathered information. In general, AI encompasses machine learning (using algorithms), deep learning (making connections using unstructured data), and large language models (predicting and generating the human language) (New Jersey Industry Partnerships, 2024). GenAI is a type of large language model where learning artifacts — derived from data in text, image, video, audio, and 3D forms — use reasoning, problem-solving, and creativity to create new, original content in systems that are iterative and "preserve a likeness" to the original data, often from prompts (Lawton, 2024; Scoble-Williams et al., 2023; Cornell University, 2024). The underlying technology, using machine-learning algorithms, is not new; however, the complexity of the new data created and the scale of that data sets current and future applications of GenAI apart from previously known applications (Zewe, 2023; Orrell & Veldran, 2024).

It is estimated that the GenAI market will grow to $1.3 trillion in 2032, rising from $40 billion in 2022, including $280 billion in new software revenue (Bloomberg Intelligence, 2023). Job posting sites such as LinkedIn, Indeed, and others have measured large increases in GenAI-related search inquiries, as well as the number of postings mentioning the use of GenAI platforms or seeking hires having GenAI experience as early as November 2022 (when ChatGPT was launched) through to the present. For example, LinkedIn reported a 21-fold increase in the number of job postings that include AI technologies between November 2022 and August 2023 (Kimbrough et al., 2023; Monahan, 2023). Another estimate reported a 142-fold increase in the number of LinkedIn members who have added AI skills to their profiles (Microsoft Source, 2024). An August 2024 survey found that 39.4% of the U.S. adult population reports using GenAI, including 28% of employed adults who use it at work and 24% of employed adults who use it weekly (Bick et al., 2024). A 2024 Gallup survey found that one in three workers reports AI technology or tools are being integrated into their organizations (33%); one in three also said they have used AI in their jobs (Den Houter, 2024). Survey research has also found that "broad adoption across occupations" is happening throughout the United States (Pazzanese, 2024; Bick et al., 2024).

Experts suggest that the rapid acceleration of GenAI adoption in the United States will likely occur within two to four years (The Wharton School, 2024). One study that compared self-reports of use of the technology in the United States suggested that GenAI's adoption rate by workers is twice the adoption rate of the Internet in the same time period, likely because GenAI "targets" the worker and the

consumer rather than the organization or firm itself (Bick et al., 2024). Relatedly, the ways in which GenAI will replace or supplement tasks, workflows, jobs, and workers is currently unknown and there is heightened speculation on how that will evolve over time; for example, organizational hierarchies may flatten due to GenAI's impact on organizational structure and work culture, which could disproportionately affect higher-skilled workers (M. Purk, personal communication, March 25, 2024). Because it is not yet known what use cases GenAI will be applied to, talent considerations flow from this — a shift in job tasks, and consequently, changes in the structure of work — what workers are doing, how they are doing it, and how they are trained to do their work will have wide-ranging implications; ironically, people will be at the core of GenAI deployment in the economy (New Jersey Senate, 2024).

The concept of AI and GenAI is known to workers as tools are currently being used daily by workers globally — for example, auto-completing text, auto-composing content, analyzing diagnostic imaging, and conducting meta-analyses of scientific literature (Gartner, 2023). While these uses of GenAI are widely accepted, there is tremendous uncertainty surrounding its development and a general absence of public and private governance structures supporting its usage because of the limitless opportunities for value-added application and development that are yet to be conceived in nearly all sectors of the economy (Orrell & Veldran, 2024).

This literature review provides a general overview of the impact of GenAI on work in the United States, and how GenAI may affect workers and employers in the life sciences and technology sectors of the economy, and where feasible, in New Jersey (due to data availability, the general impact of AI and/or automation is considered). The discussion considers the possible and actual use cases of GenAI for these sectors and highlights the ways in which the technology is being explored and/or has been recently adopted by New Jersey businesses and organizations. This summary also samples some survey data and highlights recent initiatives, partnerships, and events hosted by life sciences and technology organizations in the New York tri-state area. Finally, as GenAI moves through the "hype" stage of adoption, this literature review summarizes the considerations

that workers, employers, and policymakers might make and actions they could consider taking to support the successful implementation of GenAI in the workplace, including ideas about reskilling, training, and policy.

Supplement, Complement, Augment, or Replace?

The specific ways in which GenAI will affect the New Jersey economy, particularly in the life sciences and technology sectors, and the potential use cases that will emerge from its application, remain uncertain as the technology continues to evolve (Orrell & Veldran, 2024). Compared to the impact of automation on work, where jobs requiring the completion of "routine" tasks were predicted to be the most vulnerable, GenAI impacts are more complex to measure and are expected to vary widely (Muro et al., 2019; Orrell & Veldran, 2024). Use cases of GenAI are iterative and, in many ways and for many enterprises, not yet conceived by the government and most employers, even as deployment becomes the reality. These use cases — what systems, jobs, roles, tasks, and skills will either be supplemented, complemented, augmented, or replaced by GenAI — will affect the work activities undertaken by current and future workers, hiring decisions made by leaders, and credential pathways. The potential for GenAI to change the nature of job tasks — manual, repetitive, and creative — will facilitate the development of products and processes that are better quality, personalized, and secure, giving workers the opportunity to have more collaborative interactions with consumers and peers, rather than interacting with direct technology, along with affecting other workflows that have yet to be explored or realized (Ooi et al., 2023). One recent estimate suggests that almost one-quarter of blue-collar workers and nearly half of workers in management, computer, and mathematical occupations used GenAI in 2024; men, young workers, workers with a college education, and white-collar workers are currently more likely to use GenAI at work compared with other workers (Bick et al., 2024).

Furthermore, these changes and impacts will likely vary between organizations producing similar outputs and in the same sectors. Experts agree that AI-facing jobs should be "decomposed" by tasks, and therefore skills, to evaluate possible supplements, complements, enhancements, and replacements of added GenAI, which will ultimately affect recruitment, upskilling, and reallocating talent in workplaces (Scoble-Williams et al., 2023; Daugherty et al., 2023). In addition, the creation of new roles — in trust, security, prompt engineering, content editing, and ethics related to AI and GenAI — will occur due to shifts and increases in workforce capacity (Lucas, 2023; Kempton, 2024; Shook & Daugherty, 2024). Given this, "it seems likely that just about every job will be affected in some way, as nearly all involve skills to some extent that can be enhanced with generative AI" (Marr, 2024a). The National Academies of Sciences, Engineering, and Medicine (2024) specify that measuring changes in "human expertise" supply and demand is most appropriate given this uncertainty.

The impact of GenAI on jobs — whether GenAI tools will replace or complement skills, tasks, or entire occupations, and how disruption versus opportunity will affect work — is of key interest to employers and policymakers. Some research has reported that "within-occupation" shifts that result from technological impact should be focused on rather than measuring changes in occupational employment shares (Freeman et al., 2020). However, leaders of large corporations expect that, as with any technological change, a restructuring of the workplace will likely be needed, but many factors will determine where disruption occurs and how quickly (Singhania, 2024). In general, GenAI will accelerate automation, enhance creativity and innovation, and streamline workflows to improve business and customer outcomes. The potential for automation (exposure to GenAI technology), based on work tasks, is a predictor of impact, in addition to the potential for "complementarity" (Cazzaniga et al., 2024). Estimates vary considerably; measuring and realizing the potential gains and accompanying shifts in organizational structure and workflow is speculative, giving rise to the need for companies to explore, experiment, pilot, and assess use cases of the technology (Lamarre et al., 2024):

> A March 2023 report suggested that 300 million jobs across the world might be affected, including 7% of U.S. jobs being replaced or substituted, 63% complemented, and 30% unaffected (Hatzius et al., 2023).

