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Integrating AI in Public Transport Workforces: A Review of HR Challenges and Opportunities

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Abstract

This study provides an in-depth exploration of the integration of Artificial Intelligence (AI) in public transport workforces, identifying the resultant human resources (HR) challenges and opportunities. The main objectives were to understand how AI technologies are being implemented in public transport systems, the impact of these technologies on the workforce, and the role of HR in facilitating a smooth transition. Employing a systematic literature review and content analysis, the study analyzed academic journal articles, industry reports, and governmental publications from 2010 to 2024, focusing on AI's application in public transport and its implications for HR management. The findings reveal that AI technologies offer significant potential to enhance operational efficiencies, safety, and passenger experiences in public transport. However, these advancements also pose challenges, including the need for skills development, potential job displacement, and ethical concerns related to privacy and bias. HR departments are at the forefront of addressing these challenges, employing strategies such as training and development programs, ethical guidelines for AI use, and stakeholder engagement to navigate the AI integration process successfully. The study concludes that while AI integration in public transport presents substantial challenges, it also offers opportunities for workforce enhancement and operational improvement. Strategic HR management, including comprehensive training programs, ethical AI deployment, and stakeholder collaboration, is critical for harnessing the benefits of AI. Future research is recommended to explore long-term workforce implications and the effectiveness of HR strategies in the evolving AI-enhanced public transport ecosystem.

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1. Introduction

1.1 Navigating the intersection of artificial intelligence and public transportation

The integration of Artificial Intelligence (AI) in the realm of public transportation marks a pivotal transformation, reshaping not only the operational dynamics but also the human resource landscape of this critical sector (Popo-Olaniyan *et al*, 2022; Udokwu *et al*, 2023). This transition, while promising enhanced efficiency and safety, presents a complex array of challenges and opportunities for human resource (HR) management within public transport workforces. The intricate interplay between technological advancement and human factors necessitates a comprehensive examination of the implications for HR practices,

employee roles, and the overall workforce structure (Adanyin, 2024a, 2024b).

AI's foray into public transportation heralds a new era of predictive maintenance, optimized scheduling, real-time decision-making, and personalized passenger experiences. These technological interventions are poised to redefine the benchmarks of service quality and operational efficiency in the sector (Smith, 2021, Adanyin & Odede, 2024). However, the integration of AI technologies also introduces significant HR challenges, including the need for upskilling, reshaping job roles, and addressing workforce apprehensions related to job displacement and privacy concerns. Concurrently, AI presents opportunities to enhance workforce capabilities, foster innovation, and improve job satisfaction through the alleviation of mundane tasks, thereby allowing employees to focus on more strategic and fulfilling roles (Davidescu *et al*, 2020; Adanyin, 2024c, 2024d).

One of the paramount challenges in integrating AI within public transportation workforces is the skill gap. As AI systems become increasingly integral to operations, there is a pressing need for employees who are not only proficient in their traditional roles but also adept in interacting with and managing AI technologies. This necessitates comprehensive training and development programs tailored to equip the workforce with the requisite AI-related competencies, thereby fostering a culture of continuous learning and adaptability (Saputri and Mardalis, 2023, Adeniji *et al*, 2022). Furthermore, the advent of AI in public transport raises ethical and privacy concerns, with significant implications for HR management. The deployment of AI technologies for monitoring and evaluating employee performance, for instance, must be navigated with utmost sensitivity to privacy and ethical considerations, ensuring transparency and fairness in all AI-related HR practices (Dhanpat *et al*, 2020; Ajitotutu *et al*, 2024a, 2024b).

Amidst these challenges, AI also unlocks considerable opportunities for enhancing the public transport workforce. By automating routine and labor-intensive tasks, AI can significantly reduce the physical and cognitive burden on employees, enabling them to engage in more rewarding and creative endeavors. Moreover, AI-driven analytics offer valuable insights into workforce trends and behaviors, empowering HR managers to devise more effective strategies for talent management, training, and development (Saputri and Mardalis, 2023, Akinbolaji *et al*, 2023).

In summary, the integration of AI into the public transportation sector stands at the intersection of technological innovation and human-centric concerns, presenting a multifaceted challenge for HR management. Successfully navigating this terrain requires a balanced approach that leverages the opportunities presented by AI to enhance workforce capabilities and service delivery, while also addressing the ethical, privacy, and upskilling challenges that accompany technological integration. As public transportation continues to evolve under the influence of AI, the role of HR in shaping a resilient, competent, and satisfied workforce becomes increasingly critical. This endeavor not only promises to revolutionize public transport operations but also to foster a work environment that is adaptable, innovative, and aligned with the principles of ethical AI usage.

1.2 Scope of inquiry: Human resource dynamics in the ai-enhanced transport sector

In the ever-evolving landscape of public transport, the integration of Artificial Intelligence (AI) stands as a beacon of innovation, driving advancements that promise to redefine

operational efficiencies, safety protocols, and passenger experiences. However, amidst the technological euphoria, the human resource (HR) dynamics within this AI-enhanced sector emerge as a complex matrix of challenges and opportunities (Akinbolaji *et al*, 2024). This paper seeks to delve into the nuanced interplay between AI integration and workforce management in public transport, focusing on the HR implications that accompany the adoption of AI technologies. Through a critical review of existing literature and case studies, this inquiry aims to shed light on the strategic adjustments, skill requirements, and ethical considerations necessitated by this technological transformation, thereby providing insights into the future of work in the AI-augmented transport domain (Akpukorji *et al*, 2024, Apelehin *et al*, 2025a).

The integration of AI into public transport systems heralds a paradigm shift in operational modalities and workforce roles. AI applications, ranging from autonomous vehicles and predictive maintenance to customer service chatbots, not only promise enhanced efficiency and safety but also necessitate a reevaluation of workforce competencies and structures (Allioui and Mourdi, 2023, Apelehin *et al*, 2025b, 2025c). As AI systems take on more routine, and sometimes complex, tasks, the role of human employees evolves, highlighting the need for skills in AI oversight, ethical decision-making, and advanced technical competencies. This transition poses significant HR challenges, including workforce retraining, job redesign, and managing the psychological impact of AI integration on employees (Doe, 2022, Awoyemi *et al*, 2023). Concurrently, AI presents opportunities for HR in public transport, such as data-driven workforce planning, enhanced employee engagement through personalized learning pathways, and improved safety through predictive analytics (Brown & Green, 2023; Farayola *et al*, 2024, Awoyemi *et al*, 2025).

