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A Framework for Diversifying the Artificial Intelligence Talent Pipeline: Collaboration between Historically Black Colleges and Universities, Industry, and Government

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ABSTRACT

The rise of Artificial Intelligence (AI) creates significant opportunities for economies and societies, but its development is hampered by insufficient availability of diverse talent from traditionally disadvantaged communities, including African Americans. The objective of this study is to build on the concept of the talent pipeline, a pool of qualified candidates ready to fill organizational vacancies, to propose a theoretical framework for how to diversify the AI workforce. Our main finding is that there needs to be a synergy between historically black colleges and universities (HBCUs), industry, and government in order to create a diverse and inclusive workforce in AI. We point to actionable recommendations for organizations and existing successful examples for such talent pipelines on which we can build.

Keywords: AI, Artificial Intelligence, Diversity, Government, HBCU, Historically Black College and University, Industry, Talent pipeline

INTRODUCTION

The significance and reliance on Artificial Intelligence (AI) technologies for problem solving in all aspects of our lives has led to an increasing demand for AI professionals, thereby creating a talent shortage in the AI workforce.

Unfortunately, many AI companies are leaving significant amount of human capital on the table due to a lack of diversity in the AI workforce coming to the detriment of African Americans (Goins et al., 2022). To address the gap in this research in this article we present a diverse AI talent pipeline framework that involves collaboration between Historically Black Colleges and Universities (HBCUs), governments at all levels, and industries seeking AI talent.

AI is a broad term that encompasses anything that relies on machines taught through a variety of unique learning processes to reason or behave like people (Krafft et al. 2020). As a vital tool for innovation, problem solving and transforming human capital across all sectors, AI systems have become an important contributor to US economic growth and national security/ defense (Gehlhaus et al., 2021). Although AI systems play this significant role in all aspects of our economic, social, and political life, they also present a number of ethical challenges, including trust, fairness, bias, and transparency (Shams et al., 2023).

Recent work by Pal et al., (2024) notes that the root cause of these challenges is the lack of diverse perspectives in the design, development, implementation and evaluation of AI systems. Shams et al. (2023) also support this view, given that AI systems reflect discriminations, biases, perspectives, and values of their designers, developers, and operators. Consequently, it becomes critically important to ensure that diversity and inclusion principles are embedded in the development life cycle of AI systems. In addition to helping to foster creativity and innovations by bringing together different perspectives and experiences, embracing diversity in the AI workforce helps to increase the likelihood of AI systems being fair and trustworthy, thereby avoiding harm to marginalized and underserved communities (Hawk & Currie, 2024). The inability of technical solutions to effectively address the challenges in AI systems and the benefits of integrating diversity in AI ecosystems have received significant attention in recent years. Notwithstanding the awareness and evidence that diversity and inclusion in AI systems development is associated with positive outcomes, the AI workforce still suffers from a lack of diversity and inclusion, especially people of color and other marginalized groups (Goins et al., 2022).
We first review the talent pipeline literature and examples for a diverse AI talent pipeline. Then we provide the theoretical framework of the AI talent pipeline, and an actionable set of recommendations of how to create such a pipeline.

LITERATURE REVIEW

Talent Pipelines

The talent pipeline involves a pool of qualified candidates who are ready to fill organizational vacancies (Joyce, 2009; Stewart, 2016). Unfortunately, many business organizations have an ad hoc hiring pipeline to meet their talent needs

(Fuller & Sigelman, 2021) and neglect potentially fruitful collaborations with the government and universities.

Organizations ideally offer a compelling employment proposition and an appealing brand that attracts employees to work for them (Joyce, 2009, p.124). The individual organizational model is beneficial for business organizations that already have a well-established brand or an institutional history of talent recruitment. However, the recruitment of a significantly more ethnically or racially diverse workforce requires a much broader interorganizational framework focusing on the strengths of each organization. We identify the application of the talent pipelines to diversity of the AI workforce as a significant gap in the research literature. Therefore, we propose a practical and actionable framework that generates a diverse pipeline of AI talent and addresses the critical labor shortage in this emerging industry based on the thematic analysis from the relevant literature. Next, we turn to current initiatives in this space on which educators, corporate and government leaders can build.

Current Initiatives and Insights

The diverse pipeline of AI talent already exists in nascent forms. Rather than thinking of it as a difficult objective to obtain, stakeholders should build on existing frameworks and improve them to meet all the aforementioned objectives. This section highlights some of the HBCU-industry-government collaborative initiatives on developing a diverse AI talent pipeline.