> Another estimate suggested that 9% of U.S. workers will be displaced by GenAI. GenAI could automate 60% to 70% of current working hours, affect tasks in 80% of jobs, including 50% of tasks in 20% of jobs, and two-thirds of jobs could be partially automated (Chui et al., 2023).

> Another study found that 80% of the U.S. labor force might have 10% of work tasks affected by large language models, including 19% of U.S. workers who could have 50% of their tasks affected, at a minimum (Eloundou et al., 2023).

> Research from McKinsey reported that 63% of U.S. employment will be complemented, 7% replaced, and 30% not affected. In addition, the acceleration of automation by GenAI might lead to automation replacing 30% of hours worked (Ellingrud et al., 2023).

> One in three architecture and engineering tasks and life, physical, and social science tasks may be automated by GenAI. These complementary estimates are labeled as "productivity enhancing," as a "perfect state" of GenAI is the technology's ability to boost productivity and spur innovation to improved outcomes while making tasks easier for workers (and changing those tasks) (Ellingrud et al., 2023; Hatzius et al., 2023; De Smet et al., 2022; Scoble-Williams et al., 2023).

The "productivity-enhancing" capabilities of GenAI are numerous and complex: automation, task complementarity, deepening of automation, and the creation of new tasks are the ways in which AI-based productivity gains might be realized (Acemoglu, 2024). For knowledge workers specifically, identical outputs might be produced using different approaches based on the abilities and styles of workers themselves, and the "reciprocal learning" between a GenAI tool or platform and the worker implementing it will lead to an "ongoing, intricate and complex adaptation process" (Alavi, 2024). However, some researchers report that GenAI will not displace entire jobs but instead address needs that have yet to be met, provide an efficient means to meet those needs, and create new tasks in the process, further complicating predictions about impact (Cappelli, 2024).

Given these complexities, Felten et al.'s (2021) "AI occupational exposure" scores link probable applications of AI technology to the "portfolio" of occupational abilities used in a job through the O*NET database in order to construct measures of exposure, finding that "most-exposed" occupations to AI technologies vary considerably; the most-exposed industries securities, accounting, insurance, legal, and technology (Felten et al., 2021). Felten et al.'s (2023) more recent analysis of language modeling and image generation finds occupations that might be most exposed to these GenAI advances are in jobs where workers have more education, earn more pay, and are traditionally considered white-collar.

One study of the New York combined statistical area's labor market (parts of Connecticut, New Jersey, and New York) found that up to 29% of total hours worked could be automated, including 56% of work hours on tasks "applying expertise" (Liu et al., 2024). In New Jersey, data collection, processing, and repetitive physical work are tasks likely affected by automation, which could represent nearly half of New Jersey's total working hours in 2022, while office support services is the occupational group in New Jersey having the most jobs "at risk of disruption" from automation technology, amounting to 41% (DeSmet et al., 2022). Researchers report, however, that "worker displacement from automation has historically been offset by the creation of new jobs, and the emergence of new occupations following technological innovations accounts for the vast majority of long-run employment growth" (Hatzius et al., 2023, p. 1). Even so, some researchers report that communities like the New York metropolitan area might be least exposed to automation but more exposed to AI and GenAI because of the area's "large workforces in high-skilled and creative professions" (Pranger & Su, 2023).

Socioeconomic Implications of GenAI Adoption

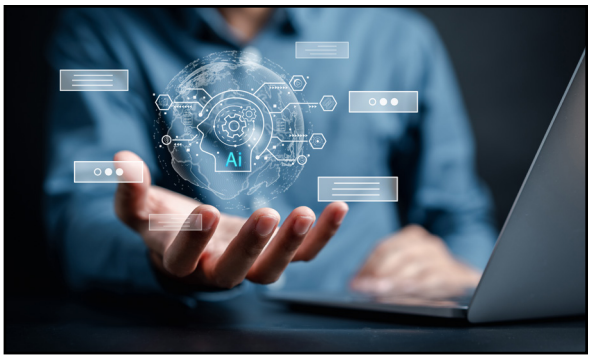
In some ways, the advent of GenAI in the labor market is not unlike other technology booms. There will be an inevitable reinvention of products, tasks, and skills in the New Jersey economy and labor market, as was experienced by the labor market during the advent of the computer and the Internet. Successful development of web- and cloud-based technologies integrated into the labor market and economy might be "extended and adapted" to AI and GenAI as it is scaled (Sankaran, 2024). With these technologies especially, a "democratization of knowledge" in GenAI will occur for workers and organizations, with profound impacts on product ideation, process efficiency, organizational productivity, and personalization of products and services (Perri, 2023). Like the impact of the Internet on jobs, credentials, and products, labor market conditions will have an impact on the scale and pace of the adoption of GenAI (Carlsson-Szlezak et al., 2023). But what is unlike these other trends is the iterative adoption and dynamic use of GenAI, even as the technology's capabilities, governance, and concerns are not fully understood or developed (O'Donnell, 2023). Given this, the complexity of measuring the socioeconomic impacts of the adoption and scale of GenAI on workers and communities in the United States, and how "impact" is measured, is of interest to business leaders, policymakers, and workers themselves — whether upskilling, reskilling, or an entire occupational transition will be necessary for individual workers, teams, and whole organizations — through exposure to automation potential and complementarity potential.

Of particular concern are the multiple ways in which the use of AI and GenAI specifically affects enterprises and workers, especially how they could deepen or even reduce inequities in the U.S. labor market between firms and among workers. On an organizational level, enterprises with more resources and access will disproportionately benefit from a quicker understanding and adoption of GenAI, compared to smaller, less-connected enterprises (Wilmers, 2024; Carlsson-Szlezak et al., 2023). According to McKinsey, approximately 12 million "occupational transitions" might be expected in the next five to six years, and a "reweighting" toward higher-wage jobs is possible (Ellingrud et al., 2023). Research reports that there is some potential for reducing wage inequality, benefitting lower-skilled and lower-wage workers (Wilmers, 2024). Yet, in some cases, female and lower-wage workers will need to transition, requiring upskilling and reskilling to do so. Some research has shown that female and Asian workers, in addition to workers having more education, income, and "the presence of creative abilities," are more likely to be exposed to GenAI compared to other workers (Felten et al., 2023; Kochhar, 2023). Similarly, Chui et al. (2023) have written that workers with the highest levels of education will be affected the most. Yet researchers found that lower-skilled workers may experience a "leveling effect" that will allow workers to enter the labor market easier by improving job performance, decreasing the need for workers with advanced writing skills and other tasks replaced or supplemented by GenAI (Orrell & Veldran, 2024). The use of GenAI could level the playing field for lower-skilled workers; early evidence has shown that access to GenAI tools can positively contribute to learning and development for novice workers, even knowledge workers with fewer skills compared to their more experienced counterparts, improving retention and decreasing attrition (Alavi, 2024; Brynjolfsson et al., 2023). These impacts are happening now and will continue to develop over time; for example, a November 2024 "predictions report" from Deloitte suggests that the "adoption gap" of female workers compared to male workers using GenAI will narrow in the next year, with women's experimentation and usage of GenAI tools and platforms in the United States potentially exceeding men's experimentation and usage by 2026 (Hupfer et al., 2024).