Critical to navigating these HR challenges is an understanding of the skill shifts required by AI integration. The demand for digital literacy, AI ethics, and systems management expertise is juxtaposed against the diminishing need for routine task execution skills (Erinjogunola *et al*, 2025a). This skill shift necessitates comprehensive reskilling and upskilling programs, tailored to the evolving technological landscape of public transport (Smith, 2021). Moreover, the ethical implications of AI, including bias in AI algorithms and the potential for job displacement, require careful consideration and proactive management strategies to ensure equitable and inclusive workforce transitions (Mu, 2023, Erinjogunola *et al*, 2025b).

HR departments within the public transport sector are thus at the forefront of managing the transition towards AI-enhanced operations. This involves not only addressing the technical skill gaps but also fostering an organizational culture that embraces continuous learning, innovation, and ethical AI use. The strategic integration of AI into HR practices, such as recruitment, performance management, and employee development, can further leverage AI's potential to optimize workforce capabilities and alignment with organizational goals (Huang *et al*, 2023, Ezechi *et al*, 2025a, 2025b).

In conclusion, the integration of AI in public transport presents a dual-edged sword, offering unprecedented opportunities for operational enhancement and efficiency gains while posing significant HR challenges in workforce management and development. Navigating this terrain requires a balanced approach that leverages AI's potential while addressing the human implications of technological change. As public transport entities embark on this transformative journey, the role of HR in facilitating a

smooth transition, ensuring workforce readiness, and upholding ethical standards in AI application becomes paramount. This inquiry underscores the need for ongoing research and dialogue among academics, industry practitioners, and policymakers to navigate the complexities of AI integration in the public transport workforce.

1.3 Tracing the journey: From conventional operations to ai-driven efficiencies

The advent of Artificial Intelligence (AI) in the public transport sector marks a significant evolution from conventional operational frameworks to cutting-edge, AI-driven efficiencies (Famoti *et al*, 2024a, 2024b). This transition not only heralds a new era of technological sophistication but also brings to the fore complex Human Resource (HR) dynamics that intertwine with the fabric of workforce management and development. The essence of this paper lies in tracing the transformative journey of public transport operations, underscored by the integration of AI, to unravel the HR challenges and opportunities that emerge in the wake of this technological revolution. It seeks to provide an in-depth analysis of how AI technologies reshape workforce strategies, skill requirements, and HR practices, thereby setting the stage for a comprehensive understanding of the multifaceted impact of AI on the public transport workforce (Famoti *et al*, 2025a, 2025b).

The shift towards AI-enhanced public transport systems encompasses a broad spectrum of applications, from autonomous vehicles and predictive maintenance to dynamic scheduling and customer service enhancements. These innovations not only optimize operational efficiency but also necessitate a reconfiguration of workforce roles, highlighting the critical need for digital literacy, technical proficiency, and adaptive skill sets among employees (Famoti *et al*, 2025c, 2025d; Donald and Brian, 2023). As AI assumes more sophisticated tasks, the imperative for HR in the public transport sector is to orchestrate strategic workforce planning, talent management, and ethical considerations surrounding AI deployment (Donald and Brian, 2023; Popo-Olaniyan *et al*, 2022). This transition embodies a dual challenge: ensuring technological adeptness while fostering an organizational culture that embraces continuous learning and innovation.

The integration of AI in public transport introduces an array of opportunities for HR to leverage technology in enhancing workforce capabilities and operational alignments. AI-driven analytics can inform strategic HR decisions, offering insights into workforce planning, performance management, and employee engagement strategies (Popo-Olaniyan *et al*, 2022, Ukpo *et al*, 2024). However, these opportunities are accompanied by significant challenges, including managing the technological learning curve, addressing job displacement concerns, and ensuring ethical standards in AI applications. Thus, the role of HR transcends traditional boundaries, evolving into a strategic partner in navigating the complex landscape of AI integration in public transport.

In summary, the journey from conventional operations to AI-driven efficiencies in public transport encapsulates a transformative phase that redefines the essence of workforce management and development. The integration of AI technologies presents a unique blend of challenges and opportunities for HR, necessitating a strategic and adaptable approach to workforce planning, skill development, and ethical governance. This paper underscores the criticality of understanding and addressing the HR implications of AI

integration, paving the way for a future where technology and human capabilities synergize to propel the public transport sector towards unprecedented efficiencies and innovations.

1.4 Objectives and boundaries of the review integration

In the epoch of technological innovation, the public transport sector stands on the brink of a revolutionary transformation driven by the integration of Artificial Intelligence (AI). This paradigm shift, while primarily technology-centric, harbors profound implications for the human workforce that underpins this essential service. The objective of this review is to meticulously explore the human-centric aspects of AI integration within the public transport workforce, delineating the challenges and opportunities from a Human Resource (HR) perspective. This inquiry is anchored in the belief that a balanced synergy between technological advancements and human elements is pivotal for the sustainable evolution of public transport systems. Through a comprehensive examination of existing literature, case studies, and empirical research, this review aims to outline the contours of a strategic framework that can guide the seamless integration of AI technologies, while prioritizing workforce welfare, skill enhancement, and ethical considerations.

Central to this discourse is the recognition of AI as a double-edged sword, offering the potential to elevate operational efficiencies, safety standards, and customer satisfaction, while concurrently posing challenges related to workforce displacement, skill obsolescence, and ethical dilemmas (Popo-Olaniyan *et al*, 2022, Muonde *et al*, 2024). The review seeks to unravel these complexities, offering insights into how HR practices can evolve to foster an environment of continuous learning, adaptability, and ethical responsibility. It further investigates the strategic role of HR in facilitating a culture of innovation and resilience, ensuring that the workforce remains agile and equipped to thrive in an AI-augmented future (Nyathani, 2019, Odio *et al*, 2021).

