Can AI Bridge the Productivity Gap of an Aging Workforce?

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The aging global workforce poses significant challenges for organizations striving to sustain productivity amidst the physical and cognitive decline associated with aging. Artificial intelligence (AI) emerges as a transformative tool, offering solutions to enhance the capabilities of older employees, automate routine tasks, and support informed decision-making. This paper explores the potential of AI to counteract productivity losses linked to workforce aging through a comprehensive review of existing research. It synthesizes insights on the effects of aging on employee productivity, examines how AI can complement and augment the contributions of older employees, and evaluates the broader implications of AI integration on organizational efficiency. By exploring exploring the interplay between AI's potential and workforce aging and providing recommendations for inclusive AI implementation, the paper aims to contribute to the ongoing discourse on how AI can foster a sustainable, productive, and inclusive work environment in the face of demographic changes.

1   Introduction

As global demographics shift towards an older population, there is an observable increase in the proportion of older workers, potentially affecting productivity dynamics within the labor force (WHO, 2021; OECD, 2021). The combination of workforce aging and technological advancement necessitates innovative solutions to maintain productivity, underlining the urgency of integrating Artificial Intelligence (AI) into workplace processes. AI, which is a technology that simulates human intelligence in machines, offers promising avenues by enhancing the capabilities of older workers through automation and cognitive support (Calo, 2022). However, effective AI deployment requires strategic management to address skill gaps and organizational resistance (Criado et al., 2024). While the long-term effects of AI on productivity remain uncertain, early evidence indicates its potential to revolutionize labor dynamics (Brynjolfsson & McAfee, 2017). The transformative potential of AI to augment and even replace certain human tasks positions it as a revolutionary tool for addressing productivity declines due to workforce aging (Abril-Jiménez et al., 2022; Jong-Wha et al., 2021; Milanez, 2020).

This paper aligns with research emphasizing the oppurtunities of AI to counteract this demographic challenge and sustain economic growth (McKinsey Global Institute, 2020). The purpose of this paper is to explore how AI can bridge the productivity gap created by an aging workforce. Specifically, it seeks to analyze how AI can augment the productivity of older employees and what practical challenges are associated with this transformation. By addressing these aspects, this paper contributes to the broader understanding of how AI can be strategically utilized to enhance productivity in aging workforces. The overarching research question guiding this paper is: How can AI be effectively utilized to mitigate the productivity challenges associated with an aging workforce?

2   Population Aging

Population aging is a universal phenomenon, though its progression varies significantly across regions. Developing nations are experiencing a much more rapid pace of demographic transition compared to the historical patterns observed in developed economies (United Nations, 2020). Among developed regions, Japan is widely recognized as the most advanced example of demographic aging. Following

closely behind is the European Union (EU), which demonstrates distinct aging trends that reflect decades of low fertility rates and increased life expectancy (Eurostat, 2020).
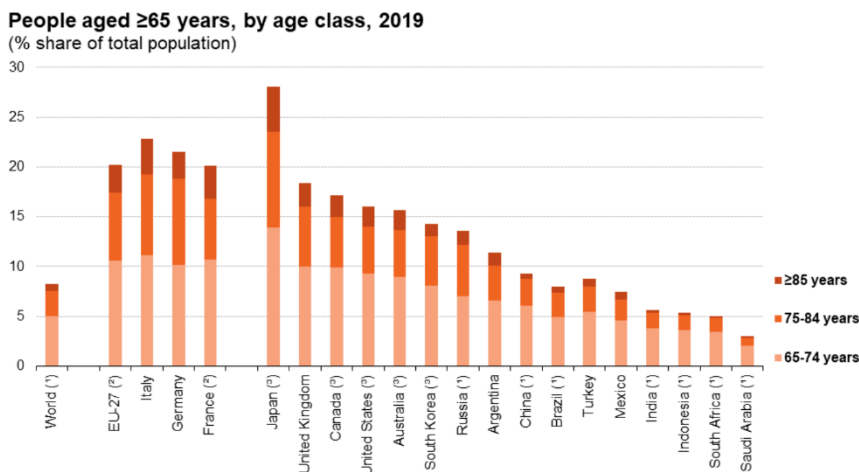