For workers, equity concerns abound and are complex: lower-wage, less-educated workers will likely need to change occupations (or be upskilled into changing roles) in most industries having customer sales and support and office support roles, as administrative and reporting tasks are automated and productivity gains are realized by these workers (Ellingrud & Sanghvi, 2023; Ellingrud et al., 2023). In addition, because "nonroutine, cognitive tasks" are typically done by white-collar workers, and these tasks encompass work roles that might be substituted rather than augmented by GenAI, there could be less demand for white-collar work in the labor market; meanwhile, how many tasks and jobs are substituted versus augmented remains to be seen (Wilmers, 2024). Preliminary evidence has also shown that GenAI tools may not only minimally affect but could negatively affect higher-skilled workers' skills when comparing them to lower-skilled workers doing the same job; lower-skilled workers may fare better compared to higher-skilled workers, "closing the gap" between higher performers and lower performers in the same job (Brynjolfsson et al., 2023). Furthermore, some research has shown that while higher-wage occupations engage in work that GenAI could complement, it is higher-skilled occupations (not necessarily higher-wage occupations), that might be vulnerable to the adoption of the technology; the highest-wage occupations might benefit, widening the gap between the highest paid and all others in the labor market (Pranger & Su, 2023).

The impacts on workers with various levels of educational attainment are complex because impact is likely related to complementarity and exposure of jobs; one study showed that, for workers with master's degrees or higher, GenAI could increase the automation potential of tasks three times more than workers without a high school degree (Liu et al., 2024). In addition, research suggested that GenAI could negatively affect knowledge workers with more education and at higher skill levels, yet could also improve the productivity of all workers while replacing some of the lowest-skilled workers and, in turn, replacing some skill sets with others (Orrell & Veldran, 2024). This will also have implications for certain geographic locations of the United States, where more college-educated workers live, such as in the New York combined statistical area (Pranger & Su, 2023). There could be short-term, lower-skilled job losses, but with the redistribution of tasks and upskilling, some workers will instead become more productive and change occupations (Ellingrud et al., 2023). Relatedly, predicting the productivity gains from the adaption of GenAI is complex, given the nature of the technology itself (Alavi, 2024).

Previous research has shown that men and Hispanics were most vulnerable to the impacts of automation because of the adoption of earlier forms of AI. Current research shows that women and workers of color may be most vulnerable to job displacement due to GenAI, though estimates vary by workers from different racial and ethnic backgrounds (Muro et al., 2019; Cazzaniga et al., 2024; Ellingrud et al., 2023). GenAI tools and platforms will affect the mobility pathways for vulnerable communities. For example, Black workers are more likely to work in roles at risk of automation, compared to all other workers, because of their concentration in "gateway" or "target" jobs, which don't require a four-year degree but are considered high mobility due to the career trajectory opportunities and the livable wages afforded by these jobs, such as customer service and office support positions (Shelly Brown et al., 2023). Researchers suggest that Black workers will be affected because "ultimately, between 2030 and 2060, Gen AI may be able to perform about half of the gateway or target jobs that many workers without degrees



have pursued — closing a pathway to upward mobility that many Black workers have relied on" (Shelly Brown et al., 2023, p. 4). Yet, Felten et al. (2023) found that Black and Hispanic workers are less likely to work in occupations that are exposed to GenAI specifically.

Furthermore, women in particular, because of their occupational types, are more likely to be exposed and therefore affected by automation due to GenAI (McNeilly, 2023; Ellingrud et al., 2023). While AI mostly affects younger workers, some research suggested that GenAI exposure will likely affect older workers disproportionately compared to younger workers, while other studies, such as one of the New York combined statistical area, highlight younger workers being "more adversely affected" by GenAI (Cazzaniga et al., 2024, Liu et al., 2024). Yet the effects of GenAI could largely depend on the ways in which the technology complements higher-income work (work that is exposed to the technology), but ultimately, it is the job, rather than race, ethnicity, or age, that will determine a worker's exposure and impact (Hering, 2023). This complicated adaptation to technological change is not new; as with the adoption of other technologies in the labor market, restructuring within organizations will be necessary and expected; these efforts will depend on the company, worker, and skill set but will also have impacts on the company and workers as adoption and adaptation occur (Zahidi et al., 2020; Di Battista et al., 2023).

Life Sciences: Selected GenAI Use Cases and Impact

In the life sciences industry, much like any applicability of GenAI to an industry or discipline, the development and use of GenAI is highly "context driven and content specific" (BioNJ, 2023). These domains and use-case categories disaggregate into hundreds of work tasks that are being used in the workplace and others that are yet to be determined. Meanwhile, half of the tasks in the life sciences industry are "non-language tasks" and are generally not applicable to GenAI (Daugherty et al., 2023; Marr, 2024a). Life sciences stakeholders' (insurance companies, healthcare conglomerates, clinicians, and patients) expectations of the applicability of GenAI are varied and high, complicating and raising the stakes and the pace of adoption of GenAI-use cases. Use cases where GenAI will likely affect the life sciences discipline, with impacts on costs, time, efficiency, and effectiveness on workflows and projects that could catalyze enterprise-wide innovation include accelerating research and clinical development, generating proactive quality management in manufacturing processes, developing hyper-personalized marketing content and strategies, and streamlining application development and testing to prioritize innovation and creativity (Levy & Lyons, 2023). In general, companies may seek strategic partnerships with other organizations to identify, discover, and work through those applicable-use cases (BioNJ, 2023; Ural, 2022). It is likely that most life science use cases for GenAI will require human validation because of safety concerns, particularly as public agencies such as the U.S. Food and Drug Administration continue to explore and define policy for the responsible use of GenAI in the life sciences sector (Mesa, 2023). For this reason, GenAI tools or platforms might be considered "co-pilots" that are used side-by-side with workers, such as using data models for testing drugs in pharmaceutical companies that work in tandem with scientists (Lamarre et al., 2024). A recent McKinsey study found that commercial life science companies observing a high degree of impact from GenAI adoption have implemented "interaction" use cases, which include patient assistance and healthcare personnel engagement (Aksu et al., 2024). In addition, considerations for reskilling and hiring may need to be made for enterprises building their own GenAI tools or platforms, compared to enterprises partnering with external organizations to apply an already developed technology (Aksu et al., 2024). Finally, internal "at-scale technical upskilling programs" that are continuously updated and assessed will be essential for life sciences companies and for pharmaceuticals in particular (Shah et al., 2024).

McKinsey researchers found that AI-related job postings in the biopharmaceutical industry increased by 43% each year from 2018 to 2023 for the 10 leading pharma companies in the United States (Shah et al., 2024). It is likely that, while GenAI might affect half of life sciences work hours, impacts in biopharmaceuticals and biotechnology will adapt to the GenAI technologies **slower** than other sectors due to regulatory and legal barriers. GenAI will likely have a significant impact on biopharmaceutical development because "images, omics, patient information, and other types of data — (are all) required to explain and solve the processes of diseases" and treatments. GenAI not only augments but can facilitate, innovate, and accelerate discovery and decision-making (Shah et al., 2024). In pharmaceuticals specifically, GenAI can be applied to five domains: research and early discovery, clinical development, operations, commercial, and medical affairs. Four use-case categories for these areas include knowledge extraction, content and compound

generation, customer engagement, and coding and software generation (Shah et al., 2024; Devereson et al., 2022). Moderna, for example, uses its mChat GenAI tool to assist workers with creating code, encouraging a "self-start process" for workers, even for those with no experience using GenAI (Shook & Daugherty, 2024).