Research Funding from the National Science Foundation (NSF)

The National Science Foundation (NSF) promotes interdisciplinary research at HBCUs, fostering innovation and collaboration. Scaling these initiatives and collaborating with leading research institutions could markedly improve student preparedness and research outcomes. NSF grants may also prioritize initiatives that tackle the ethical and social ramifications of AI (Donlon & Goel, 2023). NSF has the Industry-University Cooperative Research Center Programs where the government funds breakthrough research connecting industry and universities in fields like biotechnology, information (AI), communication and computing (AI), health and safety, advanced manufacturing, advanced materials, energy, and the environment (NSF IUCRC 2024). The NSF provides initial funding, and the government benefits from the spillover of added economic activity and tax revenues. Industry provides follow-on funding and receives access to university talent and intellectual property. Universities provide talent (faculty, students, post-docs) and receive funding from the other two institutions and have their students benefit from placement in jobs and internships.

Private Sector/ HBCU Initiatives

In collaboration with HBCUs, IBM provides access to quantum computing, the cloud, and artificial intelligence resources. This program offers students a thorough education but lacks internship opportunities and defined career pathways (Lee & Searles, 2021). To enhance the efficacy of this partnership, incorporating tailored mentorship programs and assured internships would be advantageous.

Numerous private companies, including Microsoft and Google, have established partnerships with HBCUs. For example, Microsoft provides grants and training resources to faculty at HBCUs, whereas Google's "Grow with Google" initiative offers education in artificial intelligence and coding. Google has a partnership with Howard University to train black college students in computer science courses on the Google campus (Elias, 2021). These programs show potential. However, they are often limited in scope, suggesting the necessity for a more comprehensive and cohesive approach (Burge et al., 2017). They also do not guarantee internships or jobs (Elias, 2021).

HBCUs are also taking an active role in finding collaborative opportunities with industry and government. AT&T and North Carolina State University have established the Center for Excellence in Cybersecurity Research, Education and Outreach which also has a focus on AI research (Smith, 2024). Howard University has an AI research program funded by Amazon (Shah, 2023). Morgan State University has established the Center for Equitable Artificial Intelligence and Machine Learning Systems, whose funding was initiated and is guaranteed by the State of Maryland (CBS, 2022).

RESEARCH METHOD

The methodology involves a systematic review of the existing research literature to develop a theoretical framework for diversifying the Artificial Intelligence (AI) workforce. The process was stratified by the use of specific search terms: "historically black colleges and universities (HBCUs)," "industry," "government," "talent pipeline," "human resource management," "AI workforce," and "diversity." These terms were selected to ensure comprehensive coverage of the multifaceted components involved in building a diverse and inclusive talent pipeline for the AI industry.

The research began with database searches across multiple academic repositories, including peer-reviewed journals, conference proceedings, and industry white papers. Studies were included if they addressed at least one of the core elements—HBCUs, industry, government roles, or talent pipeline development—and provided insights into diversity in the AI workforce. Gray literature, such as reports from governmental agencies and non-profit

organizations, was also considered to capture real-world applications and programs not covered in academic publications.

Each identified study was evaluated for its relevance and contribution to understanding the dynamics of workforce diversity in AI. The researchers conducted a thematic analysis to extract recurring patterns and categorize findings under overarching themes. For instance, findings related to HBCU-led education initiatives were grouped under "academic pathways," while insights about corporate diversity efforts were categorized under "industry practices."

The thematic synthesis revealed actionable recommendations and highlighted successful examples of talent pipelines from both academia and industry. The analysis also emphasized the critical role of government policies in fostering synergy between HBCUs, industry, and other stakeholders. This iterative process of review and synthesis provided a robust foundation for proposing a theoretical framework for diversifying the AI workforce. By employing this rigorous methodological approach, the study ensured a balanced and evidence-based discussion of actionable strategies to promote equity and inclusion in AI workforce development.

RESULTS

We identify the following components that are relevant to build a diverse AI talent pipeline.

Historically Black Colleges and Universities (HBCU)

Colleges and universities play an important role in the talent pipeline at the beginning of the talent cycle. Elite professional service firms hold career fairs in the Ivy League and other elite universities to find suitable job candidates, assuming that these universities concentrate on the best talent (Rivera, 2012). Unfortunately, only a very small number of all college students attend a top 25 institution, and only 7% of Ivy League students are black (Ede-Osifo, 2023) compared to 15% of total college enrollment (Journal of Blacks in Higher Education, 2023). Even worse, the increasing political opposition to affirmative action that reserves some slots for disadvantaged racial minorities has resulted in a decline in black enrollment in elite colleges like Harvard (Riley, 2024). Thus, conventional talent recruitment approaches neglect a significant talent pool.