People aged ≥65 years, by age class, 2019
(% share of total population)

Figure 1: Population Aging
Source: Eurostat, 2022

The G20 countries present a diverse demographic landscape, spanning various stages of economic and population development. Figure 1 illustrates the share of older individuals (aged 65 years or more) within the total populations of G20 countries. As of 2015, older adults constituted 8.2% of the global population. Japan stood out with more than a quarter of its population aged 65 years or older (28.0% in 2018), followed by the EU-27, where older people comprised 20.3% of the population in 2019 (OECD, 2021). In contrast, several non-EU G20 countries recorded older population shares above the global average, including the United States (16.0% in 2018) and China (9.3% in 2015). Conversely, emerging economies like Mexico (7.4% in 2019), India (5.6% in 2015), Indonesia (5.4% in 2015), South Africa (5.0% in 2015), and Saudi Arabia (3.0% in 2015) reported relatively small proportions of older populations, reflecting their youthful demographic profiles and growing labor forces (United Nations, 2019).

2.1   Aging Workforce and Labor Productivity

The aging workforce represents a critical aspect of demographic change, posing significant implications for labor markets and organizational structures worldwide. The World Health Organization (WHO) projects that by 2050, the number of individuals aged 60 and over will rise to 2 billion, a nearly threefold increase from 2000 (WHO, 2021). Moreover, in developed countries, the share of workers aged 55 and over is projected to increase by 23% between 2018 and 2030 (OECD, 2021). This demographic shift has profound implications for the functioning and performance of organizations. To address these challenges, organizations must develop effective strategies for managing their aging workforce (Kim & Feldman, 2015). The implications of workforce aging on labor productivity are multifaceted, with significant debates surrounding the direction and magnitude of its impact. Productivity outcomes associated with an aging workforce depend on a balance between the benefits of accumulated experience and the potential drawbacks of age-related physical and cognitive decline.

Moreover, theoretical perspectives on age-related productivity effects are divided. Proponents of the experience-based hypothesis argue that older workers contribute positively to productivity due to their extensive knowledge, expertise, and problem-solving abilities accumulated over decades of employment. This view is particularly relevant in sectors that rely heavily on tacit knowledge and mentorship (Skirbekk, 2008; Börsch-Supan, 2013). Conversely, detractors highlight that the productivity of older workers may decline due to health deterioration, slower adaptation to technological advancements, and skill obsolescence (Bloom et al., 2010). Empirical studies indicate that productivity typically peaks in middle age, with significant variation across occupations and industries (Lazear, 2020; Göbel & Zwick, 2012).

Furthermore, evidence from longitudinal analyses suggests that workforce aging negatively influences aggregate productivity, primarily through reductions in total factor productivity (TFP). Using data from European countries spanning 1950 to 2014, studies have shown that a five-percentage-point increase in the proportion of workers aged 55–64 correlates with a three-percent decline in labor productivity (Aiyar et al., 2016). These results emphasize the structural challenges posed by demographic shifts, particularly in economies with rapidly aging populations. Breaking down labor productivity into its components—physical capital, human

capital, and TFP—research consistently identifies TFP as the primary mechanism through which workforce aging exerts its impact. TFP, which measures the efficiency of input utilization, is crucial for sustained economic growth. An aging workforce has been associated with a 2–4% reduction in TFP, reflecting inefficiencies in adapting to technological change and innovation (Aiyar et al., 2016; Acemoglu & Restrepo, 2017).

2.2   Effects of Aging on Employee Performance

The productivity of older workers has become a key focus of research, driven by the need to balance the benefits of accumulated experience with potential declines in physical and cognitive capabilities (Calvo-Sotomayor et al., 2019). While certain cognitive functions, such as memory and processing speed, may decline with age, other skills, including problem-solving, leadership, and emotional intelligence, often improve (Skirbekk, 2008). These attributes significantly contribute to workplace productivity, particularly in roles requiring interpersonal communication, strategic thinking, and decision-making (Harvard Business Review, 2022).