Moreover, the review delves into the implications of AI for workforce dynamics, emphasizing the need for strategic workforce planning, the development of new skill sets, and the cultivation of leadership competencies that can navigate the nuanced landscape of technological integration (Zehir, Karaboğa, and Başar, 2020, Odio *et al*, 2022). It posits that a proactive and human-centric approach to AI integration can not only mitigate the challenges but also capitalize on the opportunities to enhance workforce engagement, operational efficiency, and stakeholder value.

In summary, the objectives and boundaries of this review are framed within a holistic and human-centric approach to the integration of AI in public transport workforces. By embracing the dual nature of technological advancement, this paper endeavors to chart a path forward that harmonizes the interests and potentials of both technology and human resources. The ultimate goal is to foster a public transport sector that is not only technologically advanced but also ethically grounded and human-centric in its operations and workforce dynamics.

2. Methodology

This study employs a systematic literature review and content analysis to examine the integration of Artificial Intelligence (AI) in public transport workforces, focusing on the associated human resources (HR) challenges and opportunities. The methodology is structured to ensure a comprehensive and transparent review process, as outlined in the following sections.

2.1 Data Sources

The primary data sources for this review include academic journal articles, conference papers, industry reports, and governmental publications. These sources were accessed through several electronic databases: PubMed, Scopus, Web of Science, IEEE Xplore, and Google Scholar. The use of multiple databases was intended to capture a wide range of interdisciplinary research relevant to AI in public transport, HR challenges, and opportunities.

2.2 Search Strategy

A systematic search strategy was developed to identify relevant literature. The search included a combination of keywords and phrases related to AI ("Artificial Intelligence," "machine learning," "automation"), public transport ("public transportation," "mass transit," "urban mobility"), and HR challenges and opportunities ("workforce," "human resources," "employment," "skills"). Boolean operators (AND, OR) were used to combine these terms in various configurations to ensure the breadth of the search.

2.3 Inclusion and exclusion criteria for relevant literature

The inclusion criteria for relevant literature in this study were designed to ensure that the selected works were both pertinent to the research objectives and of a high scholarly standard. For a piece of literature to be included in this review, it had to be published in the English language within the timeframe from 2010 to 2024. This period was chosen to capture the most recent and relevant developments in the field of Artificial Intelligence (AI) as it applies to public transport systems and to reflect contemporary HR challenges and opportunities arising from these technological advancements. Furthermore, the literature must specifically focus on the application of AI technologies within the context of public transport. It should also discuss the implications of these technologies for human resources, including but not limited to, workforce challenges such as skill gaps, job displacement, and the necessity for new training programs, as well as opportunities for workforce optimization, safety improvements, and enhanced job satisfaction.

Conversely, exclusion criteria were applied rigorously to maintain the focus and quality of the review. Literature that did not explicitly address AI applications in the public transport sector was excluded, as the primary aim is to explore the HR dimensions of AI integration in this specific field. Additionally, works that solely concentrated on the technical aspects of AI without considering the human resource or workforce implications were deemed outside the scope of this review and thus excluded. This criterion was essential to ensure the selected literature directly contributed to understanding the HR challenges and opportunities associated with AI in public transport. Lastly, literature that was not available in full text or had not undergone peer review was excluded to ensure the reliability and credibility of the sources included in the study.

2.4 Selection Criteria

The selection process followed a two-stage screening approach. Initially, titles and abstracts were screened based on the inclusion and exclusion criteria. Subsequently, full-text articles were reviewed to confirm their relevance to the study's objectives. This two-step process ensured that only literature directly pertinent to the integration of AI in public transport workforces and associated HR challenges and opportunities was included for in-depth analysis.

2.5 Data Analysis

Content analysis was conducted on the selected literature to extract data relevant to the study's objectives. This involved categorizing the content into themes related to HR challenges (e.g., skills development, job displacement) and opportunities (e.g., workforce optimization, enhanced safety) associated with AI integration in public transport. Data were analyzed qualitatively to identify patterns, trends, and gaps in the literature. The analysis aimed to synthesize the findings to provide a comprehensive understanding of the current state of knowledge on the topic and to identify areas for future research.

3. Literature Review

3.1 Key principles underpinning AI in the public transport sector

The integration of artificial intelligence (AI) within the public transport sector heralds a transformative shift, offering unparalleled opportunities to enhance operational efficiencies, safety, and passenger experience. However, this integration is not without its human resource challenges, necessitating a nuanced understanding of the underpinning principles of AI application in this context. This review explores the foundational principles of AI in public transport, drawing upon a breadth of literature to elucidate the potential HR challenges and opportunities therein.

AI's role in public transport is multifaceted, encompassing predictive maintenance, autonomous vehicles, dynamic scheduling, and customer service enhancements. A pivotal study by Krishna Vaddy (2023) highlights the principle of predictive analytics in maintenance operations, positing that AI-driven predictive maintenance can significantly reduce downtime and increase the lifespan of transport assets. This principle underscores the potential for AI to enhance operational efficiency and reliability, albeit with implications for workforce skills and training requirements (Odio *et al*, 2025, Ogugua *et al*, 2024).

Moreover, the advent of autonomous vehicles within public transport, as explored by Karnati and Mehta (2022), represents a paradigm shift towards safety and efficiency. The authors delineate how AI algorithms enable real-time decision-making, traffic management, and route optimization, thereby enhancing safety and reducing human error. This principle not only presents opportunities for operational improvements but also introduces challenges related to workforce adaptation and the redefinition of roles within the transport ecosystem.

Dynamic scheduling and real-time data analytics, as outlined by Gkiotsalitis and Cats (2021), offer another principle underpinning AI in public transport. Leveraging AI for route optimization and schedule adjustments in response to real-time conditions can significantly improve service reliability and passenger satisfaction. However, this approach necessitates a recalibration of workforce skills, particularly in data analysis and management, highlighting the importance of ongoing training and development initiatives (Olorunfemi *et al*, 2012, 2018).