Medical technology is another example of the vast application of GenAI technology, building on AI and machine learning technologies already in use by enterprises in the United States. As of August 2024, there were 950 non-GenAI AI machine-learning medical devices authorized for marketing and use in the United States (U.S. Food and Drug Administration, 2024a, 2024b). The use of GenAI in medical devices spans a wide range, particularly in device design, because of the role that enterprise data collection plays in optimizing medical technology. It is expected that engineers will be supported by GenAI in the design and testing of medical devices, particularly for personalizing treatments, reducing complications, addressing and streamlining safety and regulatory requirements, and accelerating the design process (World Intellectual Property Organization, 2023; Schroer et al., 2023). A Boston Consulting Group analysis described more than 60 use cases for medical technology companies in the application of GenAI for research and development, operations, marketing and sales, after-sales/customer support, and corporate functions/collaboration, including product manual drafting, code research, employee onboarding, and conversational digital sales agents (Schroer et al., 2023). As recently as November 2024, the U.S. Food and Drug Administration (2024b) acknowledged that there are critical "open questions" that challenge the process of evaluating and regulating GenAI-enabled medical devices, questions that must be addressed immediately for the sake of public health, given the degree of consumer and enterprise interest and the pace of deployment. These questions have critical implications for the development, adoption, and scaling of GenAI in the medical technology marketplace in the United States, which will ultimately affect the life sciences labor market.

Technology: Selected GenAI Use Cases and Impact

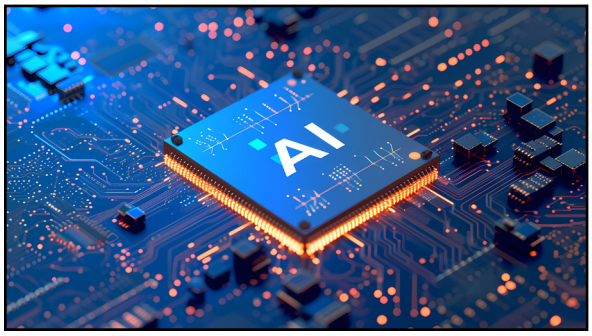
The use cases of GenAI in the technology sector — in software engineering and development, telecommunications, scientific research and development services, and architecture and engineering — are varied and vast. Researchers suggest that the impacts of GenAI on many industries could lead to job pathways that resemble the pathways in and impacts on the software engineering and development industry, where software platforms, tools, and technologies are regularly introduced and updated, requiring continual upskilling for all workers (Cihon & Demirer, 2023). In addition, these sectors are changing rapidly and will continue to do so as the specific technology of interest evolves. For example, while domestic manufacturing of semiconductors, and accompanying new manufacturing jobs, is likely to increase due to the federal Creating Helpful Incentives to Produce Semiconductors and Science Act, there will be an increased need for workers to have technical skills in more "high-tech" positions rather than in traditional production jobs (Liu et al., 2024). As such, the experimentation and piloting of use cases, measurement of impacts, and communication of these successes and challenges are essential to the responsible integration of GenAI tools and platforms in technology enterprises, especially software engineering and development, telecommunications, and architecture and engineering.

Software development impacts over the past several decades can offer a preview of how GenAI might affect these knowledge workers, particularly how they have weathered technological change and in the ways they are projected to grow as a profession in the United States. In software development specifically, GenAI may lead to the development of new software categories, even in coding, which may create jobs (Cihon & Demirer, 2023). In fact, it is estimated that science, technology, engineering, and mathematics jobs, including software development, computer systems, and data science jobs, will grow 23% by 2030, particularly given the increased demand for technological expertise and knowledge in other industries (Ellingrud et al., 2023). The adoption of GenAI tools and platforms in software development and engineering will be a "continuation, rather than a discontinuity" because software developers "regularly adopt new technologies, tools, and frameworks," leading to continuous upskilling; for example, LinkedIn data show that software engineering skills changed more than 30% between 2015 and 2022 (LinkedIn, 2024; Cihon & Demirer, 2023). Software developers will also be needed to help the technology assimilate within existing workflows and in organizations, transforming workers' jobs throughout adoption, deployment, and scaling (Shank & Combs, 2023). The transformation of roles is a crucial consideration for

human resources professionals and managers in software development specifically, as skills within roles will shift, new roles will emerge, and others will merge (Hussin et al., 2024). For example, prompt engineers will be in demand initially but may not be needed in the distant future if GenAI products are trained now (Candelon et al., 2023). Overall, for this industry, GenAI will be applied in various ways with varying subsequent impacts on workers, managers, and leaders, allowing enterprises to meet the pressing demand for coding skills, increasing the efficiency of software development teams, replacing lower-skilled jobs altogether, or enhancing/augmenting the jobs of coders (Zinkula & Mok, 2024).

Similarly, the potential for automation by GenAI in the telecommunications industry is tremendous: the use of GenAI tools in customer engagement and technical support by automating routine tasks, assisting network engineers with optimizing network traffic, and streamlining workflows (Rose, 2023). Telecommunications use cases will affect customer engagement, operations, and product development, improving effectiveness, alignment, and agility, especially "hyper-personalized" experiences and products using predictive analytics in marketing, copywriting, new product development and game content, code summarization, language translation, improving chip design outputs, field sales assistance, and more (Deloitte AI Institute, 2023b).

In architecture and engineering, as with most industries, the use of GenAI in architectural design will develop as governance structures are defined and use cases are identified. Architects will continue to lead the design process with technology assisting estimation decision-making, project documentation creation, and the generation of electrical and mechanical diagrams (Deloitte AI Institute, 2023a). These use cases will evolve into the coordination and orchestration of GenAI tools as they lead design processes, especially in housing construction, with productivity improvements and cost/time savings (Lindsay & Townsend, 2024). In conjunction with these developments, "a deep reevaluation will be required of the standard paradigms used for digital drawing and modeling" in addition to addressing functional, legal, and regulatory compliance associated with architecture and the implementation of GenAI (García del Castillo y López, 2022). GenAI in the engineering field is not a new tool, as engineers have used computer-aided design platforms employing GenAI platforms for years for design functions. In the future, GenAI will ensure design optimization for engineers; that is, GenAI will allow for testing, predictive analysis of potential regulatory and compliance issues, facilitating sustainable considerations, and automating project management tasks, including reporting and scheduling. Like other fields, routine tasks will be replaced with tasks that optimize customer service, engagement, and strategy (Marr, 2024b).



Selected Employer and Nonprofit-Led Partnerships and Events in New Jersey

This section provides an overview of selected recent activities led by businesses, employer organizations, universities, and other New Jersey-based entities focused on partnering, collaborating, and/or strategizing about GenAI development and discovery statewide, especially in the life sciences and technology sectors. This list represents activities through the third quarter of 2024, demonstrating that New Jersey employers and nonprofits are engaged in the conversation to provide education and skilling opportunities to New Jersey residents, explore the impacts of GenAI on their respective industries, and share ways in which adoption, deployment, and scaling of use cases are affecting workers and enterprises.

- The Mark Cuban Foundation partnered with South Jersey Gas in fall 2024 to host a no-cost AI educational boot camp for high school students in Atlantic City, part of a nationwide effort to teach the technology and explore career opportunities in AI for high school students.
- A GenAI council met in February 2024 in Princeton to discuss use cases and deployment. Led by ArisGlobal, a technology life sciences company with a Bridgewater, NJ office (headquartered in Boston, MA), 12 companies were invited to attend closed-door meetings about governance, compliance, and adoption frameworks related to next-generation AI and machine learning, with an emphasis on GenAI.
- The BioNJ trade association, which represents nearly 400 life sciences organizations in New Jersey, sponsored informative, publicly available content on the use of GenAI across the healthcare ecosystem, including publicly available webinars.