We argue that HBCUs play an important role in closing the diversity gap in the AI workforce, as they enroll 8% of all black students and confer 23% of all black STEM graduates (White House, 2024). Since the COVID-19 pandemic, there has been a significant upsurge in applications to HBCUs such as Morgan State University (NPR, 2022), making these institutions important feeder organizations for AI companies seeking to hire top talent.

HBCUs were originally founded to provide higher education to black Americans, who were prevented from entering predominantly white institutions prior to the end of legal segregation in the 1960s. Even after the end of legal segregation, HBCUs have played an important role in promoting the upward social mobility of black Americans. 30% of HBCU graduates move up at least two income quintiles compared to their parents by age 30 compared to 18% in non-HBCUs. The impact of HBCUs on social mobility is much greater than that of other institutions because they enroll so many low-income students (White House, 2024). Furthermore, HBCUs offer a destigmatized, inclusive environment where black students can thrive academically. They offer curriculums that are tailored to black culture. They receive significant mentorship from HBCU faculty and staff who pursue the mission of advancing their careers (Price & Viceisza, 2023).

The high graduation rate for black STEM graduates is an important starting point for the recruitment of diverse AI talent. At an institutional level, some HBCUs like Howard, North Carolina A&T and Morgan State University are aiming to become R-1 research universities that involve increasing research expenditure and training more PhD graduates, many of which will be hired by AI companies. In addition to training of doctoral students, HBCUs must provide more critical coursework that provides actionable skills that can be used in the workplace. AI is a fast-changing industry, so HBCUs should develop shorter modules and certifications that can be adjusted to industry needs. Faculty inside and outside STEM should seek industry funding and collaborations that allow them to gain insight into needed industry skills. These collaborations allow faculty to engage their graduate and undergraduate students in AI-related work, easing their transition into the labor force.

The important role that HBCUs play in AI talent development is limited by the historic underfunding of HBCUs, which make up $12 billion compared to other state land-grant institutions (U.S. Department of Education, 2023). Public HBCUs have 54% smaller endowments than non-HBCU public colleges, and private HBCUs have 79% smaller endowments than non-HBCU private colleges (Goldman Sachs, 2023). High-profile private donations to HBCUs by the Bill & Melinda Gates Foundation or MacKenzie Scott reduce the gap in institutional resources (Weissman, 2023). The state of Maryland settled a 15-year federal lawsuit in 2021, which resulted in an increase in state funding to the four state HBCUs by $577 million spread over a decade (Shwe, 2021). More similar initiatives would need to take place in other states to make HBCUs more competitive to train more critical AI talent.

To address the barriers that can inhibit the advancement of underrepresented HBCUs in the AI workforce and ensure that they are well positioned to produce qualified graduates to meet the increasing demand for the AI workforce, it is important that AI educators and providers take deliberate and decisive actions to make AI training available to HBCUs.

Industry

Functional talent pipelines within organizations involve all steps in human resource management, including recruitment (how to find the best talent), training (how to make that talent the most valuable to the company), and retention (how to keep the talent in the organization) (Stahl et al., 2007). Firms look for talent from various colleges based on their academic record and assess the job candidates according to predetermined competencies (Bhatnagar, 2008). Good talent pipelines must emphasize mentoring relationships and programs, where younger employees are coached by older employees on how to perform the job well. Once employees are hired, they also need to receive ongoing career planning advice and a career advancement within the firm so they become confident in their career success (McGettingen & O'Neill, 2009). Employees receive 360-degree reviews within a year of hire to receive targeted feedback. Employees are kept motivated by being put on challenging assignments and rotated in different roles in the organization (Stahl et al., 2007). Employees who receive positive reviews are prioritized for wage raises, recognition, and promotion (Bhatnagar, 2008).

Industries must pay more attention to diversity in their workforce. These efforts may involve offering more diversity training to employees, writing inclusive job ads, having diversity policies, and creating affinity groups to allow for better networking and mentorship opportunities (Grossmann, 2024). However, there are limitations to keeping diversity efforts in siloed organizational settings. We argue that a more fruitful approach to meeting diverse AI talent objectives is to strengthen the linkages with HBCUs, industry and government.