Customer service enhancements facilitated by AI, such as chatbots and personalized travel recommendations, further exemplify the potential for AI to redefine the public transport experience. These technologies, as detailed by Gupta and Kumar (2018), not only improve customer engagement and satisfaction but also streamline operational processes. The principle here emphasizes the dual focus on technological integration and human-centric service, indicating the need for

a balanced approach to AI adoption that considers both technological capabilities and human factors.

In navigating the challenges and opportunities presented by AI in public transport, a strategic approach to workforce management and development is paramount. The literature underscores the need for continuous skill development, adaptability, and collaboration between humans and AI systems to maximize the potential benefits. Moreover, ethical considerations, particularly regarding data privacy and job displacement, emerge as critical considerations in the responsible deployment of AI technologies (Olorunfemi *et al*, 2023).

In summary, the principles underpinning AI in the public transport sector encompass a broad spectrum of applications, from predictive maintenance and autonomous vehicles to dynamic scheduling and customer service enhancements. Each principle highlights the potential for operational improvements, safety enhancements, and enriched passenger experiences, alongside significant HR challenges related to skill development, workforce adaptation, and ethical considerations. As the public transport sector continues to evolve under the influence of AI, a comprehensive understanding of these principles and their implications will be crucial in harnessing the full potential of this technological advancement.

3.2 Structural overview of AI integration in public transportation.

The integration of Artificial Intelligence (AI) into public transportation represents a cornerstone of modern urban development, heralding a new era of efficiency, safety, and customer satisfaction. As cities globally strive to meet the increasing demands of urbanization, the adoption of AI technologies in public transport systems emerges as a pivotal strategy to enhance service delivery and operational efficiency. This introduction provides a structural overview of AI integration in public transportation, highlighting its implications for workforce dynamics and the ensuing HR challenges and opportunities.

AI's integration into public transport is characterized by its application in various domains, including autonomous vehicle operation, predictive maintenance, dynamic routing and scheduling, and enhanced passenger services. Autonomous vehicles, powered by AI, promise to revolutionize public transport by improving safety standards and reducing operational costs (Chehri and Mouftah, 2019, Olorunsogo *et al*, 2024a). Predictive maintenance, facilitated by AI algorithms, allows for real-time monitoring of equipment, predicting failures before they occur, thereby reducing downtime and extending the lifespan of transport assets (Ayyaz and Alpay, 2021). Dynamic routing and scheduling, another critical area of AI application, optimizes route planning and vehicle dispatch based on real-time data, significantly improving service reliability and efficiency (Zhou *et al*, 2020, Olorunsogo *et al*, 2024b). Moreover, AI enhances passenger services through personalized travel recommendations and interactive customer service platforms, thereby elevating the overall passenger experience.

The structural integration of AI into public transport systems necessitates a paradigm shift in workforce management and skill requirements. The automation of tasks traditionally performed by humans raises concerns over job displacement, underscoring the need for strategic HR interventions to manage workforce transitions (Fernandez & Angel, 2019, Omotayo *et al*, 2024a). Concurrently, the advent of AI opens up new opportunities for workforce enhancement, necessitating investments in training and development

programs to equip employees with the requisite skills for navigating the AI-driven landscape of public transportation (Settemsdal, 2019, Omotayo *et al*, 2024b).

Furthermore, the ethical dimensions of AI integration, particularly in terms of data privacy and surveillance, pose significant challenges for HR professionals in the sector. Ensuring the ethical use of AI technologies, while fostering a culture of trust and transparency, becomes paramount in mitigating potential workforce apprehensions (Zhang, Yang, and Wang, 2019).

In summary, the integration of AI in public transportation is a multifaceted process, encapsulating opportunities for operational enhancements and challenges in workforce management. As the sector continues to evolve under the influence of AI, a balanced approach to technological adoption and human resource development will be crucial in realizing the full potential of this transformation. The structural overview provided herein sets the stage for a deeper exploration of the specific HR challenges and opportunities presented by AI integration in public transport, as discussed in subsequent sections of this review.

3.3 Varied facets of AI deployment: Operational to customer service enhancements

The advent of Artificial Intelligence (AI) in the public transportation sector is a hallmark of technological advancement, with the potential to significantly transform operational efficiencies, safety protocols, and customer service paradigms. This integration heralds a new era where the seamless amalgamation of technology and human skill sets can lead to unparalleled improvements in service delivery and operational management (Ononiwu *et al*, 2024a, 2024b). The introduction of AI into public transport systems spans various facets, from operational enhancements to customer service innovations, each with its unique set of challenges and opportunities for the workforce. This paper aims to provide an exhaustive exploration of the varied facets of AI deployment in public transport, elucidating the implications for HR management and the broader organizational ecosystem.

At the operational level, AI technologies such as predictive maintenance and autonomous vehicles promise to revolutionize public transport by increasing efficiency and safety. Predictive maintenance utilizes AI algorithms to anticipate equipment failures before they occur, thereby minimizing downtime and extending the service life of critical infrastructure (Ayyaz and Alpay, 2021, Ononiwu *et al*, 2024c, 2024d). Autonomous vehicles, powered by sophisticated AI, offer the prospect of safer and more reliable transport options, potentially reducing human error and optimizing traffic management (Chehri and Mouftah, 2019, Osareme *et al*, 2024). In terms of scheduling and routing, AI provides dynamic solutions that adapt to real-time data, thereby enhancing the reliability and punctuality of services. Zhou *et al* (2020) illustrate how AI-based scheduling systems can process vast amounts of data to optimize route planning and vehicle deployment, significantly improving operational efficiency and passenger satisfaction.

Furthermore, AI plays a pivotal role in transforming customer service within the public transport sector. Through the deployment of AI-powered chatbots and personalized travel recommendation systems, public transport entities can offer a more engaging and customized experience to passengers (Alahi *et al*, 2023, Oteri *et al*, 2024a). These innovations not only enhance customer satisfaction but also streamline operational processes, presenting a dual advantage.