- The New Jersey chapter of the American Institute of Architects organized education on AI image generation for its members, calling generative design an "emerging technology of the future," along with 3D printing and smart building design. The chapter has a Technology in Architecture in Practice Committee charged with investigating and prioritizing information gathering and training about new technologies in architectural design.
- The New Jersey Business and Industry Association featured a keynote address by a GenAI business consultant at its 2024 Insights and Outlooks event.
- The New Jersey Big Data Alliance's 11th annual symposium highlighted "AI Impacts on Society and Higher Education" at Rutgers, The State University of New Jersey in May 2024, collaborating with Rutgers, the Office of the Secretary of Higher Education, Amazon Web Services, and others to share perspectives and experiences of AI and GenAI in the New Jersey labor market, including core skill competencies, ethical considerations, and applications to educational pathways.
- A Princeton Tech Meetup, a networking group of technology workers and leaders, hosted a March 2024 AI in healthcare panel discussion in Princeton to discuss GenAI use cases in healthcare in New Jersey, including participants from Edison's Hackensack Meridian *Health*, Allentown's SciMar ONE, and Somerset's WhizAI, all headquartered in the state.

Selected New Jersey Employer Applications and Actions Related to GenAI

This section describes recent and current activities led by businesses, employer organizations, and other New Jersey-based entities focused on GenAI development and discovery, including examples of use cases by New Jersey companies (either headquartered in New Jersey or having a satellite location in the state) in the life sciences and technology sectors. The applications of GenAI are vast within the state's life sciences and technology sectors, as the rate of adoption and integration varies extensively among employers.

- Johnson & Johnson (New Brunswick, NJ) expects GenAI will assist healthcare stakeholders with making informed, personalized decisions, including clinical trial settings, and to determine if drugs are working for the right patients/populations, especially in rare disease diagnosis and management. GenAI models will support medical professionals with decision-making, reducing bias in prescriptions and diagnosis/imaging, and improving workflows in case management for doctors. The company views the development of governance structures and regulatory policy as a prerequisite to moving forward.
- Bayer (Whippany, NJ) employs "AI communities of practice" for areas such as human truths, consumer engagement, business intelligence, and other practices. Current uses of GenAI include using BioGPT for biomedical text generation and mining; Bayer documented this effort's productivity improvement for its medical affairs team, finding it is 100 times more productive and accelerated the company's processes.
- Merck & Co. (Rahway, NJ) is partnering with Amazon Web Services in various functions, including supporting meta-analysis tasks, patient analytics, and drug discovery functions.
- Hackensack Meridian Health (Edison, NJ) is working with Google to use GenAI technology to customize patient engagement experiences for improved health literacy, automate paperwork and authorizations, and support clinical diagnosis processes.
- Novartis's (East Hanover, NJ is the U.S. headquarters) learning and development function is partnering with numerous other functions — strategy, information technology, risk, and human resources — to deploy GenAI learning and development/upskilling and strategy.
- Cognizant (Teaneck, NJ) is collaborating with NVIDIA on its GenAI platform to assist with drug discovery processes, including meta-analyses and drug pathway exploration. The company also announced its own GenAI platform for the software development and engineering life cycle.
- Amdocs (Jersey City, NJ office) is partnering with Microsoft to combine its proprietary platform with Microsoft's OpenAI and facilitate the development of a center of excellence to discover potential GenAI applications for the telecommunications industry.

- Vonage (Holmdel, NJ is the U.S. headquarters) recently announced the deployment of integrated GenAI products that will empower customer support representatives, agents, and marketing employees to improve customer engagement. These changes include a marketing template content generator to reduce human workloads (and lead to the ability for teams to coordinate a variety of marketing campaigns) and live chat assistance to improve customization and engagement for customer service personnel.

- ADP (Roseland, NJ is the U.S. headquarters) is using GenAI for efficiency and compliance in a mixed-initiative approach, where humans and technology work together, "proactively nudging HR practitioners and employees about tasks they need to perform, steps they should take or information they need to review — a human-machine interplay being added to today's HR software — can help productivity flourish" (ADP, n.d.). The aggregation of data and preparation of solutions, where the core principle is "human oversight" of processes. GenAI technology is currently being used to summarize phone calls and aggregate data to generate solutions to common problems in payroll reporting and processing and to improve business functions, including interactions, processes, and transactions.

- T-Mobile (Parsippany-Troy Hills, NJ corporate office) will use GenAI to research customer motivations and use customer interaction data to research and improve customer attrition, which could affect who is hired and employee workflows in the future.

Selected Survey and Public Opinion Data: Awareness, Use, and Opinions of GenAI

This section highlights various surveys of business executives and workers conducted since 2022 that explore the various uses of GenAI, the role of AI in the workplace, and the challenges leaders face in various industries. These and other surveys of workers, executives, and human resources professionals in the United States are an important source of information for policymakers and business leaders about awareness, use, perceptions, and predictions of GenAI adoption in the labor market.

- A June 2024 Deloitte study of 2,770 international C-suite executives found that 36% of life sciences and health leaders and 56% of telecommunications, media, and technology executives said their organizations' GenAI expertise is "high" or "very high." While 45% of organizations said their technology infrastructure is "highly prepared" to adopt GenAI tools and platforms, just 20% of organizations said the same about their talent.

- A May 2024 McKinsey survey showed that GenAI "high performers" are different from all others; those organizations have "curated learning journeys tailored by role to build critical gen AI skills for technical talent."

- A Deloitte Center for Health Solutions study of healthcare executives released in 2024 found that nearly all biopharma and medical technology device leaders believe GenAI will affect their organizations, including two-thirds who indicated they are currently "experimenting" with GenAI to develop test use cases in administrative work, supply chain, and regulatory/compliance functions.

- The Federal Reserve Bank's February 2024 survey of consumer expectations found that 63% of GenAI users at work reported that the technology enhanced their productivity. GenAI users were more likely to say that the technology could help them learn new skills for work or assist with finding employment but were also more likely to express concerns about the negative impact of GenAI on generational inequality.

- A February 2024 Pew Research Center survey found that 20% of employed Americans have used ChatGPT at work, an increase from 8% in March 2023. Thirty-three percent of employed Americans having a postgraduate degree have used ChatGPT at work, compared to 25% of college graduates, 19% with some college, and 8% having a high school degree or less.

- A July 2023 Pew Research Center study found that workers having more exposure to AI in their jobs were more likely to say the technology will help rather than hurt them, compared to workers having less exposure to AI at work.
- Upwork Research Institute's analysis of World Economic Forum data showed 50% of hiring managers reported that they expect to hire more full-time employees in the next five years because of GenAI.
- A 2024 analysis of 2023–24 business trends and outlook survey data, conducted by the U.S. Census Bureau, found that 26.6% of respondent U.S. businesses reported that they are using AI to replace worker tasks, of which 85% said a "small number" of tasks are being replaced. Also, 6.5% of respondent businesses said they expect an increase in employment due to AI use in the future, while 6.1% also said they expect a negative net employment change (an increase from 2.8% and 2.6%, respectively, six months prior).