One of the most pressing challenges for aging workers is the growing skill gap, particularly as technological advancements reshape workplace requirements. Research indicates that older employees often face difficulties in adapting to new digital tools, with barriers such as limited access to training opportunities and resistance to change exacerbating the issue (Brynjolfsson & McAfee, 2014). Older workers are less likely to participate in skill development programs, leading to disparities in technological proficiency (Charness & Czaja, 2006). Resistance to change can stem from fear of failure or unfamiliarity with emerging technologies, further hindering adaptation to modern workplaces (Czaja & Sharit, 2012). This has profound implications for productivity at the individual level. Workers who struggle to adapt to new technologies may experience reduced efficiency and heightened stress. Moreover, their limited digital literacy can hinder collaboration in technology-driven workflows, diminishing their contributions to team productivity (Eurofound, 2020). For example, in industries where digital tools dominate, older employees who are not digitally proficient may face challenges in meeting performance expectations (Davenport & Kirby, 2016).

3   Artificial Intelligence

As Kreutzer and Sirrenberg (2020) explain, AI encompasses machines' ability to perform complex cognitive tasks, such as perception, reasoning, and independent learning. This allows AI to perform many tasks traditionally done by humans more efficiently and cost-effectively. As outlined by McKinsey Global Institute (2018), AI's transformative impact is evident through several facets including augmentation of human capabilities, substitution of human labor with automated solutions, and the development or enhancement of products and services. AI has the potential to reshape industries and economies, as well as everyday life of individuals (Kreutzer and Sirrenberg, 2020). AI has rapidly advanced, with applications in diverse areas transforming how we interact with technology and data.

Despite the positive potential of AI, there are concerns regarding its integration. Research from the USA suggests that about 80% of the workforce could have at least 10% of their tasks automated with the introduction of large language models, while nearly 20% of employees could see at least 50% of their tasks automated (Brynjolfsson et al., 2021). Unlike previous waves of automation, jobs requiring higher skills, including those of older employees, are more at risk. The European context poses unique challenges; while technology is essential for preserving the European social model amid demographic changes, AI without proper skills development and adaptation for the aging workforce could threaten jobs. Nearly 70% of participants in a Eurofound (2023) survey favored imposing restrictions on AI to protect jobs, indicating widespread anxiety about the displacement effects of technology. The exposure to AI has been generally positive in Europe, enhancing rather than replacing the workforce, although challenges remain in adapting to these changes as the workforce ages.

3.1   Artificial Intelligence and Aging Workforce

The dynamic between aging workforce and AI integration in the work environment is nuanced, presenting both opportunities and challenges in the labor market. AI alredy automates routine tasks and mimics complex human decision-making, reshaping the labor market through simultaneous job creation and displacement (Hunt et al., 2021; Rammer et al., 2022; Brynjolfsson et al., 2018). While AI facilitates operational efficiencies and the transformation of job roles and employment

structures, it raises concerns the therat of replacing many tasks, particularly among older workers (Agrawal et al., 2019). Nevertheless, it offers promising solutions for addressing skill gaps and and improving workability and productivity of older workers, particularly in the context of an aging workforce.

AI plays a pivotal role in providing innovative solutions for upskilling and reskilling, optimizing workloads, and enabling the retention of an aging workforce, which are critical in addressing labor shortages and adapting to a changing work environment. Studies confirm that older workers proficient in ICT and job-related training experience higher productivity and wages, emphasizing the need for policies that promote lifelong learning to mitigate the adverse effects of aging and support adaptation to technological advancements (Milanez, 2020; Jong-Wha et al., 2021). Personalized learning solutions are essential for integrating older employees into rapidly digitizing workplaces, where continuous skill development is paramount, as challenges such as low digital literacy and limited prior exposure to technology can hinder older employees from fully utilizing AI solutions (Acemoglu & Restrepo, 2020). Addressing these barriers requires targeted training programs designed to foster AI literacy and equip late-career workers with the skills necessary to thrive in a digital economy (Chetty, 2023).