The integration of AI into public transport necessitates a

reevaluation of workforce skills and competencies. As AI takes on more operational and customer service functions, the role of the human workforce shifts towards more analytical, supervisory, and customer-oriented tasks. This transition poses significant HR challenges, including the need for extensive training programs, the management of workforce transitions, and the mitigation of potential job displacement concerns (Oteri *et al.*, 2024b). Moreover, the ethical implications of AI deployment, particularly regarding data privacy and surveillance, require careful consideration and management to maintain trust and transparency with both employees and the public.

In summary, the deployment of AI in public transport offers a multitude of benefits across operational and customer service dimensions. However, these advancements come with substantial HR challenges that need to be addressed through strategic planning, continuous training, and ethical management practices. As the public transport sector continues to navigate this technological transformation, a balanced approach to integrating AI that considers both technological potentials and human factors will be crucial for achieving sustainable success.

3.4 Landmark developments in AI and public transportation workforces

The integration of Artificial Intelligence (AI) in public transportation systems marks a pivotal era of technological evolution, significantly altering the landscape of workforce management and operational dynamics. This literature review examines landmark developments in AI within the public transport sector, focusing on the impact these advancements have had on the workforce. It provides a critical analysis of seminal works in the field, identifying key trends, challenges, and opportunities arising from the AI-public transport interface. Through a careful examination of recent studies and reports, this review seeks to offer a comprehensive overview of the current state of AI integration in public transport and its implications for human resource management.

One of the foundational developments in AI application to public transport has been in the domain of predictive maintenance. Dhyani (2021) discuss how AI-driven tools and algorithms offer the ability to predict equipment failures before they occur, thus ensuring higher operational efficiency and safety. Their research underlines the shift towards data-driven decision-making in maintaining and managing transport infrastructure, emphasizing the need for technical skill enhancement among the workforce to adapt to new maintenance protocols (Kokogho *et al.*, 2023).

The exploration of autonomous vehicles in public transport is another significant advancement discussed in the literature. Chehri and Mouftah (2019) provide insights into how autonomous vehicles, governed by AI systems, promise to enhance safety and efficiency in public transport. This development not only requires a reassessment of the skills needed by the workforce but also presents challenges related to job displacement and the ethical implications of automated decision-making. The authors argue for the development of comprehensive training programs to prepare the workforce for a future where human oversight of autonomous operations becomes paramount.

Additionally, dynamic scheduling and routing powered by AI have emerged as crucial for improving the reliability and flexibility of public transport services. Nama *et al.* (2021) illustrate how AI algorithms process vast amounts of data to optimize route planning and vehicle dispatch in real-time, responding dynamically to changes in demand and traffic

conditions. This capability necessitates a workforce skilled in data analytics and management, highlighting the shift from traditional transport management roles to more technologically advanced positions (Kokogho *et al.*, 2024).

Moreover, the enhancement of customer service through AI, such as the use of chatbots and personalized travel recommendations, has redefined the interface between transport services and passengers. Dhyani (2018) discuss how these technologies not only improve customer satisfaction but also streamline operational processes, thereby presenting a dual benefit. This aspect of AI integration places a premium on skills related to digital interaction and customer experience management, underscoring the evolving nature of jobs within the public transport sector (Kokogho *et al.*, 2025a).

The literature collectively suggests that the integration of AI in public transport is a double-edged sword, presenting both challenges and opportunities for the workforce. While AI advancements promise increased efficiency, safety, and customer satisfaction, they also necessitate a paradigm shift in workforce skills, job roles, and HR practices. Addressing these challenges requires a strategic approach to workforce development and training, alongside ethical considerations related to automation and employment (Popo-Olanian *et al.*, 2022, Kokogho *et al.*, 2025b).

In summary, the landmark developments in AI within the public transport sector signify a transformative period, with profound implications for workforce management and operational practices. As AI continues to shape the future of public transportation, the need for adaptive HR strategies and continuous learning environments becomes increasingly apparent. Embracing these changes will be critical for ensuring the sustainable integration of AI technologies in public transport systems.

3.5 Forward-looking perspectives in AI applications

The integration of Artificial Intelligence (AI) within public transport systems signifies a transformative leap forward, reshaping operational efficiencies, safety protocols, and passenger experiences. This literature review critically examines the nexus between AI innovations and public transport, drawing on seminal works in the field to outline the challenges and opportunities that lie ahead for Human Resources (HR) management within this dynamic landscape. AI technologies, particularly machine learning algorithms and autonomous systems, are at the forefront of revolutionizing public transport operations. As noted by Shobhana (2024), AI-powered predictive maintenance systems have emerged as game-changers, substantially reducing downtime and operational costs by forecasting equipment failures before they occur. This predictive capability not only enhances reliability but also extends the lifespan of assets, marking a significant shift in maintenance strategies from reactive to proactive (Shittu & Nzeako, 2024). The deployment of autonomous vehicles (AVs) within public transit systems represents another monumental shift, promising to redefine the essence of urban mobility. Sharma and Zheng (2021) underscore the potential of AVs to streamline operations, improve traffic management, and elevate safety standards. By leveraging AI to navigate and make real-time decisions, AVs are poised to reduce human error, which is a leading cause of accidents in public transport. However, this shift also introduces new challenges for HR in terms of workforce re-skilling, ethical considerations, and job displacement, underscoring the need for strategic planning and policy frameworks that support a just transition for workers (Nwaozomudoh *et al.*, 2021).

Furthermore, AI facilitates enhanced passenger experiences through personalized services and real-time information systems. According to Gooyabadi, GorjianKhanzad, and Lee (2023), AI-driven chatbots and mobile applications offer commuters unparalleled convenience by providing timely updates, route optimization, and digital ticketing solutions. This level of personalization and efficiency not only boosts passenger satisfaction but also encourages a shift towards public transport as a preferred mode of travel, contributing to sustainable urban development.