GenAI Adoption: Workers

Workers are at the center of GenAI adoption, scaling, and tenure in the workplace. The ways in which workers could adapt through upskilling, reskilling, and weathering changes in tasks, workflows, or entire jobs because of AI are growing daily. How workers will adapt will depend on their job's exposure to GenAI; the rate, type, and scale of adoption of the technology by their organization/in their industry; and how easily, affordably, and efficiently they can reskill or, if necessary, find new work with the skills they have (O'Donoghue & Roberts, 2024). Research suggests that GenAI will be used by workers both formally — required or encouraged by firms — as well as informally — usage preferred by employees to complete work tasks (Pazzanese, 2024). Companies, government, and workers will be working in tandem dynamically to understand these impacts and adapt. Opportunities for reskilling and upskilling vary widely, but there is much work to be done to address skill misalignment between employer demand and worker supply in skill pathways beyond GenAI and automation (Donovan et al., 2022). GenAI will likely change how workers learn and are trained in the workplace, and "segmentation of the audience" will be necessary for different needs related to learning about and using GenAI (Singhania, 2024). These efforts will be complicated by an aging workforce and the variety by which the technology will be adopted between enterprises within sectors. One study of enterprises concluded that reskilling internal workforces is the "shared" responsibility of human resources departments, senior leaders, and c-suite executives (Goel & Kovács-Ondrejkovic, 2023). Boston Consulting Group recently published a "must-haves" analysis of AI upskilling for enterprises by "modeling desired behaviors and actively participating in AI initiatives" (Loh et al., 2024). A McKinsey analysis suggests that "strategic workforce planning" requires collaboration between human resources and business leaders:

> *"To be useful, however, companies should treat skills as data rather than a document. By adding skills with relevant tags (for example, expertise levels) to a database, companies can use AI and LLMs [large language models] to determine relationships and connections between skills for reskilling, prioritize which skills to develop, enable workforce planning to determine specific skill needs by program or team, and develop tailored learning programs"* (Hussin et al., 2024).

The opportunities for professional development and credential attainment in AI and GenAI are growing rapidly for workers and students. Immediate upskilling mechanisms include nondegree credit courses and certificates at postsecondary institutions, as well as privately offered certificate programs. Colleges and universities across the United States are integrating AI curricula into current courses, designing new courses in GenAI, or piloting the use of GenAI technology in teaching. LinkedIn offers at least 250 courses in multiple languages to premium members (enterprises and workers) in GenAI literacy, as well as 600 AI courses that utilize an "AI upskilling framework" that identifies five upskilling levels in AI: understanding, applying, building, training and maintaining, and deeply specializing (Microsoft Source, 2024; Brodnitz, 2024). American University is developing business curricula to include prompt engineering and programming, R, Python, and AI/machine learning models, and undergraduates will likely be required to take these courses; Georgia Institute of Technology is increasing offerings in GenAI; and Boston University is facilitating a pilot for use of AI in first-year writing to inform future programming (Mowreader, 2024).

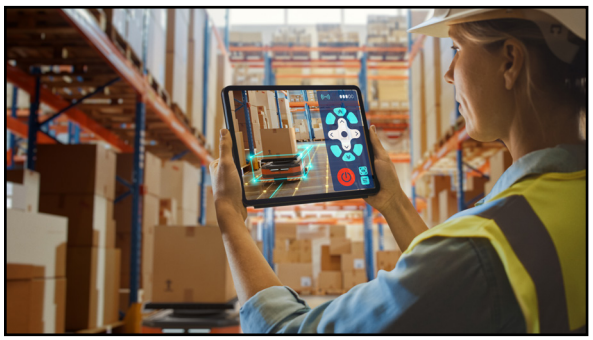
In New Jersey, the New Jersey Institute of Technology is offering an AI master's of science program and offers "AI-enabled activities and development" in various courses, including computer science, business, architecture, and engineering (Lesser, 2023). The professional and executive

education program in the Rutgers–Camden School of Business offered a seven-week, hybrid GenAI prompt engineering course in fall 2024 for individuals in various industries who are interested in learning how to apply GenAI to their current work/skill set/industry (Rutgers–Camden, 2024). The Rutgers Business School–Newark and New Brunswick is partnering with Google Public Sector to offer students and faculty access to Google AI tools and platforms and will enhance graduate and undergraduate curricula in AI and GenAI, including a master's degree in business administration with a concentration in AI (ROI-NJ, 2024).

As such, companies might consider partnering with higher education institutions to offer regular, updated courses to workers and to inform the curricula of these offerings in the future. In addition, offering on-the-job training, including mentoring, job shadowing, and apprenticeships to current workers is a valuable tool to address labor shortages while employing overlooked or vulnerable workers, especially for lower-wage workers and those with fewer educational credentials, given the evidence showing the effects of on-the-job training on earnings and mobility (Ellingrud, et al., 2023; O'Kane, 2023). Apprenticeship programs are an essential tool for companies to "demystify change" and embrace role-modeling of skills related to the deployment of GenAI (Hussin et al., 2024). Furthermore, government could administer personal employment training accounts, improve reporting of labor market information, and invest in sector-based training programs to support lifelong learning in a worker-centered approach (Orrell & Veldran, 2024; Alavi, 2024). Learning and employment records and other advanced data systems that digitize workers' employment and educational records may meet the moment for AI deployment (Andreason et al., 2024). Because experts suggest that effective hiring should be targeted toward skill sets, competencies, and capacity to learn rather than solely on credentials, policy interventions should focus on addressing these factors.

At the center of GenAI adoption and scaling are workers by giving them the opportunity to participate, collaborate, and partner on use case development, upskilling efforts, and the design of governance structures. One recent research effort provides evidence that workers should participate in GenAI use case development and implementation to improve outcomes for workers and jobs (Kochan et al., 2023). As such, the design of regulatory policies, governance structures, and standard operating procedures through these earliest use cases, where workers are "co-creating" these applications, is necessary to support the inevitable development of responsible and more refined and complex use cases of GenAI (Shank & Combs, 2023). A steady pace of GenAI implementation across tasks and jobs, with the regular, concurrent collection of data, will be advantageous to workers and managers (Selenko et al., 2022). Relatedly, architects of GenAI regulation, governance, and standard operating procedures should include workers and managers, with the advisement of legal and human resources experts in addition to data scientists and engineers. Even reskilling efforts may be anchored by partnerships between industry, policymakers, regulators, and higher education in an "academy" format that educates workers on GenAI technology while updating and, in some cases, building career pathways for workers (O'Donoghue & Roberts, 2024).

GenAI tools and platforms are and will be far-from-perfect replacements, substitutions, or additions to the life sciences and technology sectors of the New Jersey economy, requiring human interaction to assist with validation, compliance, creativity, and adaptation that comes with deployment. In fact, "hallucinations," or content generated by large language models that is deemed false, imperceptible, nonexistent, or misleading by humans are an expected complication of GenAI tools and platforms, requiring the observation of humans to verify acceptable content. Researchers have found that autonomous agents need assistance from workers when it comes to use cases such as collaborative software development, content management, and others (Loucks et al., 2024). As GenAI is adopted by companies, "noncognitive skills" — resiliency, integrity, communication, adaptability, and flexibility — will be essential for workers to have when using GenAI technology in the workplace (Orrell & Veldran, 2024). "Stakeholder management, idea generation," and other collaboration and innovation-based skills are in demand from enterprises that are searching for AI talent (O'Kane, 2023). Other research reports that these skills are those that are "future-proof" or non-automatable; that is, social-emotional skills, hand-eye coordination, and problem-solving (Shelly Brown et al., 2023). Future-proofed skills for GenAI specifically are prompt engineering and data safety considerations (Yee, 2024). In this way, GenAI might be considered a skill for workers to acquire, embedded into their work, rather than a tool for them to utilize, especially for workers of color (Kudumala et al., 2024; Shelly Brown et al., 2023). However, the idea that "humans with AI are going to replace humans without AI" is a reality that employers, government, and workers should consider, although there is enormous nuance to this assertion (Kempton, 2024;