Government

The US federal government plays an important role in developing AI talent. It has invested $6 billion dollars a year into workforce development programs, especially in response to trade shocks that displace many workers (Holzer, 2023). It also invests billions of dollars into the higher education system, including HBCUs. The Biden Administration has invested $16 billion in HBCUs via the American Rescue Plan (White House, 2024). The government's core competence is to provide the resources companies and HBCUs need to build their AI talent pipeline. Companies will tend to underinvest in their human capital, chasing short-term profit calculations (Cappelli, 2023), which can have deleterious effects on building a talent pipeline. As noted above, HBCUs are under-resourced institutions, which limits their ability to attract top faculty and graduate students to undertake cutting-edge AI research. This has the follow-on effect of limiting their ability to place students in leading AI firms. The government must close this funding gap.

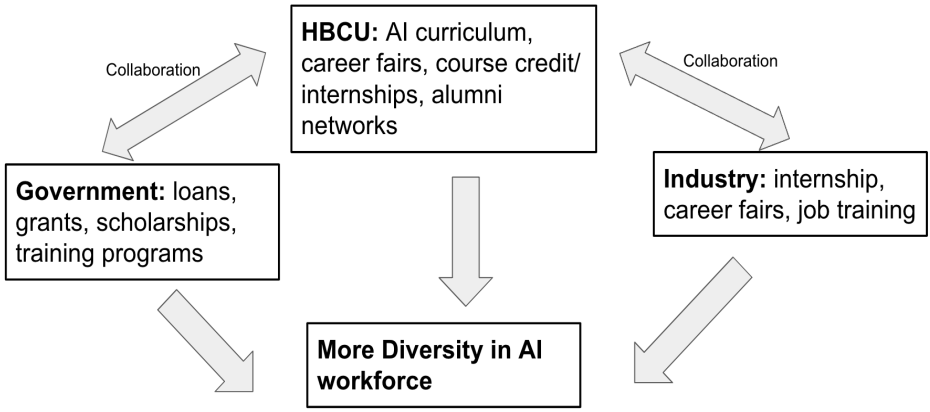
Beyond funding, the government also plays an important role in developing organizations that foster university-industry collaborations. Government grant-making organizations like the National Science Foundation can appeal to HBCU researchers to apply for lab funding to jump-start AI research and then use the products they create to build industry collaboration. As the profits become apparent, industry will increase their investment in these university labs and the government can taper off their funding streams. Importantly, during this entire process doctoral, masters and undergraduate researchers can be hired into the industry labs, thus creating an effective university-industry AI talent pipeline.

Lastly, the government itself should invest more in AI and hire more civil servants. The government has the duty to oversee the responsible use of AI, ensure uniform AI regulations and improve access to government services like veterans health care or social security benefits (Executive Office of the President, 2024). It is also easier for governments to lead efforts to promote racial integration and inclusivity. The US military was racially desegregated in 1948 and the civil service has been an important source of black middle class employment (Collins, 1983). Governments also indirectly benefit black-owned businesses through their procurement programs (Collins, 1983). Thus, we believe that the government as an employer itself forms an important part of the diverse AI talent pipeline.

Synergy Between the Three Institutions

After defining the three institutions (HBCUs, industry, and government) that develop a diverse pipeline of AI talent separately, we want to describe the synergy between them (Figure 1). HBCUs can offer an AI-focused curriculum, offer course credit/ internships for AI activities and draw on alumni networks of students working in AI companies. Industries should work with HBCUs to offer these internships, do career fairs in HBCUs and offer job training specifically for HBCU graduates. The government should provide resources to talented minority HBCU students in the form of loans, grants, scholarships, and training programs. Government funding of HBCU laboratories stimulates collaboration between HBCUs and industry. Lastly, institutions that create an AI workforce should take advantage of AI in human resource management (HRM) itself. Artificial intelligence tools in industries can automate hiring processes and reduce human bias in hiring decisions (Nawaz et al., 2024). The government can sponsor AI HRM research which can be carried out in HBCU AI labs. AI tools are new, and they can be adapted to serve valuable social objectives, such as increasing the diversity in the AI talent pipeline.

Figure 1: HBCU-Industry-Government Collaboration to Create a Diverse AI Talent Pipeline



Strategies

Having established the diverse AI pipeline framework, we can outline the objectives and strategies for addressing the underrepresentation of African Americans in artificial intelligence (AI). These strategies focus on structured internship programs, faculty and curriculum development, resource sharing, collaborative research, and addressing financial barriers.