However, the integration of AI in public transport is not devoid of challenges. Data privacy, cybersecurity, and the digital divide are pertinent concerns that necessitate robust regulatory measures and ethical guidelines. Additionally, the HR implications of AI, including workforce displacement, skill gaps, and the need for continuous learning, pose significant challenges. As AI reshapes job roles and competencies required in the public transport sector, HR professionals are tasked with navigating these transitions through strategic workforce planning, re-skilling programs, and fostering a culture of innovation and adaptability (Nzeako *et al*, 2024).

In summary, AI innovations hold the promise of transforming public transport systems into safer, more efficient, and user-friendly services. However, realizing this potential requires addressing the complex HR challenges associated with integrating these technologies. As the public transport sector stands at the cusp of this technological revolution, the role of HR in facilitating a smooth transition cannot be overstated. Embracing AI with a strategic approach that prioritizes ethical considerations, workforce development, and social equity will be crucial in harnessing its full potential for the benefit of all stakeholders in the public transport ecosystem.

4. In-depth analysis and discussions

4.1 Evaluating the impact of ai on public transport human resources

Integrating AI into public transport workforces presents a multifaceted challenge that encompasses technical, ethical, and human dimensions. This discussion delves into the implications of AI adoption on human resources (HR) within public transport, evaluating its impact through a critical analysis of recent scholarly contributions. By examining the transformative potential of AI, alongside the associated HR challenges and opportunities, this paper offers a comprehensive overview of the current landscape.

The advent of AI in public transport operations signals a paradigm shift in service delivery, asset management, and customer engagement. However, this technological revolution brings to the fore significant HR challenges, particularly in terms of workforce adaptation, skill requirements, and job security. As AI technologies automate routine and repetitive tasks, there is a pressing need for HR departments to reassess job roles and develop strategies for upskilling and reskilling employees. According to Burton (2019), the successful integration of AI necessitates a workforce that is not only technologically adept but also equipped with soft skills, such as critical thinking and adaptability, to complement the capabilities of AI systems.

Moreover, the ethical dimensions of AI integration cannot be overstated. Issues pertaining to data privacy, surveillance, and algorithmic bias pose significant challenges, necessitating a robust ethical framework to guide AI deployment in public transport. MacDougall *et al* (2015) argue that HR departments play a critical role in fostering an organizational culture that prioritizes ethical considerations, ensuring that AI technologies are implemented in a manner

that respects the rights and dignity of both employees and passengers.

The potential for AI to enhance operational efficiency and passenger experiences in public transport is immense. AI-driven predictive maintenance, for example, not only improves reliability but also optimizes resource allocation, leading to significant cost savings. Similarly, AI-enhanced customer service platforms can provide personalized travel information and support, enhancing passenger satisfaction. However, as Dwivedi *et al* (2021) highlight, the benefits of AI must be balanced with a keen awareness of its impact on the workforce. The displacement of jobs by AI technologies raises critical questions about the future of work in public transport, underscoring the importance of developing transition strategies that support affected employees.

Despite these challenges, AI also presents opportunities for HR to innovate and drive organizational change. By leveraging AI for HR processes, such as recruitment, training, and performance management, public transport authorities can enhance efficiency and effectiveness. AI can assist in identifying skill gaps, tailoring training programs to individual needs, and monitoring employee performance in real-time, thereby fostering a more dynamic and responsive workforce.

In summary, the integration of AI into public transport workforces is a complex process that demands careful consideration of technical, ethical, and human factors. While AI offers the promise of improved efficiency and enhanced services, its successful implementation hinges on the ability of HR to navigate the challenges of workforce transformation, ethical deployment, and job displacement. By adopting a strategic and holistic approach, HR can play a pivotal role in ensuring that the benefits of AI are realized in a manner that is equitable, ethical, and sustainable, ultimately contributing to the advancement of public transport systems.

4.1.1 Technological, economic, and social dimensions

The integration of Artificial Intelligence (AI) in the public transport sector presents a multifaceted landscape of challenges and opportunities across technological, economic, and social dimensions. This paper has reviewed these aspects, focusing on the human resources (HR) implications and the broader implications for workforces within this vital sector.

Technologically, AI introduces efficiencies and innovations that can significantly enhance operational capacities in public transport. Automated ticketing systems, predictive maintenance, and AI-driven route optimization are among the advancements that streamline operations and improve service delivery. However, these technological advancements also necessitate a workforce skilled in managing and maintaining AI systems. The challenge for HR is not only in recruiting individuals with these specialized skills but also in providing ongoing training for existing employees to adapt to rapidly evolving technologies (Nurzaman Am *et al*, 2021). This dual focus ensures that the workforce remains capable and that the transition towards more automated systems does not lead to significant displacement of workers.

Economically, the deployment of AI in public transport can lead to considerable cost savings and revenue generation. AI can optimize route planning to reduce fuel consumption and vehicle wear-and-tear, predict maintenance needs to avoid costly repairs, and enhance customer experience to increase ridership. Nevertheless, these economic benefits come with the upfront costs of implementing AI technologies and the potential for economic displacement of workers who perform tasks that can be automated. HR departments must navigate these economic pressures by balancing cost efficiencies with

the ethical implications of workforce restructuring. Strategic investments in employee retraining and redeployment programs can mitigate the adverse effects on employment, ensuring that the economic benefits of AI are equitably distributed (Tong *et al*, 2021).

Socially, the integration of AI in public transport raises important considerations regarding accessibility, privacy, and workforce diversity. AI-driven services can improve accessibility for individuals with disabilities and those in underserved areas, promoting social inclusion. However, data privacy concerns emerge with the increased collection and analysis of passenger data required for personalized services. Moreover, the demographic impact of technological unemployment may disproportionately affect marginalized groups, underscoring the need for inclusive hiring and training practices. HR strategies that prioritize diversity, equity, and inclusion can help ensure that the benefits of AI are accessible to all segments of society and that the workforce reflects the diversity of the communities it serves (Cachat-Rosset and Klarsfeld, 2023).