AI-driven learning platforms, as demonstrated by Morandini et al. (2023), offer personalized, adaptive training programs tailored to organizational needs, fostering engagement and helping older employees acquire new competencies at their own pace. By emphasizing user-friendly interfaces and practical applications, these platforms help older workers overcome barriers often associated with traditional training methods (Charness & Czaja, 2006; Davenport & Kirby, 2016), enabling them to remain competitive and contribute to dynamic workplaces (Van Roy et al., 2022).

Beyond skill development, AI supports older workers by optimizing workload management. Automating repetitive or physically demanding tasks can alleviate the cognitive and physical strain that often accompanies aging. For instance, AI-powered tools designed for data analysis and administrative tasks not only enhance operational efficiency but also enable older employees to focus on high-value responsibilities that align with their strengths (Muro et al., 2019). This dual function of AI—facilitating skill acquisition and reducing workload—positions it as a critical

resource in maintaining productivity among older employees, even in roles heavily influenced by technological transformation (OECD, 2021).

Moreover, AI can enhance the quality of life and workplace participation of aging employees by addressing health-related challenges. Human-Centered AI, for example, focuses on creating adaptive tools that support older workers by monitoring health, mitigating occupational hazards, and promoting long-term functional well-being (Yang & Shen, 2015; Czaja & Ceruso, 2022). These solutions not only improve workability but also contribute to organizational sustainability by reducing absenteeism and retaining experienced employees. AI's ability to simultaneously address individual needs and organizational goals underscores its transformative potential in managing an aging workforce (Abril-Jiménez et al., 2022).

3.2   Artificial Intelligence and Productivity Enhancement

Organizations utilizing AI have seen net productivity gains with minimal negative impacts on overall employment, suggesting that AI's role extends beyond mere automation to enhancing the workforce with new skills and capabilities (Necula et al., 2024; Czarnitzki et al., 2023; Jong-Wha et al., 2021; McGowan and Corrado, 2019). AI enhances decision-making, helping humans »think and work faster«, potentially leading to higher productivity in complex and strategic roles (Trabelsi, 2024; Agrawal et al., 2019), while it also plays a crucial role in automating repetative tasks (Alderucci et al., 2020; Parteka & Kordalska, 2023; Brynjolfsson et al., 2021; McKinsey Global Institute, 2018) and managing more information, documents and projects effectively (Parteka & Kordalska, 2023; Alderucci et al., 2020), which improves operational efficiency. This operational boost can improve job satisfaction, as employees are engaged in more meaningful and fulfilling activities that utilize their unique skills and capabilities (McGowan & Corrado, 2019), enabling and empowering them to concentrate on higher-value tasks (Kreutzer & Sirrenberg, 2020).

AI-driven improvements can transform the workplace into a more efficient and dynamically productive environment (Comunale & Manera, 2024; Hunt et al., 2022). By fully integrating AI into daily operations, organizations can harness its potential to drive employee efficency and performance (Kreutzer & Sirrenberg, 2020; McGowan & Corrado, 2019; McKinsey Global Institute, 2018). Despite the

optimism, productivity growth in advanced economies remains low, challenging the effectiveness of AI in driving economic growth (Necula et al., 2024; Saam, 2024). Regardless of the obvious benefits, the broader impact of AI on employment and productivity is complex and context-dependent. While AI offers promising avenues for boosting productivity, its success largely depends on organizational strategy concerning AI implementation and the ability to adapt workforce skills accordingly (Hunt et al., 2021; Rammer et al., 2022). Thus, the challenge for organizations is not merely to integrate AI but to strategically harness its capabilities to enhance productivity while fostering an adaptable workforce, prepared for the evolving technological landscape (Tasheva & Karpovich, 2024).