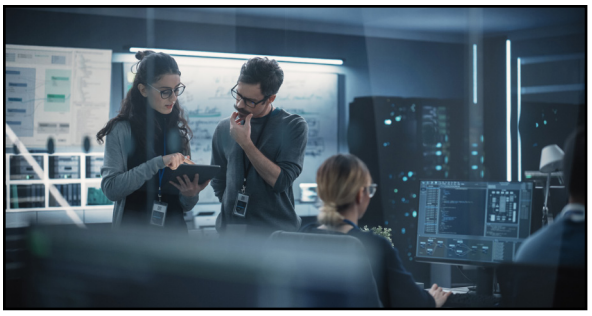
National Academies of Sciences, Engineering, and Medicine, 2024). In any case, "task disruption" is an immediate consideration for workers, managers, and business leaders to consider, and diversifying one's investment in education and, thereby, a worker's skill set might insulate workers most from detrimental change (Roubini et al., 2023; The Wharton School, 2024).

GenAI Adoption: Leaders

Leaders have their work cut out for them. While most workers will need to know what GenAI is, how it can influence work, and how to manage risks when using it, leaders will also need to weigh strategy, productivity, and market implications into their applicability of the technology and subsequent learning and development planning (Signhania, 2024). In essence, leaders might use a "researcher's mindset" to explore, test, and refine the deployment of GenAI in an organization (Scoble-Williams, 2023). Leadership will require sector-based training on AI literacy, industry applications, and potential use cases prior to and in tandem with training for its workforce (Orrell & Veldran, 2024; The Wharton School, 2024). Whether enterprises "take," "shape," or "make" GenAI tools is essential (Lamarre et al., 2024). McKinsey suggests that it will take roughly two to three years for organizations to figure out how they are using GenAI in a way that improves business outcomes; talent determinations will emanate from these decisions (Hussin et al., 2024). Relatedly, leaders should consider a "domain-based approach" to deployment is best, focusing on specific business areas such as customer service or marketing, because it:

> *"allows for end-to-end, technology-led transformation that integrates multiple use cases within a single value-creating workflow, process, journey, or, occasionally, entire function. Since domains often span organizational boundaries, implementing gen AI and other technologies at the domain level can deliver greater value than one-off solutions"* (Relyea et al., 2024).

Furthermore, a key question asked by employers is how the adoption of GenAI and a purported increase in productivity gains will affect job satisfaction, engagement, and retention of their workforce (Brassey et al., 2024). A 2023 study of the impact of a GenAI tool on worker productivity, learning, and attrition found that access to a GenAI-enabled conversational chatbot led to reduced attrition for lower-skilled workers, likely due to better treatment by customers and enhanced productivity (Brynjolfsson et al., 2023). Other research suggests that workers need to "thrive" to weather the changes that GenAI will bring to the workplace, offering leaders guidance on the ways in which autonomy, flexibility, and meaningful work can be encouraged to protect against burnout and foster personal growth, work performance, and job satisfaction (Brassey et al., 2024).



In addition, there is evidence that workers are using GenAI "secretly" and on their own, and given this, it is crucial that leaders consider "co-creating" use cases with workers, which will, in turn, build AI literacy and trust (The Wharton School, 2024). "Reorganizing" work around AI includes determining who is using AI and destigmatizing that use. Ethical experimentation and expecting that change will happen rapidly is essential (Mollick, 2024). A "diagnostic" of sorts for an enterprise can inform implementation and strategy (Adhvaryu et al., 2023). Companies should experiment with these use cases and, in some cases, engage in "job-crafting," where employees use GenAI in a self-directed way that allows the employee to lead integration of the technology into a job, especially for the unique "needs and circumstances" of that particular employee, which corresponds with the core of knowledge work, prioritizing strategy and creativity rather than clearly defined tasks, prompts, or steps (Alavi, 2024; MIT/Sloan Work/24, 2024). This could also help with worker buy-in, as evidence has shown that workers' application of GenAI to sales tasks boosted creativity, leading to different results for different employees, which was used to alter how GenAI is applied to work tasks (Shook & Daugherty, 2024; Tomaselli & Acar, 2024; Doshi & Hauser, 2024). Ultimately, leaders will need to communicate possible outcomes and gains to workers on an individual level, but this co-creation and contribution of data to systems that are used in learning and development also begs the question of whether workers should be compensated for their input into these systems (Brynjolfsson et al., 2023). This is one of many questions leaders will have to grapple with in the coming years.

How leaders pivot, adopt, and scale will be determined by many factors. Leaders should recognize the types of change and impact that are related to timing — short-term, medium-term, and long-term — in deploying GenAI (Yee, 2024). And, as these phases of testing, deployment, and refinement evolve, the impact on work and workers will also change. If new work is created by the use of GenAI, such as importing and editing data, leaders will ultimately determine whether adoption will inevitably create entirely new work roles or instead complement or replace other tasks (The Wharton School, 2024). *The Wall Street Journal* reports that entire teams of new workers are being recruited externally by technology companies to improve GenAI models (Bindley, 2024). This "balance" of recruiting external expertise vs. upskilling

internal teams is crucial, especially for pharmaceutical companies, where historical digital adoption has shown that partnering with external experts having strategic and technical expertise has translated to substantial cost efficiencies (Ziegler et al., 2024). Research shows that employers will tend to build their teams internally, but because GenAI talent varies widely and research has shown that workers' values and needs may vary based on technology use, "heavy users" are more likely to say they will leave their current roles for others (Baier et al., 2024; De Smet et al., 2024). McKinsey researchers have concluded that "too often, conversations focus on which roles are in or out, while the reality is likely to be more nuanced and messy" (Hussin et al., 2024). Relatedly, AI and GenAI can be "leveraged" to "improve working conditions, worker safety, and worker mobility/flexibility" (Kiron et al., 2023). As leaders reimagine work using technology, rather than applying technology to work, they will need to model change, including understanding how workers learn and how working conditions are affected in the workplace, while devising dynamic training programs that are responsive to their own needs in their enterprises (Shook & Daugherty, 2024; Brassey et al., 2024).

Conclusion: What's Next for Workers, Leaders, and Government?

As workers and business leaders navigate the process of the uses and impacts of AI, and specifically GenAI, on their organizations and career pathways, the federal government has made it a priority to understand these impacts on the U.S. labor market, both in public agencies and in private business. President Joe Biden's executive order on the safe, secure, and trustworthy development and use of AI announced in October 2023 indicates that the federal government will serve as a "model for the responsible use" of AI in general and directs agencies to "explore" how GenAI may be used in their work, in addition to establishing the AI and Tech Talent Task Force and proposing oversight and other protections (The White House, 2023). According to the U.S. Department of Commerce, the public comment period has closed for the draft publications proposed by the executive order, which will be published by the National Institute of Standards and Technology (U.S. Department of Commerce, 2024). The U.S. government has also taken steps toward investigating GenAI's impact and needed policy in copyright and competition (U.S. Federal Trade Commission, 2024). Recent actions undertaken by the Biden administration include the publication of draft guidance and analysis by the U.S. Department of Commerce, the Equal Opportunity Employment Commission, the U.S. Department of Labor, and the Office of Management and Budget, and the development of the AI and Tech Talent Task Force to support the hiring of AI talent in the federal government (The White House, 2024). However, with the inauguration of President Donald Trump in January 2025, the 2023 executive order was repealed. Policymakers and business leaders are now speculating about the new administration's priorities and specific actions related to AI in the nation's economy, which will first include the development of an "AI Action Plan" with the goal of "enhancing" the nation's "global AI dominance" (Shivaram, 2024; The White House, 2025). Activity is also occurring at the state level of government throughout the nation; the National Conference of State Legislatures (2024) is tracking AI legislation, finding that most states have introduced, adopted, or enacted legislative bills in the 2024 legislative session related to AI, for concepts ranging from educational use to the effects on labor/employment, private use, and other categories.