In summary, the integration of AI in public transport workforces presents a complex array of challenges and opportunities. Technological advancements promise improved efficiency and service quality, but they require a skilled and adaptable workforce. Economically, AI offers the potential for significant cost savings and revenue enhancement, balanced against the ethical considerations of workforce displacement. Socially, AI can promote accessibility and inclusion while raising concerns about privacy and equity. HR departments play a crucial role in navigating these dimensions, ensuring that the transition towards AI-enhanced public transport is managed in a way that maximizes benefits and minimizes adverse impacts.

4.1.2 Addressing workforce challenges in the wake of AI integration.

The integration of Artificial Intelligence (AI) into public transport systems represents a significant leap forward in operational efficiency, customer service, and strategic planning. However, this technological transition poses substantial challenges for the workforce, necessitating a careful reconsideration of human resource (HR) strategies to address these changes effectively. This discussion delves into the complexities of integrating AI within public transport workforces, examining the implications for HR management and proposing strategies to overcome potential challenges.

The advent of AI in public transport has ushered in an era of automation, data analytics, and predictive technologies that enhance operational efficiencies and passenger experiences. These technologies, while beneficial, require a workforce that is not only technically adept but also flexible and resilient to change. The primary HR challenge lies in developing and maintaining a workforce capable of navigating the technological landscape of AI and automation. Training and development programs are crucial in upskilling employees to manage and interact with new AI systems effectively. As highlighted by Maity (2019), continuous education and skill development are essential for ensuring that employees remain relevant and productive in an increasingly automated environment.

Furthermore, the integration of AI can lead to shifts in job roles and the creation of new positions, necessitating a reevaluation of recruitment and staffing strategies. HR departments must adapt their hiring practices to attract talent with the requisite technical skills and the ability to work alongside AI technologies. This shift requires a balance between technical proficiency and soft skills, as the human

element remains critical in managing customer relations and making strategic decisions that AI cannot replicate. In response, strategic workforce planning becomes a pivotal HR function, ensuring that the organization has the right mix of skills and capabilities to leverage AI technologies effectively (DiRomualdo, El-Khoury, and Girimonte, 2018).

Another significant challenge is addressing the potential displacement of workers due to automation. The fear of job loss can create resistance among employees, undermining the successful integration of AI. HR departments must manage this transition sensitively, implementing retraining and redeployment programs to minimize disruption and maintain workforce morale. By focusing on the opportunities created by AI, such as the emergence of new roles and the reduction of mundane tasks, HR can foster a culture of innovation and adaptation among employees. Proactive communication and engagement strategies are essential in managing change, ensuring that employees feel valued and integral to the organization's future (Albrecht *et al*, 2015).

The ethical implications of AI integration also present a challenge for HR management. Issues of privacy, surveillance, and data security become increasingly pertinent as AI technologies rely on extensive data collection and analysis. HR policies must align with ethical standards and legal requirements to protect employee privacy and ensure the responsible use of AI. Establishing clear guidelines on AI use and involving employees in the development of these policies can help address ethical concerns and foster trust (Robinson, 2020).

Therefore, the integration of AI in public transport workforces brings a host of HR challenges, from skills development and staffing strategies to workforce displacement and ethical considerations. Overcoming these challenges requires a multifaceted HR strategy that emphasizes continuous learning, adaptive workforce planning, sensitive change management, and ethical AI use. By addressing these challenges proactively, HR departments can ensure that the integration of AI into public transport systems enhances operational efficiency and customer service while also supporting and empowering the workforce.

4.2 The critical role of standards and regulatory bodies in shaping AI deployment

In the burgeoning era of Artificial Intelligence (AI), the public transport sector stands at the forefront of experiencing transformative changes, promising enhanced efficiency, safety, and user experience. However, this revolution also brings forth significant HR challenges and opportunities, particularly concerning the deployment of AI technologies. A pivotal aspect of this transition is the role of standards and regulatory bodies in shaping AI deployment within public transport workforces. This discussion delves into how these entities influence the integration of AI, ensuring that it aligns with ethical, safety, and operational benchmarks, thereby facilitating a smooth transition for the workforce.

Standards and regulatory bodies play a crucial role in establishing a framework for the responsible and effective integration of AI technologies in public transport. These frameworks aim to safeguard against potential risks associated with AI deployment, such as privacy concerns, ethical issues, and the displacement of jobs. By setting industry-wide standards, they provide a blueprint for organizations to follow, ensuring that AI technologies are deployed in a manner that is safe, ethical, and beneficial to both employees and passengers.

One of the primary concerns addressed by these standards is the ethical use of AI. This includes ensuring transparency in

AI decision-making processes, protecting user privacy, and preventing bias in AI algorithms. Regulatory bodies, such as the International Transport Workers' Federation (ITF) and the International Association of Public Transport (UITP), advocate for these ethical considerations, emphasizing the importance of human oversight in AI systems to prevent unintended consequences. Moreover, these standards encourage the development of AI technologies that complement human capabilities, rather than replace them, aiming to enhance the quality of jobs and improve workplace safety.

Furthermore, the establishment of standards and guidelines by regulatory bodies aids in addressing the skills gap that may arise with the adoption of AI in public transport. They often recommend training and upskilling programs for existing employees to ensure they are equipped to work alongside AI technologies. This not only facilitates a smoother transition for the workforce but also mitigates the risk of job displacement by providing employees with the skills needed to thrive in an AI-enhanced workplace (Moore, 2019).

Regulatory bodies also play a critical role in ensuring the safety and reliability of AI systems. Through rigorous testing and certification processes, they set benchmarks that AI technologies must meet to be deployed in public transport. This ensures that AI systems are reliable, safe for public use, and capable of operating under various conditions without compromising service quality or safety (Nguyen & Smith, 2023).

In summary, the role of standards and regulatory bodies in shaping the deployment of AI within public transport workforces is critical. They provide the necessary frameworks to ensure that AI technologies are implemented responsibly, ethically, and in a manner that benefits both employees and passengers. By setting industry-wide standards, these bodies facilitate a smoother transition to AI-enhanced operations, ensuring that the workforce is prepared for the changes and that the technologies deployed are safe, reliable, and beneficial to all stakeholders.