To establish structured internship programs that conform to industry standards, efforts must focus on increasing the availability of grants, mentorships, internships, and job placement programs that provide HBCU students with practical AI experience. Additionally, it is essential to cultivate enduring collaborations between HBCUs and industry leaders to create clear pathways from education to employment (Angolia et al., 2014). Advisory boards comprising representatives from HBCUs, government entities, and private sectors should oversee the progress and sustainability of these partnerships. Shared goals and performance indicators, such as internship completions, student satisfaction, and employment outcomes, must be established to measure success. Open communication among stakeholders can be facilitated through bi-annual conferences and cross-sector roundtables. Ensuring that students who complete internships receive job placement support and mentorship is critical, alongside implementing assessment frameworks that align internships with students' academic goals and career aspirations. Furthermore, grants and shared resources should promote knowledge exchange and provide HBCU students access to high-impact research opportunities.

Enhancing faculty and curriculum development is another critical priority. Investments should be made to train HBCU faculty to deliver cutting-edge education in AI and data science that aligns with industry standards (Rahman et al., 2021). Developing specialized degrees, training, and certifications in areas such as machine learning, AI-powered cybersecurity, data science, and analytics will address AI workforce needs. Faculty members should have access to professional development opportunities, including research fellowships, workshops, seminars, and conferences, to stay informed about evolving AI trends and practices.

Promoting resource sharing and collaborative research involves establishing partnerships among HBCUs, industry, and government entities to tackle pressing AI issues. Shared access to cloud-based platforms, virtual laboratories, and computational resources is vital for enhancing research quality, improving student learning experiences, and overcoming resource constraints. Partnerships with cloud service providers, such as Microsoft Azure, Google Cloud, and AWS, could offer computational tools either free or at a reduced cost. Online repositories should be created to provide HBCUs with access to advanced research and instructional resources. HBCUs are encouraged to lead research on societal issues related to AI, including equity, bias, and privacy (Kuhlman et al., 2020). Collaborations between social scientists and AI researchers should also be promoted to address ethical challenges in technology.

Addressing financial roadblocks to AI education is an essential step in building a more inclusive pipeline. Targeted scholarships and financial aid programs should be established to support HBCU students pursuing AI careers. Funding should also be allocated to provide computational resources and software licenses, ensuring equitable access to AI education. Government grants should be advocated to subsidize research equipment and computational tools at HBCUs, thereby fostering an equitable and inclusive environment for AI talent development.

By implementing these strategies, we can address systemic barriers, enhance educational resources, and foster collaboration to significantly increase African American representation in the AI workforce.

Implementation Plan

Implementing a diverse AI talent pipeline is a complex process that requires collaboration among governmental bodies, industry sectors, and HBCUs. This endeavor should be carried out in several phases to ensure effectiveness and sustainability.

The first phase involves strategic plan coordination and cooperation. A steering committee must be established, comprising representatives from the government, industry, and HBCUs. This committee will work together to define

the program objectives and secure the necessary funding to support the initiative. Additionally, a detailed implementation timeline should be formulated to guide the program's development and execution.

The second phase focuses on faculty advancement and program initiation. Enhancing faculty professional development at HBCUs is critical, and this can be achieved by providing targeted training and research opportunities in artificial intelligence (AI). To support the transition from training to the workforce, internship programs should be developed to maximize the conversion rate of participants into permanent employment within the AI sector.

The third and final phase emphasizes attaining scalability and ongoing enhancement. Expanding the program to include additional HBCUs and industry partners will ensure broader participation and impact. Critical performance indicators (KPIs), such as employment outcomes, internship placements, and graduation rates, should be tracked to measure the program's success. Biannual evaluations should also be conducted to assess progress and make necessary adjustments to strategies, ensuring the program's continuous improvement and relevance. By following these phased steps, the initiative aims to create a sustainable and inclusive AI talent pipeline that benefits all stakeholders and addresses the pressing need for diversity in the AI workforce.

CONCLUSIONS

This study outlines a thorough strategy for creating a diverse and inclusive pipeline of AI talent. Its findings provide a holistic approach to leveraging the strengths of HBCUs, industry and government agencies to foster collaboration, tackle systemic inequities, and prepare students with the requisite skills for successful careers in artificial intelligence. In addition, the study recommendations will help position HBCUs as prominent leaders in ethical, innovative, and equitable artificial intelligence research and education. Instead of starting from scratch, stakeholders can build on existing institutional frameworks to build the diverse AI talent pipeline.

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