Other governmental activity at the state level is related to education and training, focusing on workers and residents in the immediate future. Policymakers in some states, including California, Maryland, and Mississippi, have recently considered various initiatives that add AI skilling or certification to public school classrooms. Connecticut is looking to establish a Citizens AI Academy, which would offer free online classes teaching basic AI skills and certificate opportunities (Haigh, 2024). In California, NVIDIA is partnering with the state to facilitate direct collaboration between industry and community colleges, including training faculty and students in AI that are "relevant to in-demand local jobs and collaborate with regional employers to build up an in-demand skilled workforce" (California Office of the Governor, 2024). New Jersey Governor Phil Murphy's AI task force was charged with exploring the ways in which AI and GenAI specifically will affect the state labor market, releasing a 2024 collaborative report, including devising policies and guidance for training, talent pathways, and responsible deployment by employers, higher education institutions, and the public workforce (New Jersey Office of Innovation, 2024). The development of governmental policy is a key factor in determining the impact of GenAI on the New Jersey and U.S. labor markets, as well as the availability of data infrastructure (New Jersey Senate, 2024; Cazzaniga et al., 2024).

Strategic partnerships are at the core of the development of GenAI use cases and deployment in the workplace. Reskilling, upskilling, and governance structures will be needed in the coming months across sectors in industries and across firms, and across teams and hierarchies within individual firms. Dialogue between private and public actors is essential, especially between philanthropy and industry (such as the Mark Cuban Foundation's AI bootcamps initiative) and academia and industry. MIT recently announced the launch of its "Generative AI and the Work of the Future" working group, funded by Google, convening leaders in industry, academia, and government to explore early use cases in businesses and impacts on the workforce; convene conversations about successes and challenges among working group members and the public; and inform training tools for businesses that are adopting GenAI platforms at work. The working group will include faculty and students engaging in activities through 2026 (Massachusetts Institute of Technology, 2024). Research on the impacts of GenAI deployment on workers of color suggests that "intentional" efforts to support industry partnerships with Historically Black Colleges and Universities can better support pathways for workers of color (Ellingrud & Sanghvi, 2023). On a global scale, the AI Governance Alliance is a World Economic Forum initiative convening government, industry, and academia that looks to "establish global standards for AI governance," including recommendations on the responsible use of GenAI (Li et al., 2023). Just as open-source tools will "level" the GenAI playing field for smaller organizations without the resource capacity to invest in their own, larger enterprises will devise learning and development plans to upskill and reskill their workforces, but public-private partnerships will be essential for smaller organizations (Colombe et al., 2023; Ellingrud et al., 2023).

According to Brookings, the impact of AI on "workforce ecosystems," particularly governance and organizational structures (extended workforce, such as contractors, gig workers, professional service firms, complementor organizations, and technologies such as algorithmic management and AI that create value for an organization) is essential for policymakers to address, especially in how work is designed and conducted, how labor is supplied, and the ways in which work and workers are measured (Kiron et al., 2023). Suggested policy implications include addressing workplace safety and cybersecurity, anti-discrimination, and surveillance and transparency, supporting AI adoption in multiple ways:

> *"Policy can offer incentives to limit the use of AI in low value-added contexts, such as for automation of work with small efficiency gains, while promoting higher value-added uses of AI that increase economic productivity and employment growth"* (Kiron et al., 2023).

If AI adoption may fundamentally change the makeup of a company's workforce, this may increase the supply of contingent workers that the company relies upon. To address these changes, considering the portability of benefits and expanding Unemployment Insurance to contingent workers may be necessary to support the workforce ecosystem (Kiron et al., 2023). In addition, investment on a national scale that supports displaced workers in weathering mid-career occupational transitions will likely be necessary (Sundararajan, 2024). Other researchers suggest examining barriers to mobility in the labor market — including non-compete agreements and licensing requirements — to support workers undergoing mid-career occupational shifts (Felten et al., 2024).

While GenAI use cases and reskilling efforts will likely be worker-centered and sector-specific, workers will still need "foundational and nuanced skill building" that can be utilized across roles (Shelly Brown et al., 2023). Committed leadership, a defined company culture, and steadfast communication are essential for the integration of GenAI into life sciences and technology organizations, albeit all enterprises weather these changes (M. Purk, personal communication, March 25, 2024; Sankaran, 2024). Government should collect data on business use to inform frameworks that can address changes over time (Felten et al., 2024). Leaders can advance their own organizations' adoption and successful deployment of productive GenAI tools and platforms if they can define and prove test use cases, demonstrating early "champions" of adopting GenAI, including measuring and prioritizing the impacts on its current workforce and future talent pipeline (Shah et al., 2024). In addition, resiliency and adaptation in building a workforce that uses and is transformed by GenAI is essential; to do so, the workforce "has clear expectations, understands its role in the bigger picture, and is empowered with the autonomy to manage their tasks" (Scoble-Williams, 2023). Leaders will need to weigh trust and transparency; fairness; and diversity, equity, and inclusion considerations (Daugherty et al., 2023). The scale of integration of GenAI will depend on whether the technology can bring efficiency and/or effectiveness to life sciences and technology organizations and do so in a way that is deemed valuable — both efficient and effective — given the needed inputs to deploy (Shah et al., 2024; Ratan et al., 2023). Organizations having the capacity to pilot early use cases that demonstrate this value will lead to deployment (Shah et al., 2024; O'Donoghue & Roberts, 2024). To build trust between enterprises and their customers, and leaders and their workers, GenAI tools and platforms must enable use cases that prioritize "transparency, performance, security, privacy, and quality," convincing workers and customers that use cases are acceptable and eliminating adverse impacts on users, protecting intellectual property rights, minimizing biases and environmental harms, prioritizing data privacy and security issues and addressing the effects of actual job displacements (Daugherty et al, 2023; Sankaran, 2024; Shah et al., 2024).

How workers are affected — albeit their daily tasks, workflows, jobs, occupations, and career pathways — will emanate from the iterative development of GenAI's use cases and accompanying governance structures expected to be developed by employers and government soon or already in development in New Jersey and in the larger New York region (Orrell & Veldran, 2024; Liu et al., 2024). In New Jersey, leaders in economic development and higher education have asserted that while policies and procedures enacted through legislation are important, prescriptive legislation could be simultaneously limiting, inadequate, or outdated. Above all, the adoption of GenAI regulation requires "flexibility that does not hinder innovation" that is "both prompt and adaptable" and broad-based to "address heterogeneous effects" of GenAI adoption (New Jersey Senate, 2024; Di Battista et al., 2023; Felten et al., 2024). Given the expected impact of GenAI on jobs and workers, the implementation of policy that supports the labor force and business will require targeted government-led workforce strategies that are rooted in continuous dialogue and collaboration between secondary and postsecondary institutions, industry, and government. As such, GenAI will have considerable impacts on workers and the New Jersey labor market, transforming the life sciences and technology sectors in New Jersey, requiring the leadership and partnership of government, higher education institutions, and enterprises.

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