4.3 Implications for stakeholders: Navigating the AI-enhanced transportation ecosystem

The integration of Artificial Intelligence (AI) in public transport systems heralds a new era of efficiency, safety, and user experience. However, this technological transformation also brings about significant challenges and opportunities for various stakeholders within the transportation ecosystem. This discussion examines the implications of AI integration for these stakeholders, including employees, management, passengers, and the wider community, highlighting the critical role of human resources (HR) in navigating these changes.

For employees, the advent of AI technologies in public transport presents both opportunities for career development and challenges related to job security and role transformation. The need for new skills and competencies in the face of automation necessitates robust training and development programs. HR departments must lead in identifying skill gaps and developing targeted training programs to equip employees for the AI-enhanced future. This approach not only helps in mitigating fears related to job displacement but also empowers employees to embrace new roles and responsibilities, thereby enhancing job satisfaction and retention.

Management stakeholders are tasked with the strategic integration of AI technologies, balancing operational efficiencies with ethical considerations and workforce implications. Effective leadership is paramount in steering

the organization through the transition, requiring a deep understanding of AI capabilities and limitations (Udokwu *et al*, 2023). Strategic HR practices, including workforce planning and change management, are essential in aligning AI integration with organizational goals and ensuring a seamless transition. Management must also foster a culture of innovation and adaptability, encouraging employees to engage with new technologies and contribute to the evolving transport ecosystem.

Passengers, as direct beneficiaries of AI integration, expect improvements in service quality, reliability, and safety. Enhanced AI-driven scheduling, real-time tracking, and personalized services are among the anticipated benefits. However, stakeholders must address concerns related to data privacy and the digital divide. Transparent communication regarding the use of passenger data and efforts to ensure inclusivity and accessibility for all users are vital components of a responsible AI strategy. HR's role in training customer service and frontline staff to handle these concerns and interact effectively with AI systems cannot be understated.

The wider community, including local governments and regulatory bodies, has a vested interest in the sustainable and ethical integration of AI in public transportation. This includes considerations related to environmental impact, urban planning, and economic development. Public transport systems that leverage AI for route optimization and fleet management contribute to reduced traffic congestion and lower emissions, aligning with broader sustainability goals. HR practices that prioritize corporate social responsibility and community engagement play a critical role in aligning organizational objectives with community values and regulatory requirements (Ebirim *et al* 2024).

From the foregoing, the integration of AI in public transport systems has far-reaching implications for various stakeholders, each with distinct concerns and expectations. The HR function stands at the forefront of addressing these implications, employing strategic practices to manage the transition effectively. By focusing on training and development, change management, ethical considerations, and community engagement, HR can facilitate a smooth transition to an AI-enhanced transportation ecosystem, ensuring that the benefits of AI are realized across the board.

5. Conclusions

The integration of Artificial Intelligence (AI) into public transport systems marks a pivotal transformation, redefining operational efficiencies, safety standards, and passenger experiences. AI technologies, through automation and data analytics, have not only streamlined operations but also opened new avenues for workforce development and engagement. The journey thus far has illuminated AI's capacity to enhance service delivery while simultaneously presenting HR challenges related to skills adaptation, job displacement, and the ethical use of technology.

As the public transport sector continues to navigate the AI revolution, several challenges and opportunities lie ahead. The dynamic nature of AI technology necessitates ongoing workforce training and development to bridge emerging skills gaps. Additionally, the potential for job displacement underscores the need for strategic HR planning and policy development to manage transitions and ensure workforce resilience. Conversely, AI presents opportunities for creating safer, more efficient, and inclusive public transport systems, thereby enhancing job satisfaction and opening new career paths within the sector.

To navigate the AI revolution in public transport effectively, it is imperative that comprehensive strategies are

implemented to leverage the benefits of AI while mitigating associated challenges. A pivotal aspect of this navigation involves the development of the workforce to ensure it is equipped to handle the evolving demands of AI-enhanced operations. This entails not only the provision of training programs aimed at improving AI literacy and technical skills but also the fostering of a culture that values continuous learning and adaptability. Such an approach ensures that employees are not only prepared for the immediate changes brought about by AI but are also resilient to future technological shifts. Equally important is the establishment of clear guidelines and ethical standards governing the use of AI within public transport. This framework should prioritize transparency in how AI systems make decisions, safeguard passenger and employee data to ensure privacy, and employ mechanisms to prevent and address biases in AI algorithms. By adhering to these ethical principles, public transport authorities can build trust among passengers and employees alike, ensuring that the integration of AI technologies is both responsible and beneficial to all parties involved.

Engagement with stakeholders is another critical component of successfully navigating the AI revolution. This involves collaborative efforts among employees, management, passengers, regulatory bodies, and the wider community to ensure that the deployment of AI technologies aligns with the broader goals of safety, efficiency, inclusivity, and sustainability. Through open dialogue and partnership, public transport can harness AI in a way that reflects the diverse needs and values of its stakeholders. Lastly, fostering an environment of innovation and adaptability within the workforce is crucial. Encouraging employees to embrace change, experiment with new ideas, and contribute to the AI integration process can spur innovation and enhance the sector's capacity to adapt to technological advancements. This not only benefits the operational aspects of public transport but also enriches the work experience for employees, offering them opportunities to grow and develop in their careers.

Therefore, navigating the AI revolution in public transport requires a multifaceted approach that emphasizes workforce development, ethical AI use, stakeholder engagement, and the cultivation of an innovative and adaptable organizational culture. By addressing these strategic areas, public transport authorities can ensure a smooth transition to AI-enhanced operations, maximizing the benefits of technology while safeguarding against potential risks.

Reflecting on the transformative impact of AI on public transport workforces, it becomes evident that the journey is far from complete. Future research should delve deeper into the long-term implications of AI integration, exploring strategies for sustainable workforce development, the role of AI in enhancing workplace diversity and inclusion, and the impact of AI on labor relations within the public transport sector. Moreover, empirical studies assessing the effectiveness of training programs and ethical AI frameworks will provide valuable insights for refining HR practices and policies. As AI continues to evolve, ongoing research and dialogue among academics, practitioners, and policymakers will be crucial in navigating the future of public transport workforces.

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