4   Can Artificial Intelligence Compensate for Productivity Loss due to Aging?

The ongoing developments and applications of AI technologies hold the promise of continuous productivity improvements, paving the way for innovative future of work (Comunale & Manera, 2024; Hunt et al., 2022) and long-term workability of older workers by addressing factors that influence workability positively and negatively (Abril-Jiménez et al., 2022). In terms of supporting an aging workforce, human-centered AI tools are designed to improve long-term workability by enabling personalised learning, mitigating occupational hazards and aiding older workers in managing functional decline, supporting the evolving needs of aging employees (Abril-Jiménez et al., 2022; Dimitrios et al., 2019). AI supported automation can compensate for the decline in physical capabilities associated with aging, enabling older workers to remain engaged in meaningful work, thus extending their productive years (McGowan & Corrado, 2019). Nevertheless, empirical results on the link between AI use and productivity show mixed outcomes, indicating that whether AI can compensate for productivity loss due to aging is a complex question with no straightforward answer.

While some studies note significant productivity increase (measured by varous output indicators) connected to AI use (Necula et al., 2024; Babina et al., 2024; Czarnitzki et al., 2023; Calvino & Fontanelli, 2023; Rammer et al., 2022; Alderucci et al., 2020), some do not see universally corresponding rise (Xie & Yan, 2024; Parteka & Kordalska, 2023), suggesting that AI's benefits might depend on more factors rather than use of AI alone. The effectiveness of AI in enhancing

productivity seems closely tied to its integration level within firms; Necula et al. (2024) and Calvino and Fontanelli (2023) argue that substantial productivity gains are achievable when AI tools are fully embedded into the daily workflows, while Xie and Yan (2024) and Comunale and Manera (2024) highlihted regional and indutry-related differencess in AI effectiveness. Necula et al. (2024) concluded that the age of employees is as a significant factor predicting improved productivity with the use of AI, with younger workers more adaptable to AI tools, while Van Roy et al. (2022) argue that access to AI assistance increases productivity for all employees, with the greatest benefits enjoyed by the less experienced and those nearing retirement. Regarding the challenges of AI adoption among older employees, Necula et al. (2024) recommend targeted training programs for various age groups to maximize the benefits of AI. Therefore, strategic AI integration is vital not only for leveraging its technical potential but also for preparing the workforce, irrespective of age, for future technological shifts (Tasheva & Karpovich, 2024).

Maximizing the potential of older workers requires integrating AI solutions with comprehensive age management strategies, which can maintain human capital and mitigate productivity declines associated with aging (Hernæs et al., 2023; Calvo-Sotomayor et al., 2019). Lifelong learning initiatives are crucial for empowering older employees to remain competitive and engaged in evolving labor markets (World Economic Forum, 2020). This involves fostering an inclusive workplace culture, providing ergonomic adaptations and encouraging intergenerational collaboration to leverage the diverse strengths of a multigenerational workforce (Eurofound, 2020). By adopting a holistic approach that combines technology-driven solutions with supportive policies, organizations can mitigate productivity challenges associated with aging. Together, AI integration and skill development can help balance the negative impacts of an aging workforce with productivity gains, offered by AI (Dimitrios et al., 2019; Abril-Jimenez, et al., 2022), not only enhancing individual performance but also ensuring long-term organizational development amid rapid demographic and technological changes (Brynjolfsson & McAfee, 2014).

5   Conclusion

A strategic approach to AI integration can transform AI from a potential disruptor into a powerful ally for addressing demographic challenges. Realizing AI's benefits requires a comprehensive approach, focused on continuous learning and adaptation,

ensuring a workforce that remains robust, dynamic and capable of evolving with technological advancements. While AI can enhance productivity, integrating it in a way that supports and complements human workers, rather than replacing them, is essential for maximizing its benefits and unlocking new opportunities for growth and innovation in the context of demographic changes. To conclude, the productivity challenges associated with an aging workforce can be effectively mitigated through strategic interventions, fostering sustained economic vitality and long-term organizational growth.

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